MINISTRY OF EDUCATION

REPUBLIC OF GHANA

MATHEMATICS
CURRICULUM FOR PRIMARY SCHOOLS
(BASIC 4 - 6)

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Mathematics Curriculum for Primary Schools

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FOREWORD

The new curriculum for Ghana's primary schools is standards-based, which is our demonstration of placing learning at the heart of every classroom and ensuring that every learner receives quality education. Provision of accessible quality education for all is non-negotiable if we are to meet the human capital needs of our country, required for accelerated sustainable national development. It is for this reason that the new curriculum sets out clearly the learning areas that need to be taught, how they should be taught and how they should be assessed. It provides a set of core competencies and standards that learners are to know, understand and demonstrate as they progress through the curriculum from one content standard to the other and from one phase to the next. The curriculum and its related teachers' manual promote the use of inclusive and gender responsive pedagogy within the context of learning-centred teaching methods so that every learner can participate in every learning process and enjoy learning. The curriculum encourages the use of Information and Communication Technologies (ICTs) for teaching and learning – ICTs as teaching and learning materials.

The new curriculum has at its heart the acquisition of skills in the 4Rs of Reading, wRiting, aRithmetic and cReativity by all learners. It is expected that at any point of exit from a formal education, all learners should be equipped with these foundational skills for life, which are also prerequisites for Ghana becoming a learning nation. The graduates from the school system should become functional citizens in the 4Rs and lifelong learners. They should be digital literates, critical thinkers and problem solvers. The education they receive through the study of the learning areas in the curriculum should enable them to collaborate and communicate well with others and be innovative. The graduates from Ghana's schools should be leaders with a high sense of national and global identity. The curriculum therefore provides a good opportunity in its design to develop individuals with the right skills and attitudes to lead the transformation of Ghana into an industrialised learning nation.

For this reason, the Ministry of Education expects that learners, as a result of the new knowledge, skills and values they have acquired through the new curriculum, will show a new sense of identity as creative, honest and responsible citizens. These are our core values that underpin the identification and selection of the learning areas for this curriculum. These core values serve as fundamental building blocks for developing into our learners the spirit of teamwork, respect, resilience and the commitment to achieving excellence. The Ministry endorses a quality learning experience as an entitlement for each of Ghana's school-going girl and boy; the curriculum has rightly focused on learning and learning progression. The Ministry has also endorsed accountability as a critical domain for effective workings of standards-based curriculum.

More importantly the role of the teacher is to make this curriculum work for the intended purpose - to inculcate in learners the core competencies and values and to make learning happen; improve learning outcomes – and the support that teachers need is duly recognised and endorsed by my Ministry. The Ministry will support the implementation of the curriculum to include capacity development of all teachers in the new curriculum. Teachers matter in the development and delivery of the standards-based curriculum and we will continue to support our teachers on this journey that we have started together to put learning at the centre of what we do best; teach!

I thank all those who have contributed their time and expertise to the development of this curriculum for primary schools in Ghana.

Dr. Matthew Opoku Prempeh (MP)
The Honourable Minister of Education

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RATIONALE FOR PRIMARY MATHEMATICS

Mathematics forms an integral part of our everyday lives. is a universal truth that development is hinged on Mathematics is the backbone of social, economic, political and physical development of a country. It is a never-ending creative process which serves to promote discovery and understanding. It consists of a body of knowledge which attempts to explain and interpret phenomena and experiences. Mathematics has changed our lives and is vital to Ghana's future development.

To provide quality Mathematics education, teachers must facilitate learning in the Mathematics classroom. This will provide the foundations for discovering and understanding the world around us and lay the grounds for Mathematics and Mathematics related studies at higher levels of education. Learners should be encouraged to understand how Mathematics can be used to explain what is occurring, predict how things will behave and analyse causes and origins of things in our environment. The Mathematics curriculum has considered the desired outcomes of education for learners at the basic level. Mathematics is also concerned with the development of attitudes. It is important for all citizens to be mathematically and technologically literate for sustainable development. Mathematics therefore ought to be taught using hands-on and minds-on approaches which learners will find as fun and adopt as a culture.

PHILOSOPHY

- **Teaching Philosophy**

Ghana believes that an effective mathematics education needed for sustainable development should be inquiry-based. Thus mathematics education must provide learners with opportunities to expand, change, enhance and modify the ways in which they view the world. It should be pivoted on learner-centred mathematics teaching and learning approaches that engage learners physically and cognitively in the knowledge-acquiring process in a rich and rigorous inquiry-driven environment.

- **Learning Philosophy**

Mathematics learning is an active contextualised process of constructing knowledge based on learners' experiences rather than acquiring it. Learners are information constructors who operate as researchers. Teachers serve as facilitators by providing the enabling environment that promotes the construction of learners' own knowledge, based on their previous experiences. This makes learning more relevant to the learner and leads to the development of critical thinkers and problem solvers.

GENERAL AIMS

The curriculum is aimed at developing individuals to become mathematically literate, good problem solvers, have the ability to think creatively and have both the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens.

SUBJECT AIMS

The mathematics curriculum is designed to help learners to:

1. recognise that mathematics permeates the world around us;
2. appreciate the usefulness, power and beauty of Mathematics;
3. enjoy Mathematics and develop patience and persistence when solving problems;
4. understand and be able to use the language, symbols and notation of Mathematics; and
5. develop mathematical curiosity and use inductive and deductive reasoning when solving problems;
6. become confident in using mathematics to analyse and solve problems both in school and in real-life situations;

7. develop the knowledge, skills and attitudes necessary to pursue further studies in Mathematics; and
8. develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others.

INSTRUCTIONAL EXPECTATIONS

1. Guide and facilitate learning by generating discourse among learners and challenging them to accept and share responsibility for their own learning, based on their unique individual differences.
2. Select Mathematics content, adapt and plan lessons to meet the interests, knowledge, understanding, abilities and experiences of learners.
3. Work together as colleagues within and across disciplines and grade levels to develop communities of Mathematics learners who exhibit the skills of mathematical inquiry and the attitudes and social values conducive to Mathematics learning.
4. Use multiple methods and systematically gather data about learner understanding and ability to guide Mathematics teaching and learning, with arrangements to provide feedback to both learners and parents.
5. Design and manage learning environments that provide learners with the time, space and resources needed for learning mathematics

CORE COMPETENCIES

The core competencies for studies describe a body of skills that teachers in Mathematics at all levels should seek to develop in their learners. They are ways in which teachers and learners in Mathematics engage with the subject matter as they learn the subject. The competencies presented here describe a connected body of core skills that are acquired throughout the processes of teaching and learning.

CRITICAL THINKING AND PROBLEM SOLVING (CP)

This skill develops learners' cognitive and reasoning abilities to enable them analyse and solve problems. Critical thinking and problem-solving skill enables learners to draw on their own experiences to analyse situations and choose the most appropriate out of a number of possible solutions. It requires that learners embrace the problem at hand, persevere and take responsibility for their own learning.

CREATIVITY AND INNOVATION (CI)

Creativity and Innovation promotes entrepreneurial skills in learners through their ability to think of new ways of solving problems and developing technologies for addressing the problem at hand. It requires ingenuity of ideas, arts, technology and enterprise. Learners having this skill are also able to think independently and creatively.

COMMUNICATION AND COLLABORATION (CC)

This competence promotes in learners the skills to make use of languages, symbols and texts to exchange information about themselves and their life experiences. Learners actively participate in sharing their ideas. They engage in dialogue with others by listening to and learning from them. They also respect and value the views of others.

CULTURAL IDENTITY AND GLOBAL CITIZENSHIP (CG)

This competence involves developing learners to put country and service foremost through an understanding of what it means to be active citizens. This is done by inculcating in learners a strong sense of social and economic awareness. Learners make use of the knowledge, skills, COMPETENCIES and attitudes acquired to contribute effectively towards the socioeconomic development of the country and on the global stage. Learners build skills to critically identify and analyse cultural and global trends that enable them to contribute to the global community.

PERSONAL DEVELOPMENT AND LEADERSHIP (PL)

This competence involves improving self-awareness and building self-esteem. It also entails identifying and developing talents, fulfilling dreams and aspirations. Learners are able to learn from mistakes and failures of the past. They acquire skills to develop other people to meet their needs. It involves recognising the importance of values such as honesty and empathy and seeking the well-being of others. Personal development and leadership enables learners to distinguish between right and wrong. The skill helps them to foster perseverance, resilience and self-confidence. PL helps them acquire the skill of leadership, self-regulation and responsibility necessary for lifelong learning.

DIGITAL LITERACY (DL)

Digital Literacy develop learners to discover, acquire, and communicate through ICT to support their learning. It also makes them use digital media responsibly.

LEARNING DOMAINS (EXPECTED LEARNING BEHAVIORS)

A central aspect of this curriculum is the concept of three integral learning domains that should be the basis for instruction and assessment. These are

- Knowledge, Understanding and Application
- Process Skills
- Attitudes and Values

KNOWLEDGE, UNDERSTANDING AND APPLICATION

Under this domain, learners may acquire some knowledge through some learning experiences. They may also show understanding of concepts by comparing, summarising, re-writing etc. in their own words and constructing meaning from instruction. The learner may also apply the knowledge acquired in some new contexts. At a higher level of learning behaviour, the learner may be required to analyse an issue or a problem. At a much higher level, the learner may be required to synthesize knowledge by integrating a number of ideas to formulate a plan, solve a problem, compose a story, or a piece of music. Further, the learners may be required to evaluate, estimate and interpret a concept. At the last level, which is the highest, learners may be required to create, invent, compose, design and construct. These learning behaviours "knowing", "understanding", "applying", "analysing", "synthesising", "evaluating" and "creating" fall under the domain "Knowledge, Understanding and Application".

In this curriculum, learning indicators are stated with action verbs to show what the learner should know and be able to do. For example, the learner will be able to describe something. Being able to "describe" something after teaching and learning has been completed means that the learner has acquired "knowledge". Being able to explain, summarise, and give examples etc. means that the learner has understood the concept taught.

Similarly, being able to develop, defend, etc. means that the learner can "apply" the knowledge acquired in some new context. You will note that each of the indicators in the curriculum contains an "action verb" that describes the behaviour the learner will be able to demonstrate after teaching and learning has taken place. "Knowledge, Understanding and Application" is a domain that should be the prime focus of teaching and learning in schools. Teaching in most cases has tended to stress knowledge acquisition to the detriment of other higher level behaviours such as applying knowledge.

Each action verb in any indicator outlines the underlying expected outcome. Each indicator must be read carefully to know the learning domain towards which you have to teach. The focus is to move teaching and learning from the didactic acquisition of "knowledge" where there is fact memorisation, heavy reliance on formulae, remembering facts without critiquing them or relating them to real world – ***surface learning*** – to a new position called – ***deep learning***. Learners are expected to deepen their learning by knowledge application to develop critical thinking skills, explain reasoning, and to generate creative ideas to solve real life problems in their school lives and later in their adult lives. This is the position where learning becomes beneficial to the learner.

The explanation and the key words involved in the "Knowledge, Understanding and Application" domain are as follows:

Knowing: The ability to remember, recall, identify, define, describe, list, name, match, state principles, facts, concepts. Knowledge is the ability to remember or recall material already learned and this constitutes the lowest level of learning.

Understanding: The ability to explain, summarise, translate, rewrite, paraphrase, give examples, generalise, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic.

Applying: This dimension is also referred to as "Use of Knowledge". Ability to use knowledge or apply knowledge, apply rules, methods, principles, theories, etc. to situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate, discover etc.

Analysis:	The ability to break down material/information into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc., ability to recognise unstated assumptions and logical fallacies; ability to recognise inferences from facts etc.
Synthesising:	The ability to put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, organise, create, generate new ideas and solutions etc.
Evaluating:	The ability to appraise, compare features of different things and make comments or judgment, compare, contrast, criticise, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some material based on some criteria.
Creating:	The ability to use information or materials to plan, compose, produce, manufacture or construct other products. From the foregoing, creation is the highest form of thinking and learning skill and is therefore the most important behaviour. This unfortunately is the area where most learners perform poorly. In order to get learners to develop critical thinking and behavioural skills beginning right from the lower primary level, it is advised that you do your best to help your learners to develop analytic and application skills as we have said already.

SKILLS AND PROCESSES

The mathematical method is the means by which a mathematician solves problems or seeks to gain information about events. Learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. The more often they are faced with these challenges, the more likely they are to develop a positive attitude toward mathematics, and the more likely they are to develop the relevant process skills. Details of each sub-skill in the "Values, Attitudes and Process Skills" dimension are as follows:

Observing	This is the skill of using our senses to gather information about objects or events. This also includes the use of instruments to extend the range of our senses.
Classifying	This is the skill of grouping objects or events based on common characteristics
Comparing	This is the skill of identifying the similarities and differences between two or more objects, concepts or processes.
Communicating/ Reporting -	This is the skill of transmitting, receiving and presenting information in concise, clear and accurate forms verbal, written, pictorial, tabular or graphical
Predicting	This is the skill of assessing the likelihood of an outcome based on prior knowledge of how things usually turn out.
Analysing	This is the skill of identifying the parts of objects, information or processes, and the patterns and relationships between these parts.

Generating / possibilities	This is the skill of exploring all the options, possibilities and alternatives beyond the obvious or preferred one.
Evaluating	This is the skill of assessing the reasonableness, accuracy and quality of information, processes or ideas. This is also the skill of assessing the quality and feasibility of objects.
Designing	This is the skill of Visualizing and drawing new objects or gargets from imagination
Measuring	This is the skill of using measuring instruments and equipment for measuring, reading and making observations
Interpreting	This is the skill of evaluating data in terms of its worth: good, bad, reliable, unreliable; making inferences and predictions from written or graphical data; extrapolating and deriving conclusions. Interpretation is also referred to as "Information Handling".
Recording	This is the skill of drawing or making graphical representation boldly and clearly, well labelled and pertinent to the issue at hand.
Generalising	This is the skill of being able to use the conclusions arrived at in an experiment to what could happen in similar situations
Designing of Experiments	This is the skill of developing hypotheses; planning and designing of experiments; persistence in the execution of experimental activities; modification of experimental activities where necessary in order to reach conclusions. Learners therefore need to acquire positive attitudes, values and psychosocial skills that will enable them participate actively in lessons and take a stand on issues affecting them and others.

ATTITUDES

To be effective, competent and reflective citizens, who will be willing and capable of solving personal and societal problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. Learners therefore need to acquire positive attitudes, values and psychosocial skills that will enable them participate in debates and take a stand on issues affecting them and others. The mathematics curriculum thus focuses on the development of attitudes and values.

The mathematics curriculum aims at helping learners to acquire the following:

(i) Commitment: determination to contribute to national development.

(ii) Tolerance: willingness to respect the views of others.

(iii) Patriotism: readiness to defend the nation.

(iv) Flexibility in ideas: willingness to change opinion in the face of more plausible evidence.

(v) Respect for evidence: willingness to collect and use data on one's investigation, and also have respect for data collected by others.

(vi) Reflection: the habit of critically reviewing ways in which an investigation or observation has been carried out to see possible faults and other ways in which the investigation or observation can be improved upon.

(vii) Comportment conforming to acceptable societal norms.

(viii) Co-operation the ability to work effectively with others.

(ix) Responsibility: the ability to act independently and make decisions; morally accountable for one's action; capable of rational conduct.

(x) Environmental Awareness: being conscious of one's physical and socio-economic surroundings.

(xi) Respect for the Rule of Law: obeying the rules and regulations of the land.
The teacher should ensure that learners cultivate the above attitudes and skills as basis for living in the nation as effective citizens.

VALUES:

At the heart of this curriculum is the belief in nurturing honest, creative and responsible citizens. As such, every part of this curriculum, including the related pedagogy should be consistent with the following set of values.

Respect: This includes respect for the nation of Ghana, its institutions and laws and the culture and respect among its citizens and friends of Ghana.

Diversity: Ghana is a multicultural society in which every citizen enjoys fundamental rights and responsibilities. Learners must be taught to respect the views of all persons and to see national diversity as a powerful force for nation development. The curriculum promotes social cohesion.

Equity: The socio-economic development across the country is uneven. Consequently, it is necessary to ensure an equitable distribution of resources based on the unique needs of learners and schools. Ghana's learners are from diverse backgrounds, which require the provision of equal opportunities to all, and that all strive to care for each other both personally and professionally.

Commitment to achieving excellence: Learners must be taught to appreciate the opportunities provided through the curriculum and persist in doing their best in whatever field of endeavour as global citizens. The curriculum encourages innovativeness through creative and critical thinking and the use of contemporary technology.

Teamwork/Collaboration: Learners are encouraged to be become committed to team-oriented working and learning environments. This also means that learners should have an attitude of tolerance to be able to live peacefully with all persons.

Truth and Integrity: The curriculum aims to develop learners into individuals who will consistently tell the truth irrespective of the consequences. In addition, be morally upright with the attitude of doing the right thing even when no one is watching. Also, be true to themselves and be willing to live the values of honesty and compassion. Equally important, the ethos or culture of the work place, including integrity and perseverance, must underpin the learning processes to allow learners to apply skills and COMPETENCIES in the world of work.

The action verbs provided under the various profile dimensions should help you to structure your teaching to achieve desired learning outcomes. Select from the action verbs provided for your teaching, for evaluation exercises and for test construction. Check the weights of the profile dimensions to ensure that you have given the required emphasis to each of the dimensions in your teaching and assessment.

ASSESSMENT

Assessment is a process of collecting and evaluating information about learners and using the information to make decisions to improve their learning.

In this curriculum, it is suggested that assessment is used to promote learning. Its purpose is to identify the strengths and weaknesses of learners to enable teachers ascertain their learner's response to instruction.

Assessment is both formative and summative. Formative assessment is viewed in terms of Assessment ***as*** learning and Assessment ***for*** learning.

Assessment ***as*** learning: Assessment as learning relates to engaging learners to reflect on the expectations of their learning. Information that learners provide the teacher forms the basis for refining teaching-learning strategies. Learners are assisted to play their roles and to take responsibility of their own learning to improve performance. Learners set their own goals and monitor their progress.

Assessment ***for*** learning: It is an approach used to monitor learner's progress and achievement. This occurs throughout the learning process.
The teacher employs assessment for learning to seek and interpret evidence which serves as timely feedback to refine their teaching strategies and improve learners' performance. Learners become actively involved in the learning process and gain confidence in what they are expected to learn.

Assessment ***of*** learning: This is summative assessment. It describes the level learners have attained in the learning, what they know and can do over a period of time. The emphasis is to evaluate the learner's cumulative progress and achievement.

It must be emphasised that all forms of assessment should be based on the domains of learning. In developing assessment procedures, try to select indicators in such a way that you will be able to assess a representative sample from a given strand. Each indicator in the curriculum is considered a criterion to be achieved by the learners. When you develop assessment items or questions that are based on a representative sample of the indicators taught, the assessment is referred to as a "Criterion-Referenced Assessment". In many cases, a teacher cannot assess all the indicators taught in a term or year. The assessment procedure you use i.e. class assessments, homework, projects etc. must be developed in such a way that the various procedures complement one another to provide a representative sample of indicators taught over a period.

SUGGESTED TIME ALLOCATION

A total of ten periods a week, each period consisting of thirty minutes, is allocated to the teaching of mathematics at the Lower Primary level. It is recommended that the teaching periods be divided as follows:

- 2 periods per day (two 30-minute periods)

PEDAGOGICAL APPROACHES

These include the approaches, methods, strategies, appropriate relevant teaching and learning resources for ensuring that every learner benefits from teaching and learning process. The curriculum emphasises the:

1. creation of learning-centred classrooms through the use of creative approaches to ensure learner empowerment and independent learning.
2. positioning of inclusion and equity at the centre of quality teaching and learning
3. use of differentiation and scaffolding as teaching and learning strategies for ensuring that no learner is left behind
4. use of Information Communications Technology (ICT) as a pedagogical tool
5. identification of subject specific instructional expectations needed for making learning in the subject relevant to learners
6. integration of assessment as learning, for learning and of learning into the teaching and learning processes and as an accountability strategy
7. questioning techniques that promote deep learning

LEARNING-CENTRED PEDAGOGY

The learner is at the centre of learning. At the heart of the national curriculum for change and sustainable development is the learning progression and improvement of learning outcomes for Ghana's young people with a focus on the 4Rs – Reading, wRiting, aRithmetic and cReativity. It is expected that at each curriculum phase, learners would be offered the essential learning experiences to progress seamlessly to the next phase. Where there are indications that a learner is not sufficiently ready for the next phase a compensatory provision through differentiation should be provided to ensure that such a learner is ready to progress with his/her cohort. At the primary school, the progression phases are KG1 to KG2 and B1 to B6.

The Curriculum encourages the creation of a learning centred classroom with the opportunity for learners to engage in meaningful "hands-on" activities that bring home to the learner what they are learning in school and what they know from outside of school. The learning centred classroom is a place for the learners to discuss ideas through the inspiration of the teacher. The learners then become actively engaged in looking for answers, working in groups to solve problems. They also research for information, analyse and evaluate information. The aim of the learning-centred classroom is to enable learners take ownership of their learning. It provides the opportunity for deep and profound learning to take place.

The teacher as a facilitator needs to create a learning environment that:

1. makes learners feel safe and accepted
2. helps learners to interact with varied sources of information in a variety of ways
3. helps learners to identify a problem suitable for investigation through project work
4. connects the problem with the context of the learners' world so that it presents realistic opportunities for learning
5. organises the subject matter around the problem, not the subject
6. gives learners responsibility for defining their learning experience and planning to solve the problem
7. encourages learners to collaborate in learning

8. expects all learners to demonstrate the results of their learning through a product or performance

It is more productive for learners to find answers to their own questions rather than teachers providing the answers and their opinions in a learning-centred classroom.

INCLUSION

Inclusion is ensuring access and learning for all learners especially those disadvantaged. All learners are entitled to a broad and balanced curriculum in every school in Ghana. The daily learning activities to which learners are exposed should ensure that the learners' right to equal access and accessibility to quality education is met. The Curriculum suggests a variety of approaches that addresses learners' diversity and their special needs in the learning process. When these approaches are effectively used in lessons, they will contribute to the full development of the learning potential of every learner. Learners have individual needs and learning experiences and different levels of motivation for learning. Planning, delivery and reflection on daily learning experiences should take these differences into consideration. The curriculum therefore promotes:

1. learning that is linked to the learner's background and to their prior experiences, interests, potential and capacities.
2. learning that is meaningful because it aligns with learners' ability (e.g. learning that is oriented towards developing general capabilities and solving the practical problems of everyday life); and
3. the active involvement of the learners in the selection and organisation of learning experiences, making them aware of their importance and also enabling them to assess their own learning outcomes.

DIFFERENTIATION AND SCAFFOLDING

Differentiation is a process by which differences (learning styles, interest and readiness to learn) between learners are accommodated so that all learners in a group have best possible chance of learning. Differentiation could be by content, tasks, questions, outcome, groupings and support. Differentiation as a way of ensuring each learner benefits adequately from the delivery of the curriculum can be achieved in the classroom through i) Task ii) Support from the Guidance and Counselling Unit and iii) Learning outcomes.

Differentiation by task involves teachers setting different tasks for learners of different abilities. E.g. in sketching the plan and shape of their classroom some learners could be made to sketch with free hand while others would be made to trace the outline of the plan.

Differentiation by support involves the teacher giving needed support and referring weak learners to the Guidance and Counselling Unit for academic support.

Differentiation by outcome involves the teacher allowing learners to respond at different levels. Weaker learners are allowed more time for complicated tasks.

Scaffolding in education refers to the use of variety of instructional techniques aimed at moving learners progressively towards stronger understanding and ultimately greater independence in the learning process.

It involves breaking up the learning task, experience or concepts into smaller parts and then providing learners with the support they need to learn each part. The process may require a teacher assigning an excerpt of a longer text to learners to read and engaging them to discuss the excerpt to improve comprehension. The teacher goes ahead to guide them through the key words/vocabulary to ensure learners have developed a thorough understanding of the text before engaging them to read the full text.

Common scaffolding strategies available to the teacher are:

1. give learners a simplified version of a lesson, assignment, or reading, and then gradually increases the complexity, difficulty, or sophistication over time
2. describe or illustrate a concept, problem, or process in multiple ways to ensure understanding
3. give learners an exemplar or model of an assignment they will be asked to complete
4. give learners a vocabulary lesson before they read a difficult text
5. describe the purpose of a learning activity clearly and the learning goals they are expected to achieve
6. describe explicitly how the new lesson builds on the knowledge and skills learners were taught in a previous lesson

INFORMATION AND COMMUNICATION TECHNOLOGY

Information and Communication Technology (ICT) has been integrated into the mathematics curriculum as part of the core of education, alongside reading, writing and numeracy. Thus, the curriculum is designed to use ICT as a teaching and learning tool to enhance deep and independent learning. For instance, the teacher in certain instances is directed to use multimedia to support the teaching and learning process.

ICT has the potential to innovate, accelerate, enrich, and deepen skills. It also motivates and engages learners to relate school experiences to work practices. It provides opportunities for learners to fit into the world of work. Some of the expected outcomes that this curriculum aims to achieve are:

1. improved teaching and learning processes
2. improved consistency and quality of teaching and learning
3. increased opportunities for more learner-centered pedagogical approaches
4. improved inclusive education practices.
5. improved collaboration, creativity, higher order thinking skills
6. enhanced flexibility and differentiated approach of delivery

The use of ICT as a teaching and learning tool is to provide learners an access to large quantities of information online and offline. It also provides the framework for analysing data to investigate patterns and relationships in the geographical context. Once learners have made their findings, ICT can help them organize, edit and print the information in many different ways.

Learners need to be exposed to various ICT tools around them including calculators, radios, cameras, phones, television sets and computers and related software like Microsoft Office packages - Word, PowerPoint and Excel as teaching and learning tools. The exposure that learners are given at the primary school level to use ICT in exploiting learning will build their confidence and will increase their level of motivation to apply ICT use in later years, both within and outside of education. ICT use for teaching and learning is expected to enhance the quality and competence level of learners.

ORGANISATION AND STRUCTURE OF THE CURRICULUM

The curriculum is organised under key headings and annotations.

ANNOTATION

A unique annotation is used to label the class, strands, sub-strands, content standards and learning indicators in the curriculum for the purpose of easy referencing. The annotation is defined in figure 1:

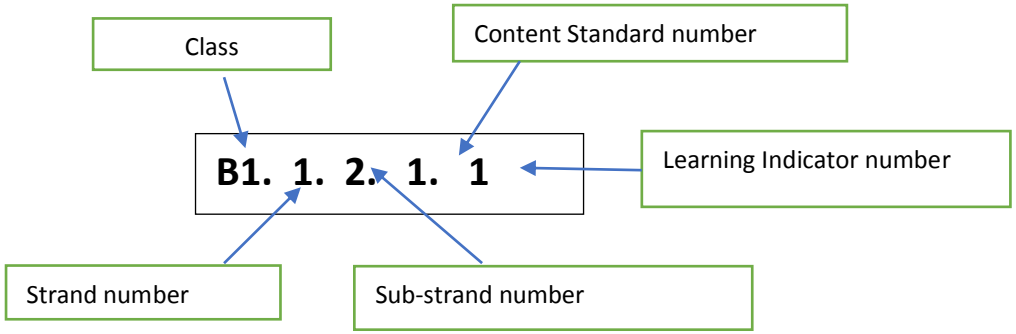


Figure 1: Curriculum Reference Numbers

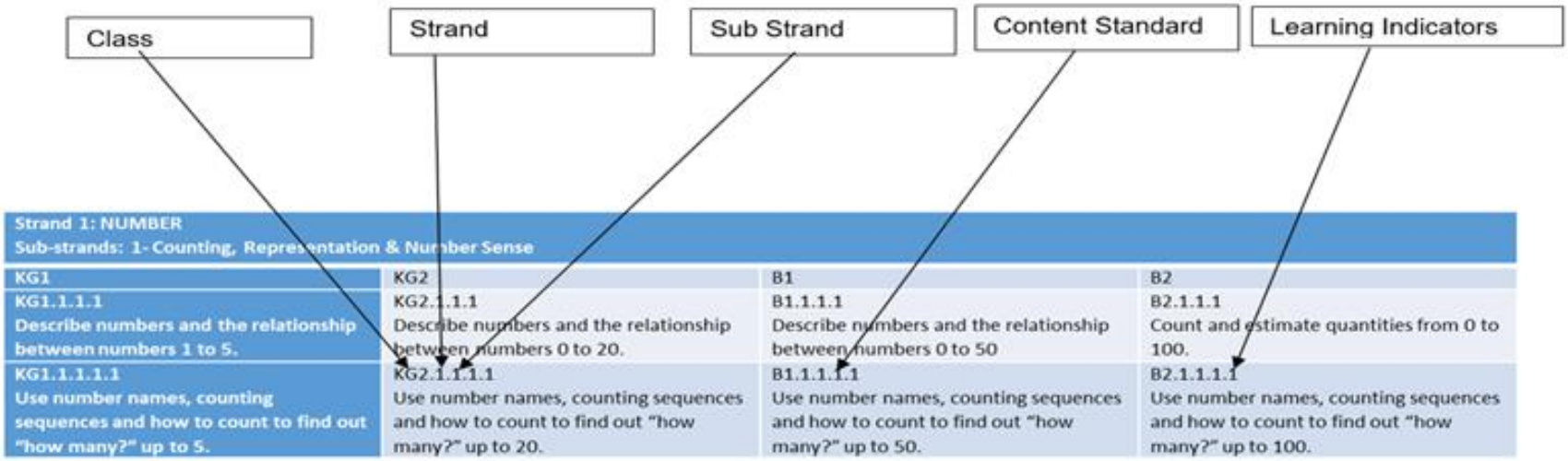
Strands are the broad areas/sections of the mathematics content to be studied.

Sub-strands are the topics within each strand under which the content is organised.

Content standard refers to the pre-determined level of knowledge, skill and/or attitude that a learner attains by a set stage of education.

Indicator is a clear outcome or milestone that learners have to exhibit in each year to meet the content standard expectation. The indicators represent the minimum expected standard in a year.

Exemplar – support and guidance which clearly explains the expected outcomes of an indicator and suggests what teaching and learning activities could take to support the facilitators/teachers in the delivery of the curriculum.



ORGANIZATION OF THE STANDARDS (B4 – B6)

The content standards in this document are organized by grade level. Within each grade level, the contents are grouped first by strands. Each strand is further subdivided into sub-strands of related indicators.

- **Indicators** are learning outcomes that define what learners should know and be able to do.
- **Content Standards** are groups of related indicators. Note that indicators from different standards may sometimes be closely related, because mathematics is a connected subject.
- **Sub-strands** are larger groups of related indicators (or mathematics topics to be studied). Indicators from different sub-strands may sometimes be closely related.
- **Strands** are the main branches of the mathematics content to be studied.

The Standards are organized at the KG1 – B6 phase under four strands:

1. Number
2. Algebra
3. Geometry and Measurement
4. Data

The table below shows the scope and sequence of the strands addressed at the B4 – B6 phase. The remaining part of the document presents the details of the standards and indicators for each grade level,

STRUCTURE OF THE CURRICULUM

STRANDS	SUB-STRANDS		
	B4	**B5**	**B6**
Number (Counting, Representation, Cardinality and Operations	Whole Numbers Counting and Representation	Whole Numbers Counting and Representation	Whole Numbers Counting and Representation
	Whole Numbers Operations	Whole Numbers Operations	Whole Numbers Operations
	Fractions, Representation and Relationship	Fractions Representation and Relationship	Fractions Representation and Relationship
Algebra	Patterns and Relationships	Patterns and Relationships	Patterns and Relationships
	Functions & Unknowns	Functions & Unknowns	Functions & Unknowns
	Expressions	Expressions	Expressions
	Equations and Inequalities	Equations and Inequalities	Equations and Inequalities
Geometry and Measurement	Lines and Shapes	Lines and Shapes	Lines and Shapes
	Measurements	Measurements	Measurements
	Geometrical Reasoning	Geometrical Reasoning	Geometrical Reasoning
Data	Data (Collection, organization, interpreting, analysis	Data	Data
	Chance (Probability)	Data	Data

SCOPE AND SEQUENCE

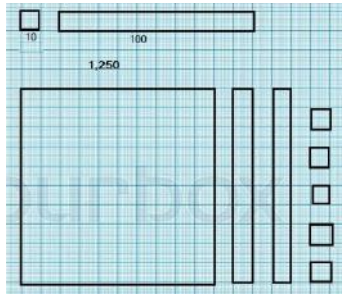
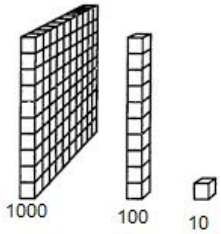
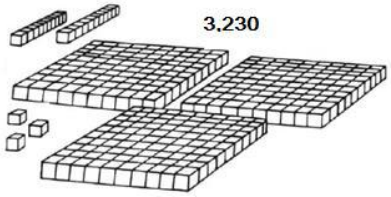
STRANDS	SUB-STRANDS	B4	B5	B6
Number	Whole Numbers: Counting and Representation	√	√	√
	Whole Numbers Operations	√	√	√
	Fractions Representation and Relationship	√	√	√
Algebra	Patterns and Relationships	√	√	√
	Functions & Unknowns	√	√	√
	Expressions	√	√	√
	Equations & Inequalities	√	√	√
Geometry and Measurement	Lines and Shapes	√	√	√
	Measurements	√	√	√
	Geometrical Reasoning	√	√	√
Data	Data (Collection, Organization, Interpreting, Analysis)	√	√	√
	Chance (Probability)	√	√	√

BASIC 4

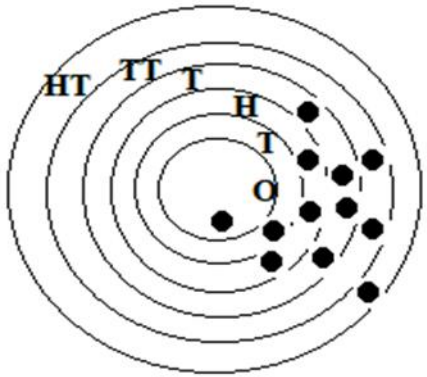
Basic 4

Strand 1: NUMBER

Sub-strand 1: Counting, Representation & Cardinality

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000.**	**B4.1.1.1.1 Model number quantities, place value for multi-digit using graph sheets or multi-base materials up to 100,000** E.g.1. Ask learners to model number quantities up to 100,000 using graph sheets or multi-base materials. For instance, with multi-base block , a cube = 100 unit; a rod = 1000; a flat = 10,000 and a block = 100,000; learners model 32,300 with the appropriate materials E.g.2 Ask learners to model the number 12,500 shading graph sheet square as shown below, where 2cm×2cm square represents 10 units.   	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Cultural Identity to Precision.

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000. CONT'D**	E.g. 3 Give learners teacher-made token currency notes [¢1, ¢10 & ¢100 notes] on different coloured-paper and ask them to model or pick given amounts up to ¢10,000; e.g. ¢2,480  **B4.1.1.1.2 Read and write numbers in figures and in words up 100,000** E.g. 1 Play the place value number wheel game: Use the hundred thousand number wheel to generate 6-digit numbers and represent the number generated on a place value frame. Throw a number of pebbles (or stones) onto the number wheel, identify the number of pebbles landing in each place value ring, and state the number generated in the wheel (i.e. 2 landed in the ten-thousand' ring making the number twenty-thousand or 20,000). NB: The representations to use also include verbal, and numerals. Learners must match number word cards to the figures	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Cultural Identity

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000** **CONT'D**	 Place value number wheel Place value chart | Hundred-thousands	Ten-thousands	Thousand	Hundreds	Tens	Ones | |---|---|---|---|---|---| | 1 | 2 | 4 | 3 | 1 | 1 | E.g. 2 Ask learners to write given numbers on the expanded form of the number: 14031=10,000 + 4,000 +30 + 1 E.g. 3 Display a number chart or number line with multiples of 500 between 10000 and 50000 and lead learners to identify numbers in different positions around a given number.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.1.1.1
Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000.
CONT'D</td>
<td>
B4.1.1.1.3 Identify numbers in different positions around a given number in a number chart

E.g. 1 Display a number chart in multiples of 500 between 10,000 and 100,000 and lead learners identify numbers in different positions around a given number. Put learners in pairs and give each group a number grid and have them identify numbers in different positions around a chosen number.
<table>
<tr><td>10,000</td><td>10,500</td><td>11,000</td><td>11,500</td><td>12,000</td><td>12,500</td></tr>
<tr><td>20,000</td><td>20,500</td><td>21,000</td><td>21,500</td><td>22,000</td><td>22,500</td></tr>
<tr><td>30,000</td><td>30,500</td><td>31,000</td><td>31,500</td><td>32,000</td><td>32,500</td></tr>
<tr><td>40,000</td><td>40,500</td><td>41,000</td><td>41,500</td><td>42,000</td><td>42,500</td></tr>
<tr><td>50,000</td><td>50,500</td><td>51,000</td><td>51,500</td><td>52,000</td><td>52,500</td></tr>
<tr><td>60,000</td><td>60,500</td><td>61,000</td><td>61,500</td><td>62,000</td><td>62,500</td></tr>
</table>
B4.1.1.1.4 Compare and order whole numbers up to 10,000 and represent comparisons using the symbols "<", "=", ">"

E.g. 1 Learners identify numbers which are 1,000 and 10,000 more or less than a given five-digit or six-digit number. E.g. 2400 is 1,000 less than 3400. Learners use words such as: "equal to" "greater than" "less than" and later use symbols such as "<", "=", ">" to compare numbers up to 100,000 taking into consideration the place value of each digit in the given number. E.g. $1200 = 1200;\ 27345 > 26355,$

E.g. 2 Learners work together in their groups to order a given set of numbers in ascending or descending order verbally and in writing. E.g. $1020, 1025, 2673, 2873,$

E.g. 3 Give two numbers between 10,000 and 100,000 to each group and encourage learners to say as many things as possible about the two numbers. For instance, 21345 and 21534; 21345 is less than (smaller than) than 21534 or 21534 is bigger than (greater than) 21345, or 21345 is almost 200 less than 21534 etc.
</td>
<td>Learners develop:

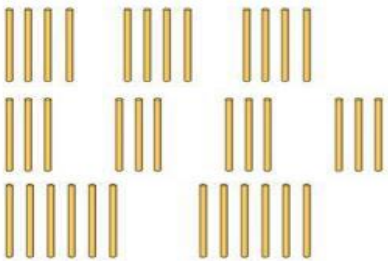
Problem Solving Skills;
Critical Thinking;
Justification of Ideas;
Collaborative Learning;
Attention to Precision;
Look for Patterns</td>
</tr>
</table>

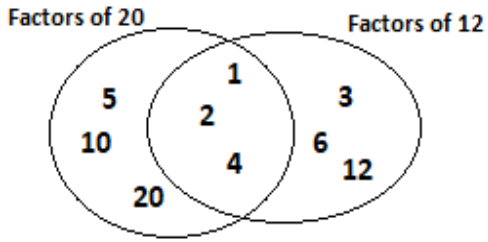
<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.1.1.1
Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000
CONT'D</td>
<td>
B4. 1.1.1.5 Round (off, up, down) whole numbers up to 10000 to the nearest, thousands, hundreds and tens
E.g. 1 Learners round off numbers to the nearest 1000, 100 and 10. For instance; 9500 is approximately 10,000 and 9100 as approximately 9,000
E.g. 2 Learners round up and round down to estimate sums and differences
NB: To round down learners consider the smaller of the two approximated numbers, while round up considers the bigger of the two numbers. The table below may bring the meaning of these two concepts clearer
<table>
<tr><td>14765</td><td>Round up</td><td>Round down</td><td>Round off</td></tr>
<tr><td>to the nearest ten</td><td>14970</td><td>14760</td><td>14970</td></tr>
<tr><td>to the nearest hundred</td><td>14800</td><td>14700</td><td>14800</td></tr>
<tr><td>to the nearest thousand</td><td>15000</td><td>14000</td><td>15000</td></tr>
</table>
E.g. 3 Learners work together to round up and round down to estimate sums and differences. For instance. $230+160$ as approximately 400 because 230 is approximately 200 while 160 is approximately 200, therefore $200+200=400$
</td>
<td>Learners develop:

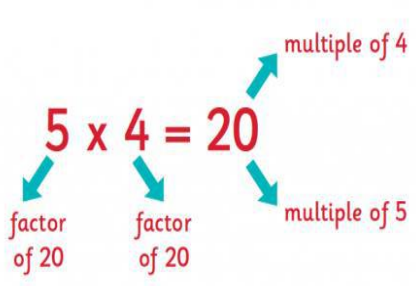
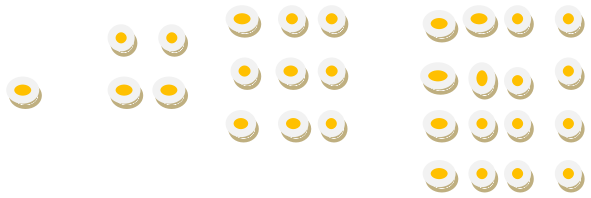
Problem Solving Skills;
Critical Thinking;
Justification of Ideas;
Collaborative Learning;
Attention to Precision;
Look for Patterns</td>
</tr>
</table>

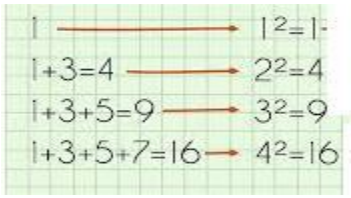
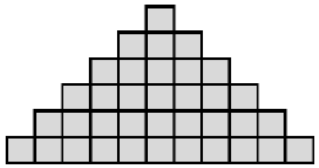
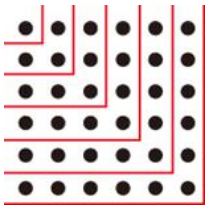
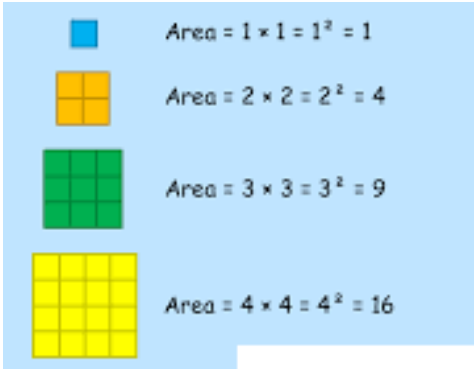
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit whole numerals up to 100,000. CONT'D**	**B4.1.1.1.6. Skip count forwards and backwards in 50s and 100s up to and from 10000** E.g. 1 Put learners into convenient groups. A learner mentions a number and another makes skip count in 50s or 100s to include the fifth count. For instance. Learner 1: Shout out "240" …. Learner 2: 290, 340, 390, 440, 490, etc. Learner 3; Shout out "1285" *skip counting down in 100s* Learner 4; 1185, 1085, 985, 885, 785….etc. E.g. 1 Skip count forwards and backwards by 50s and between 1000 and 10000 that are multiples of 50s and 100s but make an error or leave out a number. Challenge learners to identify or correct error	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns
B4.1.1.2. **Demonstrate understanding of Roman numerals up XXX (30)**	**B4.1.1.2.1 Develop an understanding of Roman Numeral system up XXX (i.e. 30)** E.g. 1 Display Roman numeral charts (1-30) arranged in sequential order and lead learners to identify the numerals. Learners identify the main characters of the roman numerals used to build the table up to 30 i.e. I, II, III, IV, V, X, Call out a numeral and have learners point at it from the chart E.g. 2 Have learners match the Roman numerals to the Hindu-Arabic numerals for instance I = 1; V= 5: X= 10, XV= 15. Mention some numerals randomly and have learners point at it on the chart	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.2. Demonstrate understanding of Roman numerals up XXX (30) CONT'D	**B4.1.1.2.2 Count and convert Hindu Arabic numerals to Roman numerals up to 30 and vice versa** E.g. 1 Learners read the chart sequentially forwards and backwards, vertically (up and down), zig-zag, diagonally and randomly without pointing to the numbers. Invite 2-3 learners to read to the class. Call a Roman numeral and ask learners to write E.g. 2 Give learners a numeral in the Hindu Arabic system and have learners convert to roman numeration and vice versa for instance XXIV = 24 **I V X L C** **1 5 10 50 100** 1 = I 10 = X 2 = II 20 = XX 3 = III 30 = XXX 4 = IV 40 = XL 5 = V 50 = L 6 = VI 60 = LX 7 = VII 70 = LXX 8 = VIII 80 = LXXX 9 = IX 90 = XC 10 = X 100 = C 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.3 Demonstrate an understanding of factors, multiples and squared numbers	**B4.1.1.3.1 Determine set of factors of a given numbers up to 50** E.g. 1 Learners make formation of sets of equal object from a given quantity. For example with 12 straws Learners make groupings such as:  $3\ groups\ of\ 4\ \Rightarrow 3,4$ $4\ groups\ of\ 3 \Rightarrow 4,3$ $2\ groups\ of\ 6 \Rightarrow 2,6$ E.g. 2 Learners pair grouping and the number of equal objects for each formation as factors; 4 groups of 3 straws (4, 3) 6 groups of 2 straws (6, 2) 1 group of 12 straws (1, 12) 3 groups of 4 straws (3, 4) 2 groups of 6 straws (2, 6) 12 groups of 1 straw (12, 1) E.g. 3 Learners collect from the pairs and form a set as the factors of the given number. For example the set of factors of $12 = \{1, 2, 3, 4, 6, 12\}$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships, Cultural Identity

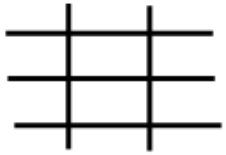
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.3 Demonstrate an understanding of factors, multiples and squared numbers CONT'D	**B4.1.1.3.2 Determine the highest common factor (HCF) of any two whole numbers between 1 and 50.** E.g. 1 Learners list the factors of two or more given whole numbers; 12 and 24 to list the factors. That is: $12 = \{1, 2, 3, 4, 6, 12\} and\ 24 = \{1, 2, 3, 4, 6, 8, 12, 24\}$ Learners determine the set of the common factors E.g. The common set factors of 12 and 24 = $\{1,2,3,4,6,12\}$. Learners select the highest common factor of 12 and 24 as 12 E.g. 2 Learners may use Venn diagrams to find the common factors and then the highest common factor by placing the factors in the regions of the shapes. The highest common factor of 12 and 20, in the diagram is 4  Note: Do not introduce formal set theory and notation. Numbers in the common regions of the two shapes. **B4. 1.1.3.3. Determine the lowest common multiple (LCM) of at least any two given numbers up to 100.** E.g. 1 Learners identify and the list the set multiples of given numbers using skip counting E.g. The set of multiples 5 = { 5, 10 15……..100} and the etc. of multiples of 10 = {10, 20, 30 , ……..100} E.g. 2 Learners list the set of common multiples of any two or more given numbers between 0 and 100. E.g. The set of common multiples of 5 and 10 ={10, 20, 30, … 100}. Learners select the least of the common multiple of the given numbers, and identify the least common multiple (LCM). The LCM of 5 and 10 is 10.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.3 Demonstrate an understanding of factors, multiples and squared numbers CONT'D	**B4.1.1.3.4 Recognise the relationship between factors and multiples.** E.g. 1 Factors represent the numbers that we can multiply to get a bigger number called the product or multiple. Since $12 = 4 \times 3$, we can say 4 and 3 are factors of 12; and 12 is a multiple of 3 or a multiple of 4. Break given multiples into factors and pairs of factors of given numbers. E.g. 2 Investigate even and odd numbers.  E.g. 3 Investigate numbers that are multiples of 2, 3, 4 and 5. How do you know a number is a multiple of 2? a multiple of 3? a multiple of 4? and a multiple of 5? (This is also known as the divisibility test). **B4.1.1.3.5 Generate and analyse patterns in square numbers** E.g. 1 Put learners into convenient groups and provide each group adequate number of bottle tops, an A4 sheet and a 30cm ruler and ask them to generate square numbers by continuing the arrangement shown below up to the 10th number; [i.e. 1, 4, 9, 16, 25, 36 …)  1 4 9 16	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

B4.1.1.3 Demonstrate an understanding of factors, multiples and squared numbers CONT'D	E.g. 2 Investigate the relationship between square numbers and the sum of consecutive odd numbers.    **B4.1.1.3.6 Represent square numbers using factors** E.g. 1 Learners draw a square whose side is 1 unit by 1 unit and determine the area; repeat the activity for a 2 unit, 3 unit and 4 unit squares. E.g. 2 Learners work in groups to continue the pattern to include the factors of 144. (Key Concept: when a number has been multiplied by itself we say the answer is a square number hence $1 \times \mathbf{1} = \mathbf{1}; \mathbf{2} \times \mathbf{2} = \mathbf{4}$; $\mathbf{3} \times \mathbf{3} = \mathbf{9}$ and we can write three squared as $\mathbf{3} \times \mathbf{3} = \mathbf{3^2}$)  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships: Cultural Identity

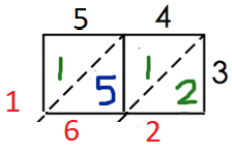
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.1.4 **Interpret negative and positive numbers in context**	**B4.1.1.4.1 Describe real life situations using positive and negative values** E.g. 1 Brainstorm learners on happenings which may be represented with positive and negative numbers (e.g. having savings with a bank and owing a bank; profit and loss etc.) Movement on the number line to the right and left of zero **B4.1.1.4.2 Count forwards and backwards with positive and negative whole numbers through zero** E.g. 1 Learners count from a given interval of positive and negative numbers on the number line. For example, count from 10 backward through zero to negative -8.	Learners develop: Critical Thinking; Justification of Ideas; Attention to Precision

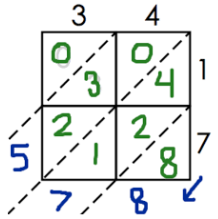
Sub-strand 2: Number Operations

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.2.1 **Recall basic multiplication fact up to 12×12**	**B B4.1.2.1.1 Determine basic multiplication facts up to 12×12** E.g. 1. To find $2 \times 3 = ?$ Learners arrange 2 straws vertically (legs) and put across it with 3 horizontal ones (arms). Learners count the number of intersections  $2 \times 3 = 6$ E.g. 2. Learners model different multiplication sentences, for example 3×4. Learners mention the number of dots (intersections) for other learners to model fence **Note:** Alternatively, learners may draw vertical lines to represent the legs and horizontal lines across them to represent the arms and then count the number of intersections as the product E.g. 3. Draw a 6 by 6 multiplication chart for the numbers 5 to 10 and use it as a game board to play the 3-in-a-line game with a pair of dice or playing cards. Players take turns in throwing a pair of dice and mark (or cover) the product made in a throw with his/her marker (or counter). The winner is the one who obtains three products in a line.   |	5	6	7	8	9	10
---	---	---	---	---	---	---
5	10	15	20	25	30	35
6	12	18	24	30	36	42
7	14	21	28	35	42	49
8	16	24	32	40	48	56
9	18	27	36	45	54	63
10	20	30	40	50	60	70 | E.g. 4. Learners find doubles of given numbers; find squares of given numbers; and skip count in 4, 5, and 8	Learners develop: Problem solving skills; Critical Thinking; Justification of Ideas; Collaborative learning; Attention to Precision; Look for Patterns and Relationships: Global Citizenship

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.2.2 **Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts**	**B4.1.2.2.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact using doubling or halving using patterns in the 9s facts using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts** E.g. 1 Describe the mental mathematics strategies used to determine a given basic fact, such as – skip count up by one or two groups from a known fact (e.g., if 5 × 7 = 35, then 6 × 7 is equal to 35 + 7 and 7 × 7 is equal to 35 + 7 + 7) – skip count down by one or two groups from a known fact (e.g., if 8 × 8 = 64, then 7 × 8 is equal to 64 – 8 and 6 × 8 is equal to 64 – 8 – 8) – doubling (e.g., for 8 × 3 think 4 × 3 = 12, and 8 × 3 = 12 + 12) – patterns when multiplying by 9 (e.g., for 9 × 6, think 10 × 6 = 60, and 60 – 6 = 54; for 7 × 9, think 7 × 10 = 70, and 70 – 7 = 63) – repeated doubling (e.g., if 2 × 6 is equal to 12, then 4 × 6 is equal to 24 and 8 × 6 is equal to 48) – repeated halving (e.g., for 60 ÷ 4, think 60 ÷ 2 = 30 and 30 ÷ 2 = 15) – relating division to multiplication (e.g., for 64 ÷ 8, think 8 × … = 64) E.g. 2 Recall multiplication facts to 81 and related division facts	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Attention to Precision; Look for Patterns and Relationships

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.1.2.2
Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts CONT'D</td>
<td>B4.1.2.2.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero halving and doubling using the distributive property
E.g. 1 Determine the products when one factor is a multiple of 10, 100, or 1000 by annexing zero or adding zeros (e.g., for 3×200 think of 3×2 and then add two zeros)
E.g. 2 Apply halving and doubling when determining a given product (e.g., 32×5 is the same as 16×10)
E.g. 3 Apply the distributive property to determine a given product involving multiplying factors that are close to multiples of 10 (e.g., 29×7 = (30×7) – (1×7) = 203</td>
<td>Learners develop:

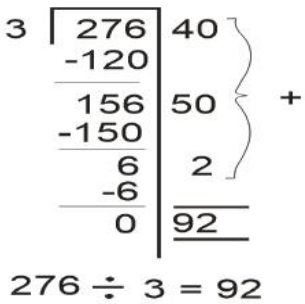
Problem solving skills; Critical Thinking; Justification of Ideas; Attention to Precision; Look for Patterns and Relationships</td>
</tr>
<tr>
<td>B4.1.2.3 Demonstrate an understanding of multiplication (2 or 3-digit by 1-digit)</td>
<td>B4. 1.2.3.1 Multiply multi-digit numbers efficiently
E.g. 1. Multiplication of whole numbers using the "expand and box" method (partial decomposition method). Lead learners to multiply a 3-digit number by a 1-digit number as shown below, for example $448 \times 2 = ?$
<table>
<tr><td>×</td><td>400</td><td>40</td><td>8</td></tr>
<tr><td>2</td><td>800</td><td>80</td><td>16</td></tr>
</table>
$$448 \times 2 = (400 \times 2) + (40 \times 2) + (8 \times 2)$$
$$= 800 + 80 + 16 = 800 + 80 + (10 + 6)$$
$$= 800 + 90 + 6 = 896$$


E.g. 2. Multiplication of whole numbers using the lattice method.
Have learners draw a 2 by 1 rectangular box for solving 54 × 3.
E.g. 3. Have learners draw a 2 by 2 rectangular box for solving 34 × 17.


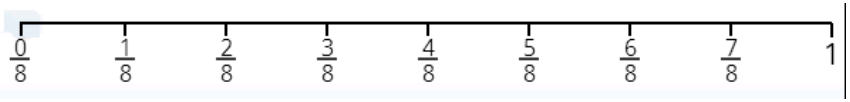
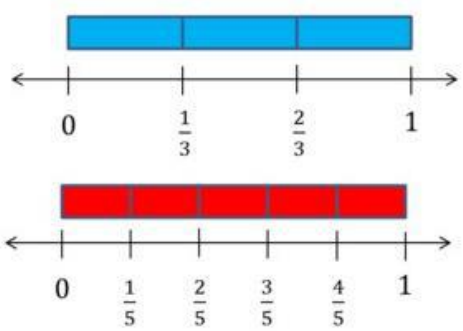
</td>
<td>Learners develop:

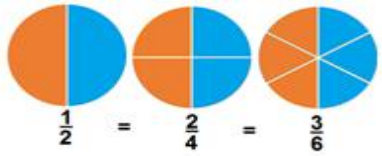
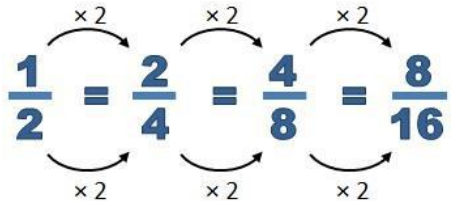
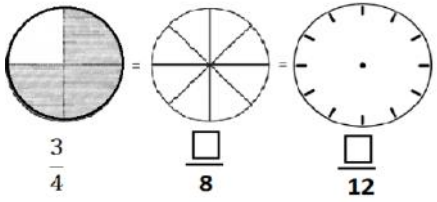
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships</td>
</tr>
</table>

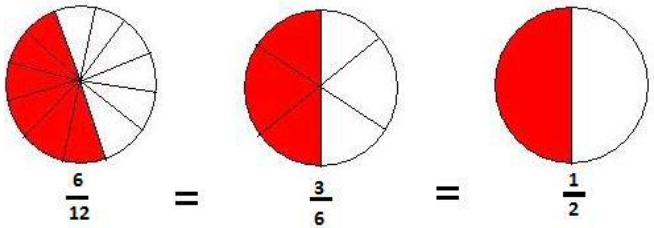
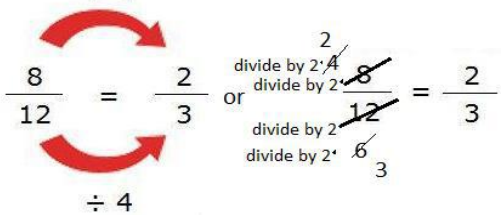
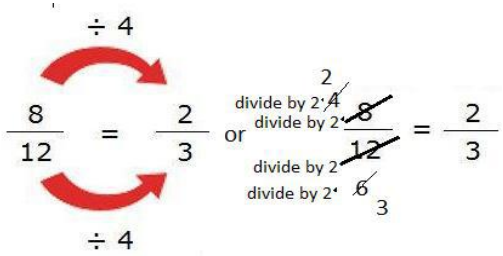
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.2.4 **Recall basic division fact up to 100**	**B4. 1.2.4.1 Determine basic division fact up to 81** E.g. 1. Investigate numbers that are multiples of 2, 3, 4 and 5. How do you know a number is divisible by 2, 3, 4 and 5 (This is also known as the divisibility test). E.g. 2. Draw a 6 by 6 multiplication chart and use it as a game board to play the 3-in-a-line game with a pair of dice or playing cards. Players take turns in throwing a one dice and mark (or cover) a number that can be divided by the results (i.e. a quotient). The winner is the one who obtains three numbers in a line.   		5	6	7	8	9	10
---	---	---	---	---	---	---
5	10	15	20	25	30	35
6	12	18	24	30	36	42
7	14	21	28	35	42	49
8	16	24	32	40	48	56
9	18	27	36	45	54	63
10	20	30	40	50	60	70		Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Global Citizenship
B4.1.2.5 **Demonstrate an understanding of division (2- or 3-digit by one digit number)**	**B4.1.2.5.1 Divide 2-digit numbers by 1-digit number efficiently** E.g. 1. Division as repeated subtraction (using the long division method). Explain division as a way of repeatedly subtracting a divisor number from a given dividend until there is none left and then determining the number of times the divisor is taken from the dividend. For example, $25 \div 5 = ?$ Learners count the number of times 5 was subtracted from 25, which is 5 times. Hence, $\mathbf{25 \div 5 = 5}$ 25 −5 *1* 20 −15 *1* 15 −5 *1* 10 −5 *1* 5 −5 *1* *00 5*	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning

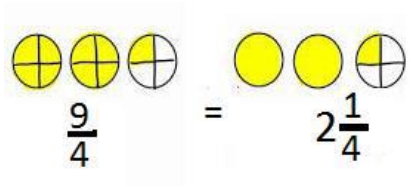
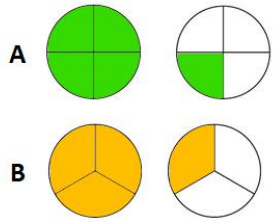
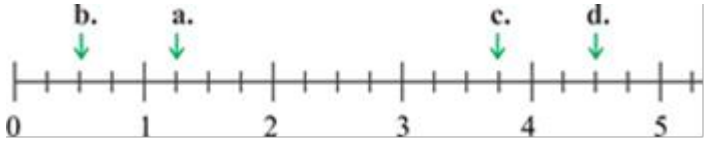
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	E.g. 2. Division using the estimation of multiples of 10, 100 and others of the divisor. For Example to solve 276 ÷ 3 = ? Learners use estimations: (they may have to use multiples of divisor to select a convenient estimate) "About how many groups of 3 can fit into 276?" The estimation used here is 40. So 3 × 40 = 120. Subtracting 120 from 276 to get 156. The next estimation used is 50. So 3 × 50 = 150. Subtracting 150 from 156 to get 6. The next estimation used is 2. And 2 × 3 = 6. Subtracting 6 from 6 to get 0. There is nothing more to share. To find the final answer add the estimations: $40 + 50 + 2 = 92$. Therefore $276 \div 3 = 92$  Note: This strategy is nicknamed the "Big 7" because the division box looks like a 7.	
B4.1.2.6 **Translate and solve word problems involving the four basic operations on whole numbers**	**B4.1.2.6.1 Solve multi-step word problems involving the four basic operations** E.g. 1. Learners model mathematical statements from a given word problem involving addition and multiplication and solve using the strategies learnt E.g. 2. Learners model mathematical statements from a given word problem involving division and subtraction and solve using the strategies learnt E.g. 3. Learners role play a given word problem involving addition and multiplication and solve E.g. 4. Learners role play a given word problem involving subtraction and division and solve E.g. 5. Learners model mathematical statements from a given word problem involving division and multiplication and solve using the strategies learnt The relationship between operations and the use of calculator and spreadsheet to assess the reasonableness of answers should be stressed	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning;

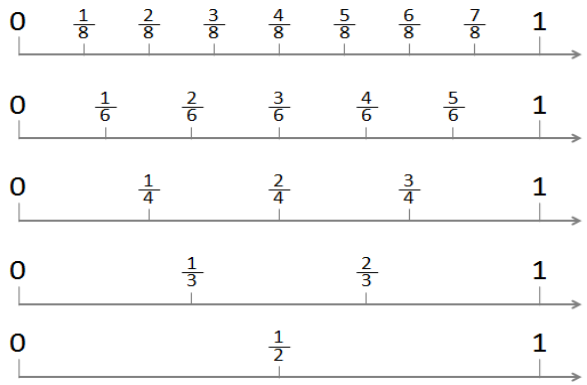
Sub-strand 3: Fractions

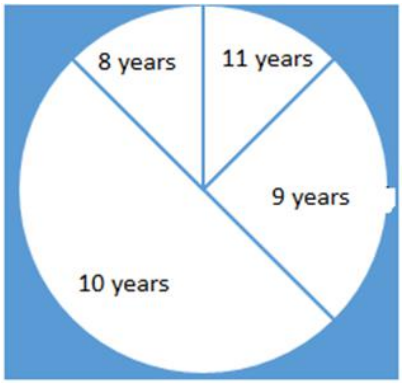
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.3.1 **Develop an understanding of equivalent and improper fractions** ~~**12 × 12**~~	**B4.1.3.1.1 Generate unit fractions and locate a unit fraction, e.g. one-eighth, on a number line by defining the interval from 0 to 1 as the whole and partitioning it into 8 equal parts and that each part has size $\frac{1}{8}$.** E.g. 1. Use number line to locate one eight by defining the interval from 0 to 1 as the whole and partitioning it into 8 equal parts  E.g. 2. Ask pupils to draw several lines, 30 units each, and mark the ends 0 and 1. For each line ask them to partition the interval from 0 to 1 into each of the following unit fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, \frac{1}{6}$, and $\frac{1}{10}$. E.g. 3. Ask pupils to use the number chart they have drawn to read fractions that are equivalent e.g. $\frac{1}{3} = \frac{2}{6} = \frac{3}{6}$ …  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision

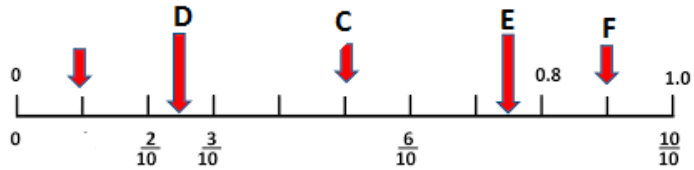
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.3.1 Demonstrate an understanding of strategies for comparing, adding and subtracting fractions (same denominator, or one being a multiple of the others) ~~12 × 12~~	**B4.1.3.1.2 Recognise and name equivalent fractions using pictorial representations and number line to determine the Lowest Common Denominator (LCD).** E.g. 1. Use fraction chart to illustrate the concept of equivalent fractions (i.e. equal fractions that have different fractional units or denominators) i.e. one-half is 2-fourths, 3-sixth or 4-eighths. E.g. 2. Illustrate the relationship between fractions and their equivalences by observing the different fractional units or denominators (i.e. the numerator is multiplied by the number of units the denominator is further broken into)   E.g. 3. Ask pupils to colour fractions that are equivalent to given fractions or write more equivalent fractions for give n fractions $\frac{1}{3} = \frac{\square}{6}$ $\frac{4}{8} = \frac{\square}{2}$ $\frac{2}{6} = \frac{\square}{12}$ $\frac{4}{12} = \frac{\square}{3}$ $\frac{2}{4} = \frac{\square}{8}$ $\frac{1}{3} = \frac{\square}{12}$  E.g. 4. To determine the equivalent fractions of given fractions, find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions that are comparable	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.3.1 Demonstrate an understanding of strategies for comparing, adding and subtracting fractions (same denominator, or one being a multiple of the others) CONT'D ~~12 × 12~~	**B4.1.3.1.3 Find the simplest form of given fractions by dividing through by the highest common factor (i.e. by cancelling through by factors)** E.g. 1. Use pictorial representations to illustrate the simplest form of a fraction; e.g. $\frac{6}{12} = \frac{3}{6} = \frac{1}{2}$  E.g. 2. Find the simplest form of a given fraction, divide through by the highest common factor.  E.g. 3. Find the simplest form of a given fraction, express the numerator and denominators as factors and cancel through common factors. $\frac{8}{12} = \frac{2 \times 2 \times 2}{2 \times 2 \times 3} = \frac{2}{3}$ E.g. 2. Find the simplest form of a given fraction, divide through by the highest common factor.  	Learners develop: Problem solving skills; Critical Thinking; Justification of Ideas; Collaborative learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.3.1 Demonstrate an understanding of strategies for comparing, adding and subtracting fractions (same denominator, or one being a multiple of the others) CONT'D	E.g. 3. To find the simplest form of a given fraction, express the numerator and denominators as factors and divide through by common factors. $\frac{8}{12} = \frac{\cancel{2} \times \cancel{2} \times 2}{\cancel{2} \times \cancel{2} \times 3} = \frac{2}{3}$ **B4.1.3.1.4 Recognise fractions that are greater than one (i.e. improper fractions), draw and label such fractions with their symbols** E.g. 1. Use several pictorial representations (or card cut outs) to introduce improper fractions (i.e. where the fraction is bigger than 1 or the numerator in larger than the denominator). Examples are $\frac{9}{4}$ and $\frac{7}{6}$ (i.e. nine-fourths and seven-sixths) and show how they are expressed as mixed fractions (i.e. $2\frac{1}{4}$ and $1\frac{1}{6}$). Ask pupils to change given improper fractions to mixed fractions  E.g. 2. Ask pupils to express given coloured mixed fractions as improper fractions or draw and colour given improper fraction (e.g. seven-fourths, eleven-eights, etc.)  E.g. 3. Use number line to present more mixed fractions for pupils to identify and state their improper fractions  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.3.2 **Demonstrate an understanding of strategies for comparing, adding and subtracting fractions (same denominator, or one being a multiple of the others)**	**B4.1.3.2.1 Compare and order fractions with like denominators by using pictorial representations and finding equivalent fractions using the Lowest Common Denominator (LCD)** E.g. 1. Use number line or fraction chart to illustrate the concept of comparable fractional units or denominators; i.e. halves, fourths and eighths are comparable; i.e. half can be changed to equivalent fractions in fourths and eighths, and fourths can changed to eighths. Also thirds can changed to sixths. E.g. 2. Use number line or fraction charts to compare and order unit fractions. Which is larger, $\frac{5}{8}$ and $\frac{3}{4}$ or $\frac{3}{6}$ and $\frac{4}{8}$? Arrange from smallest to largest, $\frac{3}{4}, \frac{2}{3}$ and $\frac{5}{6}$  E.g. 3. To arrange the fractions, $\frac{3}{4}, \frac{2}{3}$ and $\frac{5}{6}$, from largest to smallest, find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions LCD for $\frac{3}{4}, \frac{2}{3}$ and $\frac{5}{6}$ is 12; hence $\frac{3}{4} = \frac{9}{12}$; $\frac{2}{3} = \frac{8}{12}$; $\frac{5}{6} = \frac{10}{12}$ $\therefore$ the order is $\frac{5}{6}, \frac{3}{4}, \frac{2}{3}$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	CORE COMPETENCIES
B4.1.3.2 **Demonstrate an understanding of strategies for comparing, adding and subtracting fractions (same denominator, or one being a multiple of the others). CONT'D**	**B4.1.3.2.3 Provide examples of where fractions are used** E.g. 1. Discuss the contexts below in which fractions are used in real life and provide materials for pupils to act them out – Selling liquids – oil, kerosene, drinks, etc. – Sharing pizza or birthday cake - half, quarter, eighths, etc. – Buying objects in packets – egg, drinks, (half crate), – Buying cloth for sewing dresses – half, one-fourths or quarter, etc.  E.g. 2. Tell the time by half/quarter past, and half/quarter to. Draw clock-faces with times (i.e. half/quarter past or to) for pupils to read the time E.g. 3. Drawing circle graphs that represent halves, fourths and eighths. The graph shows the ages of pupils in Primary 4. If there are 40 pupils in the class, ask questions for pupils to interpret the graph  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.1.4.1
Develop an understanding of decimals (tenths and hundredths) using concrete and pictorial representations and write decimal fractions as base ten numbers with place value.</td>
<td>
B4.1.4.1.1 Describe and represent decimals (tenths and hundredths) concretely, pictorially, and symbolically
E.g. 1. Use pictorial representations or number line to revise tenths and hundredths and ask pupils to identify the fractions (i.e. A, B, C, D, & E).


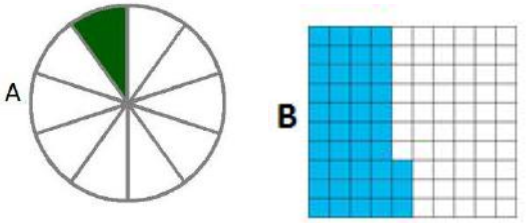
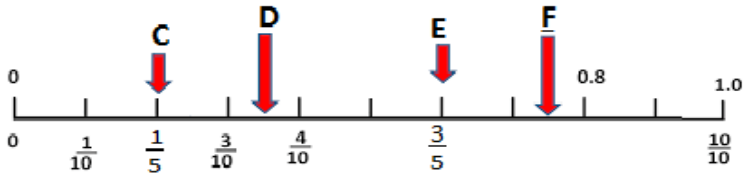
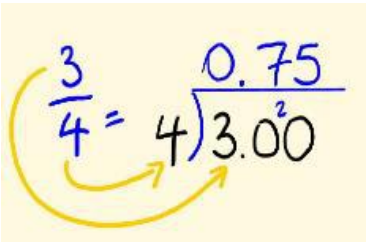
E.g. 2. Use the tenth and hundredth place value chart to illustrate how to write the fraction as a base ten number with the introduction of the decimal point "·" after ones place in the place value chart.
E.g. 3. Give pupils several common fractions (including improper fractions) to convert into tenths and hundredths and write their decimal names.
E.g. $7\frac{2}{5} = \frac{\square}{10} = \square$.
<table>
<tr><th colspan="6">Tenth and Hundredth Place Value Chart</th></tr>
<tr><th></th><th>Fraction</th><th>l s</th><th>·</th><th>$\frac{1}{10}s$</th><th>$\frac{1}{100}s$</th></tr>
<tr><td>A</td><td>$\frac{1}{4} = \frac{25}{100}$</td><td>0</td><td>·</td><td>l</td><td></td></tr>
<tr><td>B</td><td>$\frac{1}{8} = \frac{125}{1000}$</td><td>0</td><td>·</td><td>2</td><td>0</td></tr>
<tr><td>C</td><td>$2\frac{1}{2} =$</td><td>0</td><td>·</td><td>5</td><td></td></tr>
<tr><td>D</td><td>$3\frac{3}{5} =$</td><td>0</td><td>·</td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

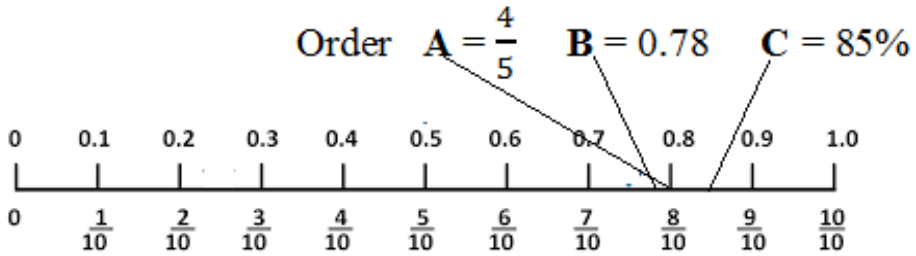
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision</td>
</tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.4.1 **Develop an understanding of decimals (tenths and hundredths) using concrete and pictorial representations and write decimal fractions as base ten numbers with place value.**	**B4.1.4.1.2 Round decimals to the nearest tenth** E.g. 1. Explain the rule for of rounding decimals, which is similar to that of rounding whole numbers. That is, rounding to the nearest tenth means that the rounded figure has one digit after the decimal mark. Rounding to the nearest hundredth means that the rounded figure has two digits after the decimal mark E.g. 2. Use a table with several decimals fractions and explain the rule for of rounding decimals. Give pupils a table of decimal fractions to round to the nearest tenths or hundredths E.g. 3. Ask students to change fractions to decimal writing their results to the nearest tenths or hundredths	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

	Fraction	Round to Nearest	Result
A	0.38	$\frac{1}{10}$	0.4
B	4.085	$\frac{1}{10}$	
C	56.584	$\frac{1}{10}$	
D	18.096	$\frac{1}{100}$	
E	30.084	$\frac{1}{100}$	

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.4.1 **Develop an understanding of decimals (tenths and hundredths) using concrete and pictorial representations and write decimal fractions as base ten numbers with place value**	**B4.1.4.1.3 Use models to explain the result of addition and subtraction of decimals (up to hundredths)** E.g. 1. To add 0.64 and 0.39, means sum $\frac{64}{100} + \frac{39}{100}$ which is $\frac{64+39}{100} = \frac{103}{100}$ = 1.03. $$\begin{array}{r} 0.64 \\ +\ 0.39 \\ \hline 1.03 \end{array}$$ That is, since both are hundredths fractions (i.e. have 2 decimal places) we can line up the decimal points to align the place values and add as whole numbers E.g. 2. To add 0.6 and 0.39, one number is in tenths and other is in hundredths (i.e. one has 1 decimal place and the other 2 decimal places) it is important to line up the decimal points to align the place values and add as whole numbers $$\begin{array}{r} 0.6 \\ +\ 0.39 \\ \hline 0.99 \end{array}$$ E.g. 3. To subtract 0.6 from 1.39, means $\frac{139}{100} - \frac{6}{10} = \frac{139}{100} - \frac{60}{100} = \frac{139-60}{100} = \frac{79}{100}$ = 0.79. That is, since one number is in tenths and other is in hundredths (i.e. one has 1 decimal place and the other 2 decimal places) it is important to line up the decimal points to align the place values and subtract as whole numbers. $$\begin{array}{r} 1.39 \\ -\ 0.6 \\ \hline 0.79 \end{array}$$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.5.1 **Demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically)**	**B4.1.5.1.1 Model or recognise percent (as a fraction related to hundredths) using concrete models, pictorial representations and number line.** E.g. 1. Use several pictorial representations or number line to introduce tenths and hundredths and ask pupils to identify the fractions (i.e. A, B, C, D, & E). E.g. 2. Use long division method to convert and write fractions as decimals in the number chart.   E.g. 3. Give pupils several common fractions (including improper fractions) to convert into hundredths and write their decimal names or use long division; e.g. $\frac{3}{4} = \frac{75}{100}$ = 75%.  | | Fraction | 2 Decimal Places | Percent | |---|---|---|---| | A | $\frac{1}{10}$ | 0.10 | 10% | | B | $\frac{43}{100}$ | 0.43 | 43% | | C | | 0.50 | | | D | | 0.35 | | | E | | | | | F | ⋮ | | |	Learners develop: Problem solving skills; Critical Thinking; Justification of Ideas; Collaborative learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.1.5.1 **Demonstrate an understanding of percent (limited to whole numbers) concretely, pictorially, and symbolically) COND**	**B4.1.5.1.2 Compare and order a mixture of common, decimal and percent fractions (up to hundredths)** E.g. 1. To compare and order a mixture of common, decimal and percent fractions, express them in one form (i.e. either common, decimal or percent); e.g. to order $\frac{4}{5}$, 0.78 and 85% (i) we can express all as decimals $\rightarrow \frac{4}{5} = \frac{80}{100}$; $0.78 = \frac{78}{100}$ and $85\% = \frac{85}{100}$, hence the order from least to the largest is 0.78, $\frac{4}{5}$ and 85%; (ii) we can also express all as percentages $\rightarrow \frac{4}{5} = \frac{80}{100}$ = 80%, 0.78 $= \frac{79}{100}$ = 79%, and $= \frac{85}{100}$ = 85%, hence the order from least to the largest is 0.78, $\frac{4}{5}$ and 85%. E.g. 2. To compare and order a mixture of common, decimal and percent fractions you can locate the fractions on the number and order them.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

Strand 2: Algebra

Sub-strand 1: Patterns and Relationships

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.2.1.1

Demonstrate an understanding of how to identify and describe patterns found in tables and charts, including a multiplication chart</td>
<td>
B4.2.1.1.1 Describe the pattern found in a given table or chart

E.g. 1. Using a hundred chart, ask students to colour each number as they skip count by 2s and describe the pattern created. Repeat for 3, 4, 5, 6, 7, 8, and 9. Ask students to describe what changes they notice as the numbers increase.
Note to what extent students:
(i) identify all, some or none of the multiples of a given number.
(ii) are able to predict and extend the pattern.
(iii) are able to describe the pattern by relating it to similar designs in the real world (e.g., students may say it looks like a checker board)

B4.2.1.1.2 Determine the missing element(s) in a given table or chart

E.g. 1. Provide students with a chart with missing numbers and ask them to identify the missing numbers and explain their reasoning

B4.2.1.1.3 Identify the error(s) in a given table or chart

E.g. 1. Provide a mapping table containing errors. Ask students to identify and explain where the pattern has errors
<table>
<tr><th>Number of Tables</th><th>Number of Chairs</th></tr>
<tr><td>1</td><td>4</td></tr>
<tr><td>2</td><td>8</td></tr>
<tr><td>3</td><td>12</td></tr>
<tr><td>4</td><td>18</td></tr>
<tr><td>5</td><td>20</td></tr>
<tr><td>6</td><td>24</td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Pattern and Relationship</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.2.1.2.

Translate among different representations of a pattern, such as a table, a chart or concrete material</td>
<td>
B4.2.1.2.1 Create a concrete representation of a given pattern displayed in a table or chart
E.g. 1. Provide a table showing a pattern (involving one operation) such as the one below. Students can complete the table and create a concrete representation using linking cubes or other manipulatives
<table>
<tr><td>Figure</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Number of Cubes</td><td>3</td><td>6</td><td>9</td><td>?</td><td>?</td><td>?</td><td>?</td><td>?</td></tr>
</table>
B4.2.1.2.2 Create a table or chart from a given concrete representation of a pattern.
E.g. Present learners with a geometric design series, such as the one shown below. Ask them to extend the pattern and record it in a T-chart. Ask learners what the 10th step would be. What would the 12th step be? What would the 20th step be?
#1 #2 #3 #4

<table>
<tr><th>Design #</th><th># of Square</th></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>2</td><td>2</td></tr>
<tr><td>3</td><td>3</td></tr>
<tr><td>4</td><td>4</td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Pattern and Relationship</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.2.1.3.

Represent, describe and extend patterns and relationships, using charts and tables, to solve problems</td>
<td>
B4.2.1.3.1 Translate the information in a given problem into a table or char
<table>
<tr><td>A</td><td>B</td></tr>
<tr><td>1</td><td>2</td></tr>
<tr><td>2</td><td>4</td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td>8</td></tr>
<tr><td></td><td></td></tr>
</table>
E.g. 1. Given the numerical pattern, ask students to extend the pattern and explain how they determined the pattern and its missing elements

E.g. 2. Ask students to use manipulatives to represent this pattern and describe the relationship between the chart and the concrete representations

B4.2.1.3.2 Identify and extend the patterns in a table or chart to solve a given problem.
E.g. 1. Give students two tables with patterns that are related in some way. Students should first extend each one by three more numbers. Then they should explain how the two patterns are alike and how they are different

<table>
<tr><td colspan="2">Pattern A</td></tr>
<tr><td>1</td><td>5</td></tr>
<tr><td>2</td><td>10</td></tr>
<tr><td>3</td><td>15</td></tr>
<tr><td>4</td><td>20</td></tr>
<tr><td>5</td><td>25</td></tr>
</table>
<table>
<tr><td colspan="2">Pattern B</td></tr>
<tr><td>1</td><td>2</td></tr>
<tr><td>2</td><td>7</td></tr>
<tr><td>3</td><td>12</td></tr>
<tr><td>4</td><td>17</td></tr>
<tr><td>5</td><td>22</td></tr>
</table>
E.g. 2. Students could make up their own pairs of patterns and challenge other students to discover how they are alike and how they are different
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Pattern and Relationship</td>
</tr>
</table>

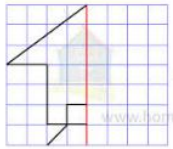
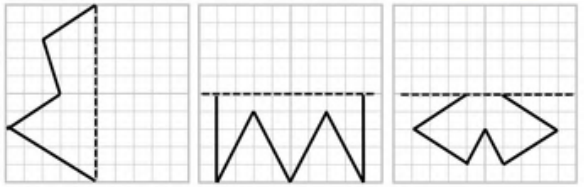
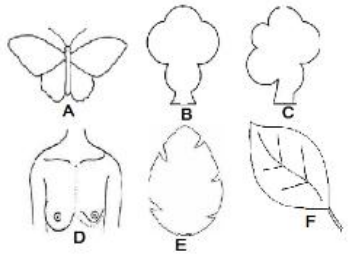
Sub-strand 2: Unknowns, Expressions and Equations

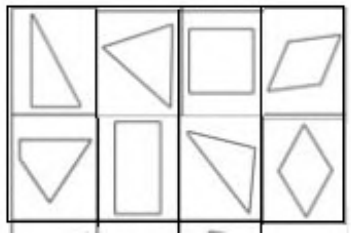
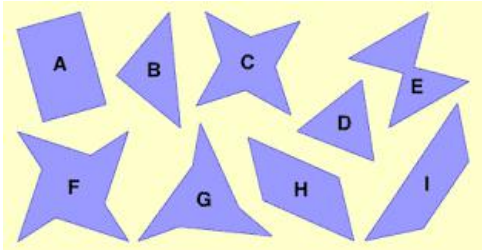
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.2.2.1 **Express a given problem as an equation in which a symbol is used to represent an unknown number**	**B4.2.2.1.1 Write a given problem as an equation in which a symbol is used to represent an unknown number** E.g. 1. Ask students to explain the purpose of the box symbol in the following equation: 15 – □ = 8 **B4.2.2.1.2 Express a given pictorial or concrete representation of an equation in symbolic form** E.g. 1. Provide a pictorial representation of the following and ask students to write equations with unknowns for each situation. Students need not solve their equations. (i) The perimeter of a triangle is 12 cm. One side is 3 cm and another side is 4 cm. What is the length of the third side? (ii) Mansa has three types of stickers. She has 25 stickers, 3 are Cocoa stickers and 18 are Cashew stickers. How many of the third type does she have? (iii) Kojo's age and his sister's age add up to 18. If Kojo is 12, how old is his sister?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Pattern and Relationship

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.2.2.2 **Solve one-step equations involving a symbol to represent an unknown number**	**B4.2.2.2.1 Solve a given one-step equation using manipulatives** E.g. 1. Ask students to solve the following using a pan balance: (i) 7 + ☐ = 12 (ii) 19 – ☐ = 11 **B4.2.2.2.2 Describe orally, the meaning of a given one-step equation with one unknown.** E.g. 1. Ask students to solve the following equations and explain their thinking. (i) △ – 13 = 20 (ii) 25 + △ = 100 **B4.2.2.2.3 Solve a given equation when the unknown is on the left or right side of the equation.** E.g. 1. Ask students to solve the following using base ten materials: (i) 109 + ☐ = 164 (ii) △ – 50 = 150 **B4.2.2.2.4 Solve a given one-step equation using "guess and check"** E.g. 1. Ask students to explain what the ☐ represents in the number sentences shown. Ask them to place numbers in the symbols to make the number sentence true. △ - 7 = 6 9 + ☐ = 17 **B4.2.2.2.5 Identify the unknown in a problem, represent the problem with an equation, and solve the problem concretely, pictorially or symbolically** E.g. 1. Provide students with linking cubes to model situations. Pose the problem: Kobby has 13 red marbles and 22 blue marbles. How many more blue marbles than red marbles does Kobby have? Observe how students solve the problem	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Pattern and Relationship

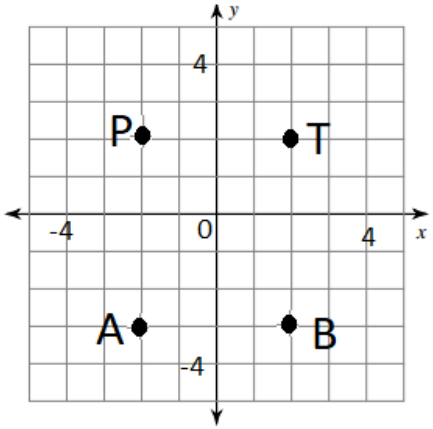
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.2.2.2 **Solve one-step equations involving a symbol to represent an unknown number. CONT'D**	**B4.2.2.2.6 Represent and solve a given addition or subtraction problem involving a "part-part-whole" or comparison context, using a symbol to represent the unknown** E.g. 1. Ask students to represent and solve these problems: (i) Eunice is Anita's older sister. The difference between their ages is 21 years. Anita is 37 How old is Eunice? (ii) Ms. Akoto allowed 7 students to go to the washroom. There were 15 students left in the room. How many students are in the class? **B4.2.2.2.7 Create a problem for a given equation with one unknown.** E.g. 1. Provide an equation such as 14 + ☐ = 21 or 25 - ☐ = 18. Ask students to create a matching story problem and solve it. Observe to what extent students are able to: -create a story to match the equation; - explain the meaning of the unknown variable; and - solve the problem in one or more way	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Pattern and Relationships

Strand 3: GEOMETRY AND MEASUREMENT
Sub-strand 1: 2D and 3D Shapes

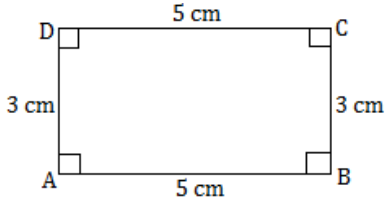
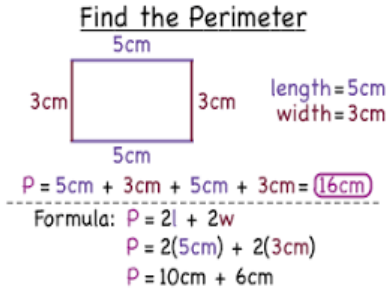
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.1.1 **Identify the lines of symmetry of regular and irregular 2D shapes**	**B4.3.1.1.1 Complete drawings of shapes to make them symmetrical** E.g. 1. Give learners graph sheets to copy the incomplete 2D shape and it complete to make a symmetrical picture E.g. 2. Give learners photocopied worksheets with several incomplete 2D shapes to complete with marked line of symmetry to complete the drawing.   **B4.3.1.1.2 Identify the lines of symmetry of regular and irregular 2D shapes (triangles and quadrilateral)** E.g. 1. Give learners photocopied worksheets with symmetrical and non-symmetrical objects to sort and explain why they are symmetrical or not showing the lines of symmetry 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

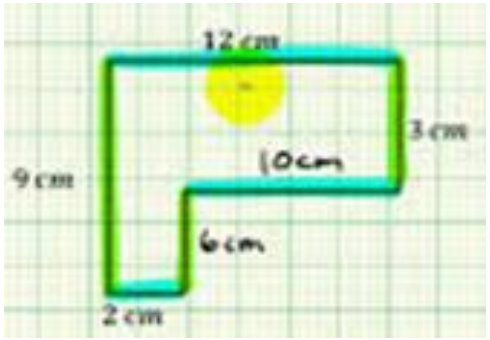
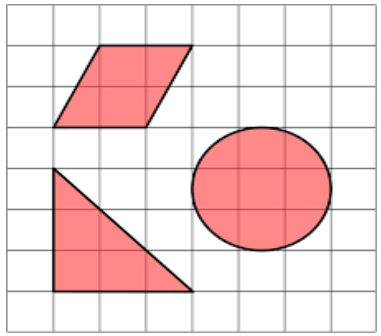
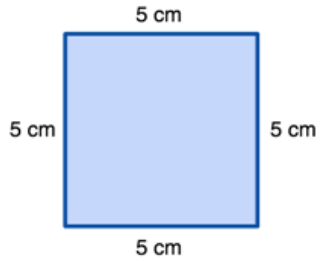
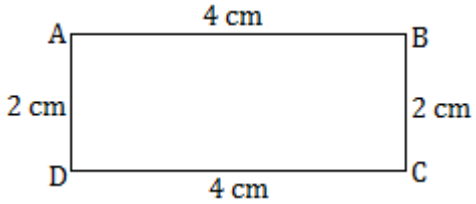
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.1.1 **Identify the lines of symmetry of regular and irregular 2D shapes**	E.g. 2. Give learners photocopied worksheets with symmetrical and non-symmetrical 2D shapes to cut out and sort, and explain why they are symmetrical or not showing the lines of symmetry  E.g. 3 Give learners cut-out 2D fold shapes to investigate the number of lines of symmetry E.g. 4 Give learners 2-D shapes to copy and draw their lines of symmetry 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

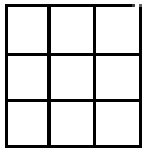
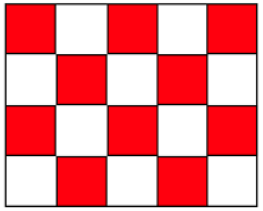
Sub-strand 2: Position / Transformation

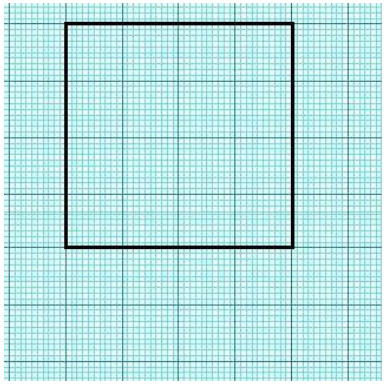
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.2.1 **Describe the position of objects in space using the cardinal points**	**B4.3.2.1.1 Tell the position and motion of objects in space using the cardinal points north, south, east and west** E.g. 1. Put pupils in convenient groups a give each group with a worksheet on graph with different labelled coordinates; some with axes labelled and other not etc. Pupils discuss their worksheets in their groups, then with whole class, describing coordinates, axes and pointing out errors on graphs if any E.g. 2. Pupils describe the position and motion of objects: e.g. The point **P** is to the west of point **T** but to the north of the **A**  E.g. 3. Ask learners to locate the coordinates (i.e. ordered pairs of the location) of the Points; e.g. B is (2,-3) and T is (2,2)	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Sub-strand 3: Measurement- (Perimeter and Area)

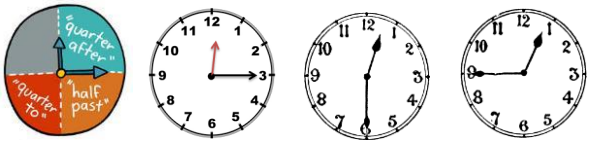
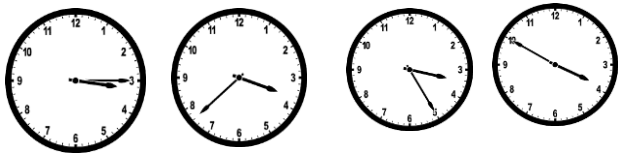
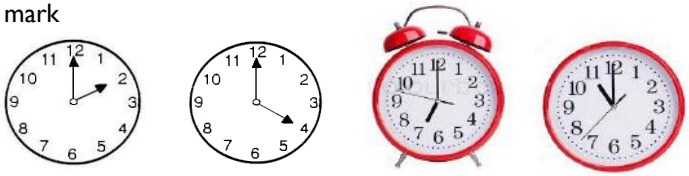
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.1 **Demonstrate understanding of perimeter of regular and irregular shapes**	**B4.3.3.1.1 Estimate perimeter using referents for centimetre or metre** E.g. 1 Using pupils' referents for centimetre or metre estimate and calculate perimeter of any object in the classroom (e.g. exercise book, floor tiles, math set, etc.) then measure with a ruler of tape and calculate the actual perimeter and compare the answers  **B4.3.3.1.2 Measure and record perimeter for regular and irregular shapes in cm and m.** E.g. 1 Ask pupils to use a ruler to measure all the sides of a regular shape and sum up the result to obtain the perimeter  P = 16cm  E.g. 2 Pupils to explore the area of irregular cut-out shapes using graph sheets. Pupils to trace the shape on the graph sheet and count out the unit squares	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision; Cultural Identity

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.1 Demonstrate understanding of perimeter of regular and irregular shapes CONT'D	E.g. 3 Given an irregular shape with its sizes, ask pupils to sum up the sizes to obtain the perimeter.   **B4.3.3.1.3 Develop and apply a formula for determining perimeter of square and rectangle** E.g. 1. Use cut out shapes to demonstrate how to determine the perimeter of 2-D shapes. Ask pupils to measure the sides of the cut out shape and add the results to obtain the perimeter  E.g. 2 Given a rectangular cut out shape, ask pupils to measure the sides of the shape and determine the perimeter of the shape  Therefore the perimeter of the triangle given is AB + AD + BC + CD. Thus 4cm + 2cm + 4cm + 2cm = 12cm	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision: Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.1 Demonstrate understanding of perimeter of regular and irregular shapes CONT'D	**B4.3.3.1.4 Construct different rectangles for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter.** E.g. 1. Given a perimeter of say 36cm, pupils to draw about three different rectangular shapes for the same perimeter. Combinations may include (6cm, 6cm, 12cm, 12cm; 8cm, 8cm, 10cm, 10cm; 4cm, 4cm, 14cm, 14cm, etc.)	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Personal Development and Leadership Attention to Precision
B4.3.3.2 **Demonstrate an understanding of area of regular and irregular 2-D shapes**	**B4.3.3.2.1 Recognise that area is measured in square units.** E.g. 1 Pupils to explore the area of their exercise books. i.e. ask pupils to cut 1cm by 1cm square sheets and tack them on the back of their exercise books until it is covered entirely. Then, count the number of the sheets to obtain the area E.g. 2. Pupils to explore the area of graph sheet. Ask pupils to calculate the area of one of the squares on the graph sheet. Then, count the number of squares on the graph sheet to obtain the area of the entire sheet  Area of graph sheet = $9cm^2$ E.g. 3 Using floor tiles, ask pupils to measure the area of one of the tiles, then multiply it by the number of tiles to obtain the area of the entire room  Note: Help pupils to come out with the understanding that the area of a figure is the number of squares required to cover it completely **B4.3.3.2.2 Select and justify referents for the units cm^2 or m^2** E.g. 1 Let pupils explore the area of smaller objects say their exercise books. Then explore the area of larger objects say the entire classroom and compare the results for the two activities. Ask pupils to tell which unit (cm^2 or m^2) they will use for which activity and why?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

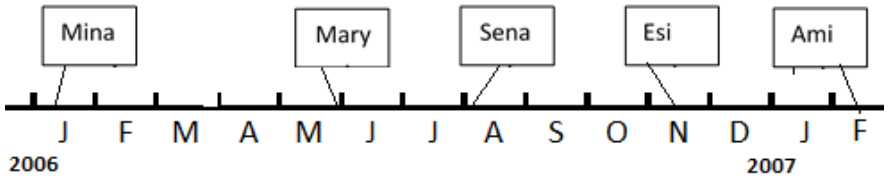
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.2 **Demonstrate understanding of area of regular and irregular 2-D shapes CONT'D**	**B4.3.3.2.3 Estimate area by using referents for cm^2 or m^2** E.g. 1 Let pupils estimate the area of items in the classroom. Then measure the actual area and compare with their estimates E.g. 2 Pupils to measure the area of say their exercise books. With that as a reference point, ask them to estimate the area of the teacher's table **B4.3.3.2.4 Develop and apply a formula for determining area of a rectangle and square** E.g. 1 Give pupils a standard graph sheet with 1 cm squares and ask them to draw a square of given length on the graph sheet. The area can be measured by counting the number of square units. So, we can count the number of unit units to find the area. In the diagram the area is $16cm^2$ since there are 36 squares in the shape  E.g. 2 Ask pupils to count the number of cubic squares on the vertical section of the shape and multiply it by the number on the horizontal section Ask pupils to compare their answer with the first strategy and draw their own conclusions. The area of a square can be given as L × L and that of a rectangle is L × B. **B4.3.3.2.5 Construct different rectangles for a given area (cm^2 or m^2) in order to demonstrate that many different rectangles may have the same area.** E.g. 1. Given an area of say $24cm^2$, pupils should draw about three different rectangles for the same area. Combinations may include (6cm × 4cm; 8cm × 3cm; 12cm × 2cm, etc.)	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Sub-strand 3: Measurement -Time

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.3 Demonstrate understanding of time taken by events in minutes and hours	**B4.3.3.3.1 Tell the time in hours and minutes in analogue and digital watches including 24-hour clocks** E.g .1 Use analogue clocks to tell time by keeping the hour hand on 12 and making jumps of 15(quarter past), 30(half past), 45(quarter to), and 60 (12 o'clock)  E.g. 2 Use analogue clocks to tell time by keeping the hour hand on any number say 3 and move the minutes hand to various numbers for different time (3:12, 3:25, 3:38, 3:50, etc.  E.g. 3 Use analogue clocks to tell time by keeping the minutes hand on 12 and moving the hour hand to tell time at the hour mark  E.g .4 Pupils should draw/sketch the face of the clock to tell time given	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision Cultural Identity and Global Citizenship

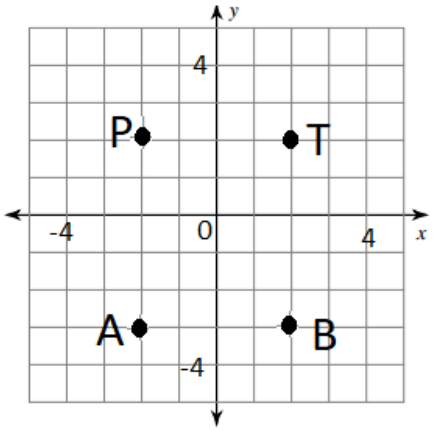
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.3 Demonstrate an understanding of time taken by events in minutes and hours CONT'D	E.g. 5 Pupils to explore the relationship in the units of time (i.e. 60 seconds = 1 minute; 60 minutes = 1hour) E.g. 6 Use digital watches to tell time. Pupils to observe the face of the digital watches and tell the time  **B4.3.3.3.2 Use clock to measure time to complete simple events in minutes and seconds** E.g. 1 Use the analogue clock to record the time it takes to say walk from the classroom to the canteen/head teacher's office/library, etc. and back. (mostly minutes) E.g. 2 Use the digital watch to record say the time it takes to walk from the teacher's table to the cupboard. (mostly seconds) E.g. 3 Ask pupils to tell the time it takes to complete activities like bathing, brushing teeth, ironing a shirt, cooking rice, etc. **B4.3.3.3.3 State dates of events and record calendar dates in a variety of formats** E.g. 1. Record dates in different formats i. Tuesday, 28th August 2018 ii. 28th August, 2018 iii. 28-Aug-18 iv. 28/08/2018 v. 28.08.18 E.g. 2. Ask pupils to write the dates for the following events from a calendar; i. Independence Day of Ghana ii. Republic Day iii. Founders' Day iv. Farmers' Day v. Workers' Day	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision Cultural Identity and Global Citizenship

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B4.3.3.3
Demonstrate an understanding of time taken by events in minutes and hours CONT'D</td><td>E.g. 3. Ask pupils in groups to state their dates of birth and put this in a table. Guide pupils to draw a time line (or time line-graph) for their birthdays (see Figure below)

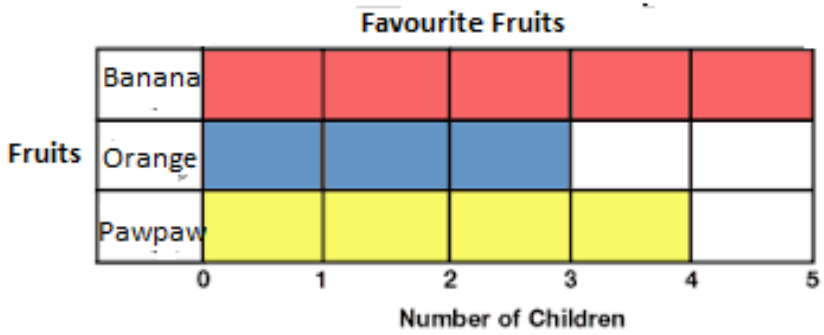
Table 1 Birthdays of pupils in Ami's group
<table><tr><th>Name</th><th>Date of birth</th></tr><tr><td>Ami</td><td>20th February 2007</td></tr><tr><td>Esi</td><td>14th November 2006</td></tr><tr><td>Mary</td><td>30th May 2006</td></tr><tr><td>Mina</td><td>10th January 2006</td></tr><tr><td>Sena</td><td>5th August 2006</td></tr></table>
 
</td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision
Cultural Identity and Global Citizenship</td></tr>
</table>

Sub-strand 3: Position/Transformation

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.3.3.1 **Describe the position of objects in space using the cardinal points**	**B4.3.3.1.1** **Tell the position and motion of objects in space using the cardinal points north, south, east and west** E.g. 1. Put pupils in convenient groups a give each group with a worksheet on graph with different labelled coordinates; some with axes labelled and other not etc. Pupils discuss their worksheets in their groups, then with whole class, describing coordinates, axes and pointing out errors on graphs if any E.g. 2. Pupils describe the position and motion of objects: e.g. The point **P** is to the west of point **T** but to the north of the **A** E.g. 3. Ask learners to locate the coordinates (i.e. ordered pairs of the location) of the Points; e.g. B is (2,-3) and T is (2,2)  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Personal Development and Leadership Attention to Precision, Global Citizenship

Strand 4: Data
Sub-strand 1: Data Collection, Organization, Presentation, Interpretation and Analysis

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.4.1.1 **Demonstrate an understanding of many-to-one correspondence in displaying, and reading or interpreting, graphs**	**B4.4.1.1.1 Use an understanding of one-to-one correspondence to read and interpret graphs** E.g. 1. Give learners graphs that use one-to-one correspondence in displaying data. For example, the graph below shows the favourite fruits of children in a P4 class. Each coloured box in the graph represents a pupil  Ask the following questions for children to read and interpret graphs i. How many pupils said they like pawpaw? ii. What is the most favourite food of the class? How many pupils are in the class? Etc.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision;

<table>
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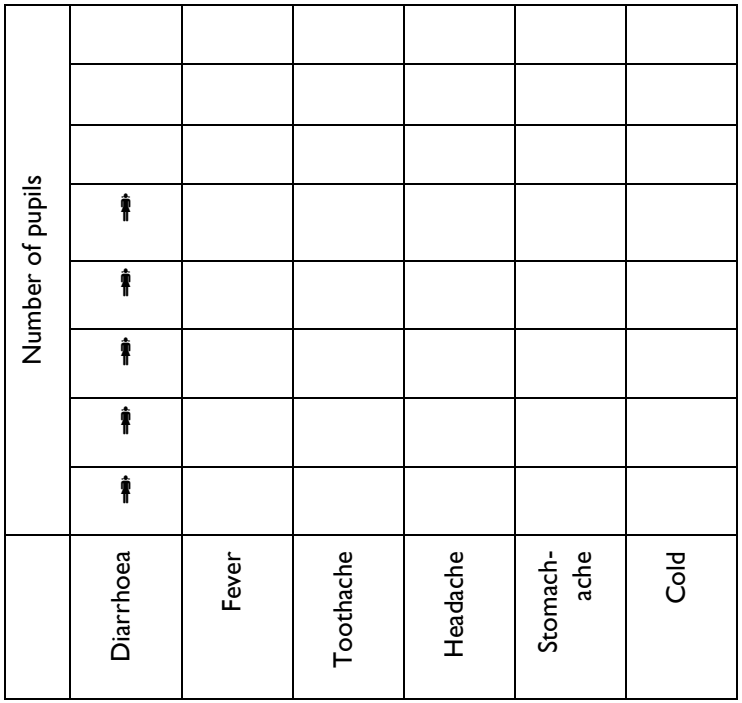
<tr><td>B4.4.1.1

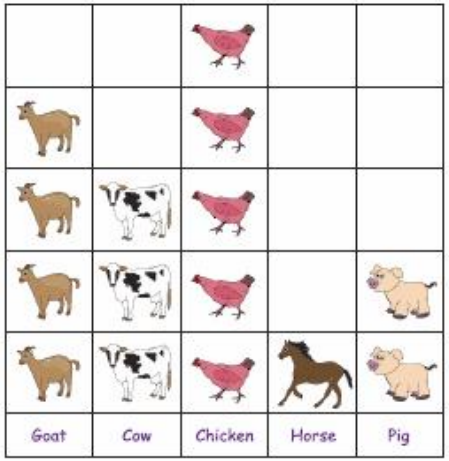
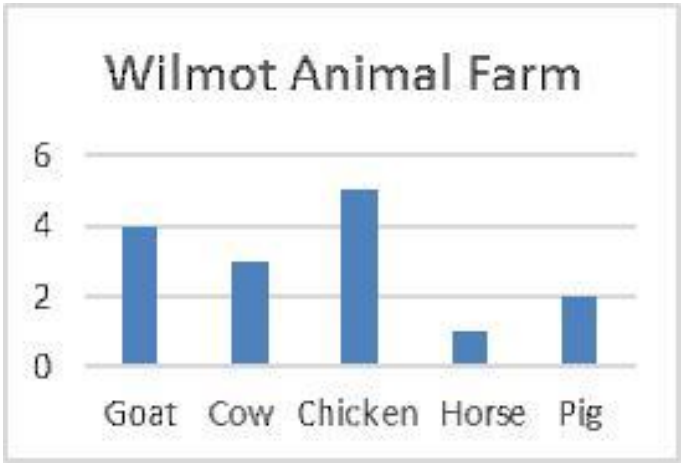
Demonstrate an understanding of many-to-one correspondence in displaying, and reading or interpreting, graphs CONT'D</td><td>
B4.4.1.1.2 Use an understanding of many-to-one correspondence to display or construct graphs

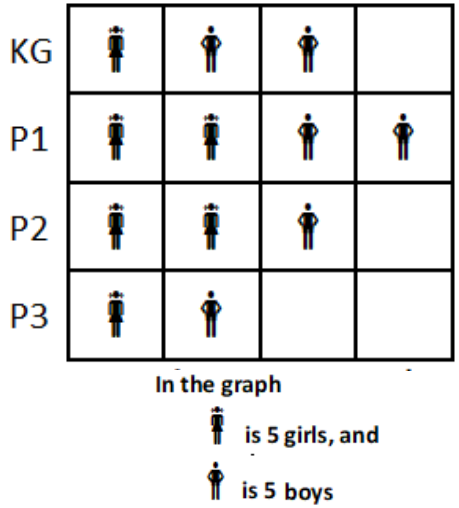
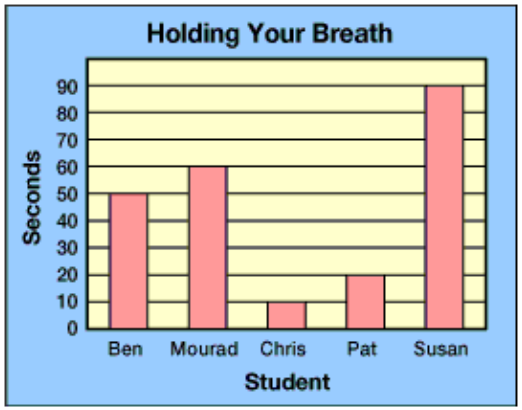
E.g. 1. Display a table for of illnesses P4 pupils have had in school last academic year. Discuss with pupils how many objects/cut-outs will be required to display or construct a graph of the illnesses in the table if 🧍 represents 2 pupils
<table>
<tr><th>Illness</th><th>Number of pupils visiting hospital with illnesses</th><th>Number of objects 🧍 in graph</th></tr>
<tr><td>Diarrhoea</td><td>10</td><td>5</td></tr>
<tr><td>Fever</td><td>16</td><td>8</td></tr>
<tr><td>Toothache</td><td>4</td><td>2</td></tr>
<tr><td>Headache</td><td>6</td><td>·</td></tr>
<tr><td>Stomach-ache</td><td>8</td><td>·</td></tr>
<tr><td>Cold</td><td>14</td><td>·</td></tr>
</table>

E.g. 2. Put a chart with labelled axes on the board; places several card cut-outs of the object " 🧍 "on the table. Ask pupils to go in turns to construct the graph of the illnesses in the chart by pasting the right number of cut-outs in the columns above each illness as in the figure below
</td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision</td></tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.4.1.1 **Demonstrate an understanding of many-to-one correspondence in displaying, and reading or interpreting, graphs CONT'D**	 E.g. 3. Ask questions for pupils to read and interpret graphs. Ask pupils also to write questions based on the graph for their friends to answer E.g. 4. Give learners tables with data that require the use an understanding of many-to-one correspondence to construct their graphs	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision

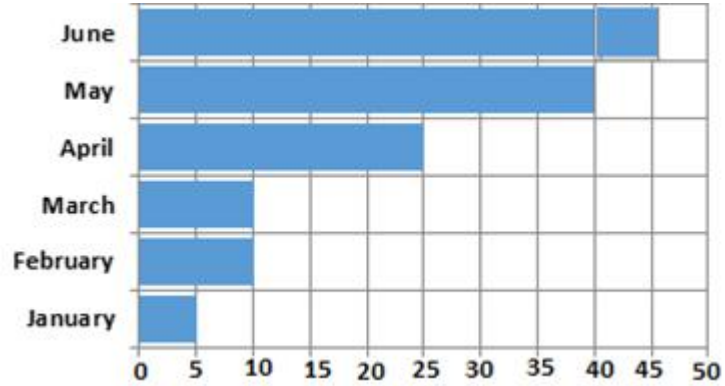
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.4.1.1 Demonstrate an understanding of many-to-one correspondence in displaying, and reading or interpreting, graphs CONT'D	**B4.4.1.1.3 Compare graphs in which the same data has been displayed and explain how they are the same and different** E.g. 1. Give learners several graphs that have used one-to-one correspondence in displaying the same data. For instance, the graph below shows the animals at Mr. Wilmot's farm. Ask children to explain how they are the same and different  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.4.1.1 Demonstrate an understanding of many-to-one correspondence in displaying, and reading or interpreting, graphs CONT'D	**B4.4.1.1.4 Find examples of graphs in which many-to-one correspondence is used in print and electronic media, such as newspapers, magazines and the Internet, and describe the correspondence used** E.g. 1. Give learners several graphs that have used many-to-one correspondence in displaying the same data. E.g. The graphs below show the number of pupils in a KG to P3 in a school and the time five pupils can take to hold their breath. Ask questions for children to read and interpret graphs   How many pupils are in KG and P1? How many pupils more pupils are in P1 than P3? How long did Ben hold his breath? Who can hold her breath longest? Etc.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Attention to Precision

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B4.4.1.2:

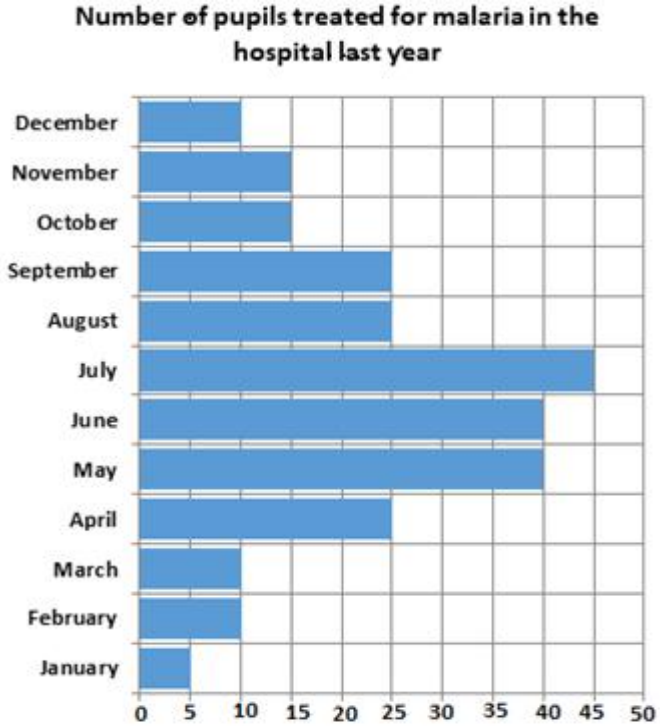
Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions.</td>
<td>
B4.4.1.2.1 Identify common features of graphs that use many-to-one correspondence and use that understanding to draw bar graphs or pictographs, complete with title, labelled axes, key or legend, to represent data collected (up to 4 categories of data).

E.g. 1. Refer to example in B4.4.1.1.4 to common features of graphs that use many-to-one correspondence. Examine such features as title, vertical axis and label, hofrizontal axis and label, key or legend.

E.g. 2. Give students data presented in a table to draw bar graph complete with title, labelled axes, key. The table show amount of rainfall recorded in Kumasi in the half of the year.
<table>
<tr><td>January</td><td>February</td><td>March</td><td>April</td><td>May</td><td>June</td></tr>
<tr><td>5mm</td><td>10mm</td><td>10mm</td><td>25mm</td><td>40mm</td><td>45mm</td></tr>
</table>


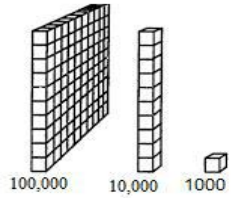
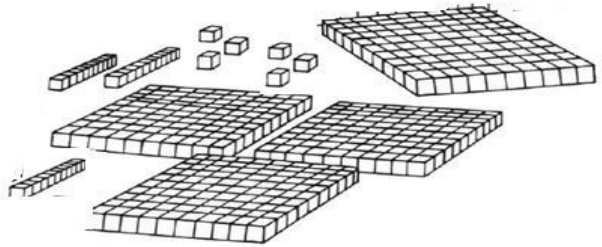
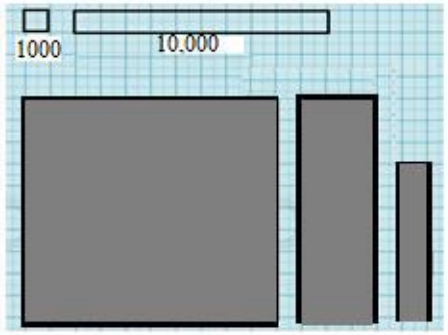
E.g. 3. Give pupils data on energy usage by households in a community over a period (e.g. six months) presented in tables for them to draw bar graph complete with title, labelled axes, key. Ask questions for pupils to read and interpret graphs.
</td>
<td>Learners develop:

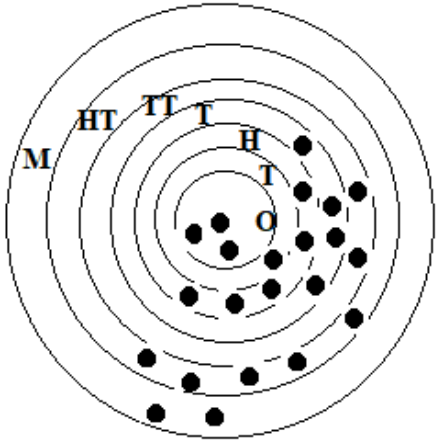
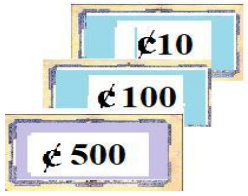
Problem Solving Skills; Critical Thinking; Justification of Ideas; Attention to Precision</td>
</tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B4.4.1.2: **Construct and interpret pictographs and bar graphs involving many-to-one correspondence to draw conclusions CONT'D**	**B4.4.1.2.2 Use understanding of many-to-one correspondence to solve simple problems (how many altogether, comparing, or take apart problems) requiring interpretation of many-to-one bar graphs (up to 4 categories of data).** E.g. 1. Give learners several graphs that have used many-to-one correspondence in displaying the same data. For example, the graph below on the number of pupils treated for malaria in a school. Ask questions for children to read and interpret graphs.  i) How many pupils were treated for malaria in the hospital in April? ii) How many pupils were treated for malaria in the hospital in May and June? iii) How many pupils were treated for malaria in the hospital in the last three months of the year? iv) In which month was the largest number of people treated for malaria in the hospital?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Attention to Precision

BASIC 5

BASIC 5
Strand 1- Number
Sub-strand 1: Counting, Representation & Cardinality

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1000,000**	**B5.1.1.1.1 Model number quantities up to 1,000,000 using graph sheets and multi-base block** E.g. 1. Ask pupils to model number quantities up to 1000,000 using graph sheets or multi-base materials. For instance, with multi-base block, a cube = 1000 unit; a rod = 10,000; a flat = 100,000 and a block = 1,000,000; learners model 436,000 with the appropriate materials E.g. 2. Ask pupils to model the number 137,000 shading graph sheet square as shown below, where 1cm×1cm square represents 1000 units .    	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1000,000. CONT'D**	E.g.3.Give learners teacher-make token currency notes [¢10, ¢100& ¢500 notes] on different coloured-paper and ask them to work out how many will be required to model given amounts up to ¢10,000; e.g. ¢23,480 **B5.1.1.1.2 Read and write numbers in figures and in words up to 1000,000** E.g. 1 Play the place value number wheel game: Use the million number wheel to generate 7-digit numbers and represent the number generated on a place value frame. Throw a number of pebbles (or stones) onto the number wheel, identify the number of pebbles landing in each place value ring, and state the number generated in the wheel (i.e. 2 landed in the ten-thousands' ring making the number twenty-thousand or 20,000)  Place value number wheel Place value chart Million | Hundred-thousands | Ten-thousands | Thousand | Hundreds | Tens | Ones 2 | 5 | 2 | 4 | 5 | 1 | 3 E.g. 2. Ask pupils to write given numbers on the expanded form of the number : 2,524,513=1000,000× 2 +100,000× 5 + 10,000 × 2+1000 × 4+ 100× 5 + 10× 1+ 1× 3 = 2,000,000 + 500,000 + 20,000 + 4,000 + 500 + 10 + 3  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.1.1.1

Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1000,000. CONT'D</td>
<td>
B5.1.1.1.3 Identify numbers in different positions around a given number in a number chart

E.g. 1 Display a number chart in multiples of 1,500 between 10,000 and 1000,000 and lead learners identify numbers in different positions around a given number. Put learners in pairs and give each group a number grid and have them identify numbers in different positions around a chosen number
<table>
<tr><td>10,000</td><td>11,500</td><td>12,000</td><td>13,500</td><td>15,000</td><td>16,500</td></tr>
<tr><td>20,000</td><td>21,500</td><td>22,000</td><td>23,500</td><td>24,000</td><td>25,500</td></tr>
<tr><td>30,000</td><td>31,500</td><td>33,000</td><td>34,500</td><td>36,000</td><td>37,500</td></tr>
<tr><td>40,000</td><td>41,500</td><td>43,000</td><td>44,500</td><td>46,000</td><td>47,500</td></tr>
<tr><td>50,000</td><td>51,500</td><td>53,000</td><td>54,500</td><td>56,000</td><td>57,500</td></tr>
<tr><td>60,000</td><td>61,500</td><td>63,000</td><td>64,500</td><td>66,000</td><td>67,500</td></tr>
</table>
B5.1.1.1.4 Compare and order whole numbers up to 100,000 and represent the comparison using ">, <, or ="

E.g. 1 Learners identify numbers which are 10,000 more or 10,000 less than a given six-digit number. E.g. 122,400 is 1,000 less than133,400 Learners use words such as: "equal to" "greater than" "less than" and later use symbols such as "<", "=", ">" to compare numbers up to 10,000 taking into consideration the place value of each digit in the given number. E.g. $251200 = 251{,}200;\ 132{,}734 > 132{,}635$

E.g. 2 Learners work together in their groups to order a given set of numbers in ascending or descending order verbally and in writing. E.g. $1020, 1025,\ 2673, 2873,$
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.1.1.1
Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1000,000. CONT'D</td><td>E.g. 3 Give two numbers between 10,000 and 100,000 to each group and encourage learners to say as many things as possible about the two numbers. For instance 1022345 and 1022534; 1022345 is less than (smaller than) than1022534 or 1022534 is bigger than (greater than) 1022345, or 1022345 is almost 200 less than 1022534 etc

B5.1.1.1.5 Round (off, up, down) whole numbers up to 100,000 to the nearest ten thousands, thousands, hundreds and tens

E.g. 1 Learners round off numbers to the nearest 10,000, 1000 and 100. For instance; 129,500 is approximately 130,000 and 19100 as approximately 19,000

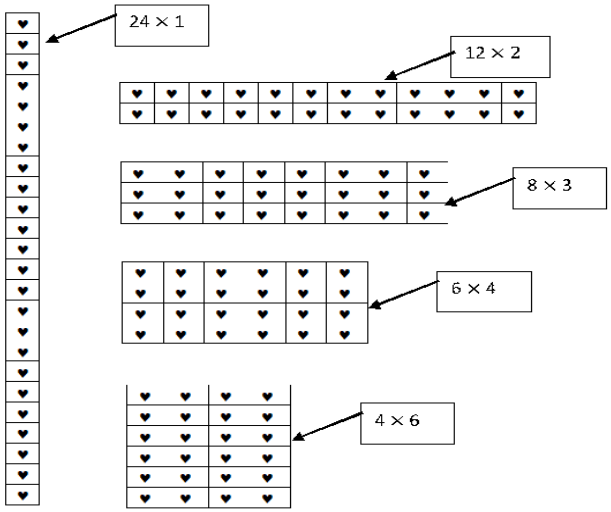
E.g. 2 Learners round up and round down to estimate sums and differences

NB: To round down learners consider the smaller of the two approximated numbers, while round up considers the bigger of the two numbers. The table below may bring the meaning of these two concepts clearer

<table><tr><th>214765</th><th>Round up</th><th>Round down</th><th>Round off</th></tr><tr><td>to the nearest ten</td><td>214770</td><td>214760</td><td>214770</td></tr><tr><td>to the nearest hundred</td><td>214800</td><td>214700</td><td>214800</td></tr><tr><td>to the nearest thousand</td><td>215000</td><td>214000</td><td>215000</td></tr></table></td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity</td></tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000,000.**	**B5.1.1.1.6 Skip count forwards and backwards in 500s 1000s etc. up to and from 100,000** E.g. 1 Put learners into convenient groups. A learner mention a number and another makes skip count in 500s or 1000s to include the fifth count. For instance. Learner 1: Shout out "15290"*skip counting up in 500s* Learner 2: 15790, 16290, 17290, 17790, 18290, etc. Learner 3; Shout out "31285"*skip counting up in 1000s* Learner 4; 32285, 33285, 34285, 35285, 36285….etc. E.g. 2 Skip count forwards and backwards by 50s and between 1000 and 10000 that are multiples of 50s and 100s but make an error or leave out a number. Challenge learners to identify or correct error.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity
B5.1.1.2 **Demonstrate understanding of Roman Numerals up to C (i.e. 100)**	**B5.1.1.2.1 Recognize Roman Numerals system up to C (i.e. 100)** E.g. 1 Display roman numeral charts (1-100) arranged in sequential order and lead learners to identify the numerals. Learners identify the main characters of the roman numerals used to build the table up to 30 i.e. I, II, III, IV, V, X, L and C Call out a numeral and have learners point at it from the chart E.g. 2 Have learners match the Roman numerals to the Hindu-Arabic numerals for instance I = 1; V= 5: IX= 9, XV= 15, XXX = 30, XL = 40, LVI = 56, XCIX = 99. Mention some numerals randomly and have learners point at it on the chart. **B5.1.1.2.2 Count and convert Hindu Arabic numbers to Roman numerals up to 100 (C) and vice versa** E.g. 1 Learners read the chart sequentially forwards and backwards, vertically (up and down), zig-zag, diagonally and randomly without pointing to the numbers. Invite 2-3 learners to read to the class. Call a Roman numeral and ask learners to write E.g. 2 Give learners a numeral in the Hindu Arabic system and have learners convert to roman numeration and vice versa for instance XXIV = 24, LX = 60, XCIV = 94, ETC.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity

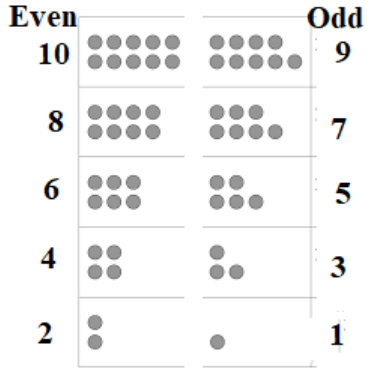
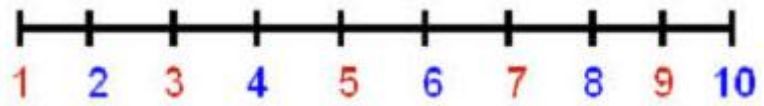
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.3 **Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100**	**B5.1.1.3.1 Identify the factors of whole numbers 1 - 100** E.g. 1 Ask learners to use different arrangements of arrays of objects to find factors of whole numbers 1 – 100. For instance the factors of 24 can be obtained from the following arrays of objects. E.g. 2 Ask learner to collect from the arrays, pairs of number as the factors of the given number, 24. Hence the set of factors of $24 = \{1, 2, 3, 4, 6, 8, 12, 24\}$  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision, Cultural Identity

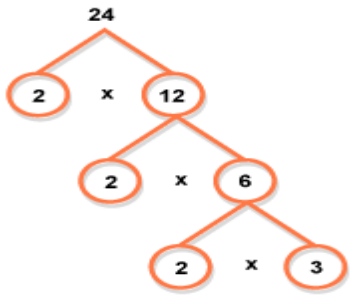
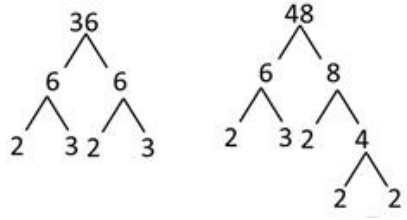
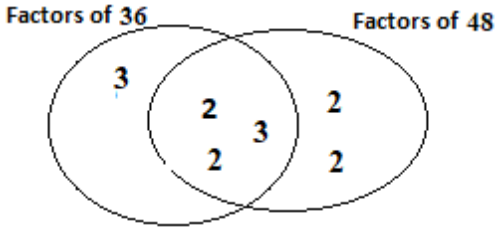
<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.1.1.3

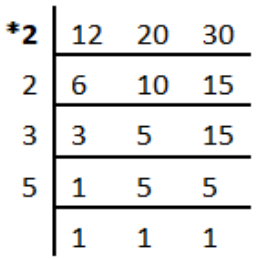
Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100</td><td>
B5.1.1.3.2 Generate and identify prime numbers and composite numbers between 1 and 100

E.g. 1 Ask learners to use different arrangements of arrays of objects (or the factorization method)to find factors of the first 30 whole numbers and use their results to complete the table below. Have learners identify prime numbers; i.e. number with only two factors, 1 and the number itself; other are composite.
<table>
<tr><th>Numbers</th><th>Factors</th><th>Number of factors</th></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
<tr><td>2</td><td>1, 2</td><td>2</td></tr>
<tr><td>3</td><td>1, 3</td><td>2</td></tr>
<tr><td>4</td><td>1, 2, 4</td><td>3</td></tr>
<tr><td>5</td><td>1, 5</td><td>2</td></tr>
<tr><td>.</td><td></td><td></td></tr>
<tr><td>.</td><td></td><td></td></tr>
<tr><td>.</td><td></td><td></td></tr>
<tr><td>30</td><td>1,2, 3, 5, 6, 10, 15, 30</td><td></td></tr>
</table>
E.g. 2 In convenient groups, have learners use the “Sieve of Eratosthenes” to identify prime numbers between 1 and 100, i.e. dividing through by whole numbers starting from 2; numbers that cannot be divided by other numbers except the number itself are prime numbers.

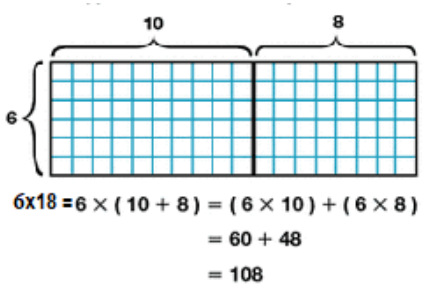
</td><td></td></tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.1 Demonstrate an understanding of quantities and place value for multi-digit numerals up to 100,000 CONT'D	**B5.1.1.3.3 Identify even and odd numbers between 1 and 100 as number that can be arrayed in twos array and those which cannot** E.g. 1 Ask learners to use arrangements of twos arrays of objects to find even and odd numbers between 1 and 100  E.g. 2 Ask learner to collect from the arrays, pairs to skip count in twos starting from 1 to generate odd numbers, and skip count in twos starting from 2 to generate even numbers  	Learners develop Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.3 Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100 CONT'D	**B5.1.1.3.4 Determine the highest common factor of any 2 or 3 numbers by prime factorisation** E.g. 1. Have learners use factor tree method to determine prime factors of any given whole number. For example the prime factors of 24 For instance, from the figure 24 = 2×2×2×3 so 2 and 3 are the prime factors of 24. Ask learners to list the factors of two or more given whole numbers using the factor tree; for 36 and 48 we have 36= 2×3×2×3 =2×2×3×3 and 48= 2×3×2×2×2 = 2×2×2×2×3.  E.g. 2 Learners use the prime factorization to determine the HCF by underlining the common factors in each product 36=**2×2×3**×3 48= 2×2×**2×2×3** → which is 2×2×3=12;  E.g. 3 Learners use the prime factorization by inspection to determine the LCM by underlining the largest number of factors in each product 36=2×2×**3×3** 48= **2×2×2×2**×3 → which is 2×2×2×2×3×3=144 	Learners develop: Problem solving skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.1.3 Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100	E.g. 4 Learners place factors in a Venn diagrams to find the HCF and LCM of 36 and 48. i.e. the HCF is product of factors in both circles →2×2×3=12; and the LCM is product of factors in the diagram →3×2×2×3×2×2 =144 E.g. 5 Learners use the prime factorization to determine the LCM and HCF of three numbers using (i) prime factorization using table and dividing through by prime factors. Example 1, find the LCM and HCF these sets of numbers: 12, 20 and 30. (see method in figure), i.e. HCF = 2, and LCM = 2×2×3×5 = 60.  The prime factor which can divide all the numbers is starred. The product of all the starred prime factors is the HCF. In this case only one is starred, and so the HCF is 2. The product of each prime factor which divided any of the numbers is the LCM **B5.1.1.3.5. Recognize relationship between factors and multiples of whole numbers from 1 to 100** E.g. 1 Investigate even and odd numbers. How do you know a number is even or odd? E.g. 2 Investigate numbers that are multiples of 4 and 6. How do you know a number is a multiple of 4? a multiple of 6? (This is also known as the divisibility test). E.g. 3 Investigate perfect numbers, that is, numbers whose factors add up to the number; for instance 6 has factors 1, 2, 3 and 6. The sum of factors other than 6 is 1+2+3 =6, and hence 6 is a perfect number. How many more perfect number can we find in the first 100 whole numbers?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.1 **Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts**	**B5.1.2.1.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact, using doubling or halving, using patterns in the 9sfacts, using repeated doubling or halving, to determine answers for basic multiplication facts to 81 and related division facts** E.g. 1 Describe the mental mathematics strategies used to determine a given basic fact, such as – skip count up by one or two groups from a known fact (e.g., if 5 × 7 = 35, then 6 × 7 is equal to 35 + 7 and 7 × 7 is equal to 35 + 7 + 7) – skip count down by one or two groups from a known fact (e.g., if 8 × 8 = 64, then 7 × 8 is equal to 64 – 8 and 6 × 8 is equal to 64 – 8 – 8) – doubling (e.g., for 8 × 3 think 4 × 3 = 12, and 8 × 3 = 12 + 12) – patterns when multiplying by 9 (e.g., for 9 × 6, think 10 × 6 = 60, and 60 – 6 = 54; for 7 × 9, think 7 × 10 = 70, and 70 – 7 = 63) – repeated doubling (e.g., if 2 × 6 is equal to 12, then 4 × 6 is equal to 24 and 8 × 6 is equal to 48) – repeated halving (e.g., for 60 ÷ 4, think 60 ÷ 2 = 30 and 30 ÷ 2 = 15) – relating division to multiplication (e.g., for 64 ÷ 8, think 8 × … = 64) E.g. 2 Recall multiplication facts to 81and related division facts	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.1 **Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts**	**B5.1.2.1.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero halving and doubling using the distributive property** E.g. 1 Determine the products when one factor is a multiple of 10, 100, or 1000 by annexing zero or adding zeros (e.g., for 3×200 think of 3×2 and then add two zeros) E.g. 2 Apply halving and doubling when determining a given product (e.g., 32×5 is the same as 16×10) E.g. 3 Apply the distributive property to determine a given product involving multiplying factors that can be written in the expanded form (e.g., 6×18 = (6×10) + (6×8) = 60+48 = 108. Or apply distributive property to determine a given product involving multiplying factors that are close to multiples of 10 (e.g., 29×7 = (30×7) – (1×7) = 203. E.g. 4 Explain the property for determining the answer when multiplying numbers by  i. one ii. zero.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

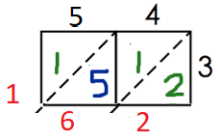
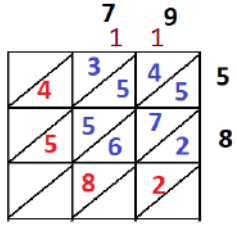
<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.1.2.2
Demonstrate an understanding of multiplication of a 2 or 3-digit number by a 2 or 3-digit number.</td>
<td>
B5.1.2.2.1. Multiply multi digit numbers by 2-digit numbers efficiently
E.g. 1. Multiplication of whole numbers using the “expand and box” method (partial decomposition method). Lead learners to multiply a 3-digit number by a 1-digit number as shown below, for example $448 \times 2 = ?$
<table>
<tr><td>×</td><td>400</td><td>40</td><td>8</td></tr>
<tr><td>2</td><td>800</td><td>80</td><td>16</td></tr>
</table>
$$448 \times 2 = (400 \times 2) + (40 \times 2) + (8 \times 2) = 800 + 80 + 16$$
$$= 800 + 80 + (10 + 6) = 800 + 90 + 6 = 896$$

E.g. 2. Multiplication of whole numbers using the Column or vertical method; i.e. 25×32
E.g. 3. Multiplication of whole numbers using the Distributive property; i.e. 25×32
$25 \times (32) = 25(30 + 2)$
$= 25(30) + 25(2)$
$= 750 + 50$
$= \mathbf{800}$

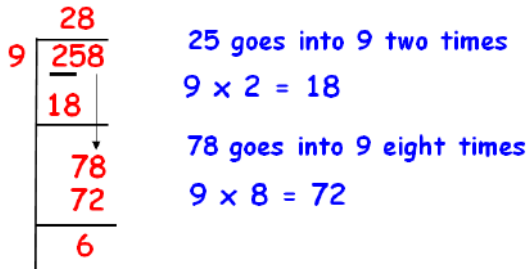
25
x32
50
+750
800

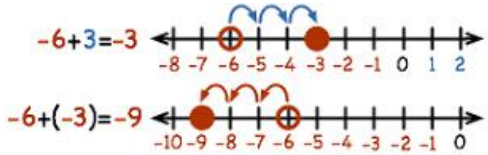
25 25
x30 x 2
750 50 = 800
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

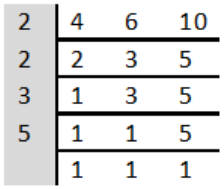
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.2 **Demonstrate an understanding of multiplication of a 2 or 3-digit number by a 2 or 3-digit number.** **CONT'D**	E.g. 4. Multiplication of whole numbers using the lattice method. Have learners draw a 2 by 1 rectangular box for solving 54 × 3.  E.g. 5. Have learners draw a 2 by 2 rectangular box for solving 79×58.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.3 **Recall basic division fact up to 100**	**B5. 1.2.3.1 Determine basic division fact up to 81** E.g. 1. Investigate numbers that are multiples of 3,4, 6, 8 and 9. How do you know a number is divisible by 3, 4, 6, 9? (This is also known as the divisibility test). E.g. 2. Draw a 6 by 6 multiplication chart and use it as a game board to play the 3-in-a-line game with a pair of dice or playing cards. Players take turns in throwing a one dice and mark (or cover) a number that can be divided by the results (i.e. a quotient). The winner is the one who obtains three numbers in a line.   		5	6	7	8	9	10
---	---	---	---	---	---	---
5	10	15	20	25	30	35
6	12	18	24	30	36	42
7	14	21	28	35	42	49
8	16	24	32	40	48	56
9	18	27	36	45	54	63
10	20	30	40	50	60	70		Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.4 **Demonstrate an understanding of division of a 2 or 3-digit number by a 1 or 2-digit number**	**B5.1.2.4.1 Divide 3-digit numbers by 1-digit number efficiently** E.g. 1. Division as repeated subtraction (using the long division method). Explain division as a way of repeatedly subtracting a divisor number from a given dividend until there is none left and then determining the number of times the divisor is taken from the dividend  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision
B5.1.2.5 **Translate word problems into mathematical sentences and solve**	**B5.1.2.5.1. Solve multi step word problems involving the four basic operations** E.g. 1. Learners model mathematical statements from a given word problem involving addition and multiplication and solve using the strategies learnt E.g. 2. Learners model mathematical statements from a given word problem involving division and subtraction and solve using the strategies learnt E.g. 3. Learners role play a given word problem involving addition and multiplication and solve E.g. 4. Learners role play a given word problem involving subtraction and division and solve E.g. 5. Learners model mathematical statements from a given word problem involving division and multiplication and solve using the strategies learnt. The relationship between operations and the use of calculator and spreadsheet to assess the reasonableness of answers should be stressed.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

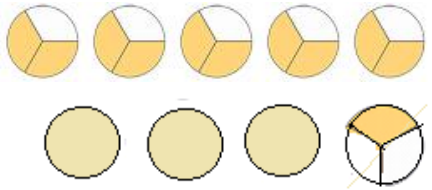
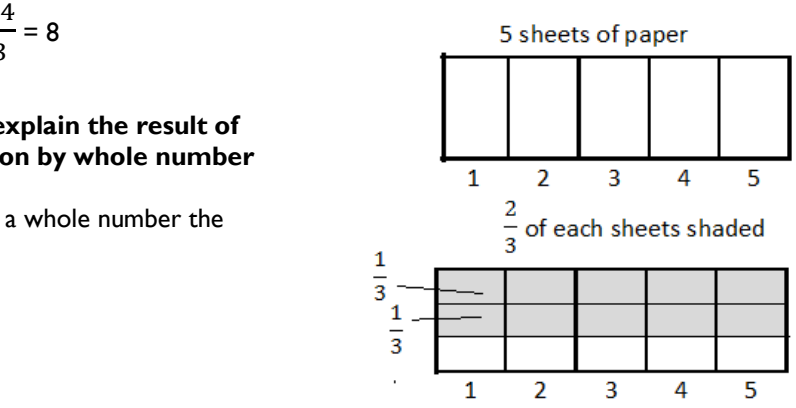
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.2.6 **Demonstrate understanding of integers**	**B5.1.2.6.1 Solve simple addition and subtraction problems involving integers** E.g. 1. Use number line to help learners to do the following types (addition) (1) 9 + -4 = _____ (2) -8 + 4 = _____ (3) -3 + -5 = _____ (4) 1 + -3 = _____ (5) -6 + 5 = _____ (6) 6 + -2 = _____ (7) -6 + 8 = _____ (8) -2 + 9 = _____  E.g. 2 Use number line to help learners to do the following types (subtraction) (9) -5 – 1 = _____ (10) -2 – 1 = _____ (11) 8 – 7= _____ (12) 2 – 6 = _____ (13) -1 – 7 = _____ (14) -5 – 7= _____ (15) -8 – 8= _____ (16) 4 – 6 = _____ E.g. 3. Solve word problems; e.g. (i) Some number added to 5 is equal to -11. Find the number. (ii) Ben and Cam are diving. Ben is 15.8 meters below the surface of the water. Cam is 4.2 meters above Ben What is Cam's position relative to the surface of the water?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Sub-Strand 3: Number: Fractions

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.1.3.1
Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions</td><td>B5.1.3.1.1 Determine equivalent fractions of given fractions
E.g. 1 To compare, add or subtract the fractions, $\frac{3}{4}, \frac{5}{6}$ and $\frac{7}{10}$, we need find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions. Use the prime factorising strategy to determine the LCD of 4, 6, and 20. Use the LCD work out the equivalent fractions.
$\frac{3}{4} = \frac{?}{36}; \frac{5}{6} = \frac{??}{36}$; and $\frac{7}{10} = \frac{???}{36}$.
[To obtain the numerators, determine how many times the denominator goes into the LCD and multiply this by the numerator to obtain a new numerator.]
24 = 2 x 2 x 2 x 3 so 2 and 3 are prime factors of 24
 
The product of each prime factor which divided any of the numbers is the LCM</td><td rowspan="2">Learners develop:

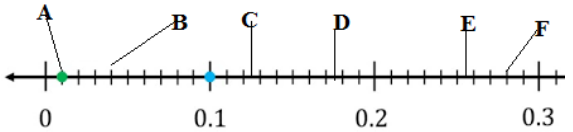
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td></tr>
<tr><td>B5.1.3.1
Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions</td><td>B5.1.3.1.2 Compare and order fractions
E.g. 1 Find the Lowest Common Denominator (LCD) of the fractions and use this to express their equivalent fractions and use them for the comparison; e.g. which is larger, $\frac{5}{6}$ and $\frac{3}{4}$ or $\frac{2}{3}$?
E.g. 2 Change the fractions to percentages or decimals and use them for the comparison.
i.e. $\frac{5}{6} = 0.83$, $\frac{3}{4} = 0.75$, and $\frac{2}{3} = 0.66$, and compare.
LCD for $\frac{3}{4}, \frac{2}{3}$ and $\frac{5}{6}$ is 12;
hence $\frac{3}{4} = \frac{9}{12}; \frac{2}{3} = \frac{8}{12}; \frac{5}{6} = \frac{10}{12}$
$\therefore$ the order is $\frac{5}{6}, \frac{3}{4}, \frac{2}{3}$</td></tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.3.1 **Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions CONT'D**	**B5.1.3.1.3 Use the concept of equivalent fractions in changing fractions to the same denominator for addition and subtraction of like fractions (one denominator being a multiple of the other)** E.g. 1 To add or subtract the fractions, $\frac{1}{3}$ and $\frac{2}{6}$, we need find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions. The LCD is 6 and the equivalent fractions are $\frac{2}{6}$ and $\frac{2}{6}$; their sum is $\frac{2}{6}+\frac{2}{6}$ is $\frac{2+2}{6}$, which is, $=\frac{4}{6}=\frac{2}{3}$ (i.e. its simplest form) E.g. 2 To add or subtract the fractions, $\frac{2}{3}$ and $\frac{2}{5}$, we need find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions. The LCD is 15 and the equivalent fractions are $\frac{10}{15}$ and $\frac{6}{15}$; their difference is $\frac{10}{15}-\frac{6}{15}=\frac{10-6}{15}=\frac{4}{15}$ **B5.1.3.1.4 Use the concept of equivalent fractions for addition and subtraction of fractions greater than one (improper or mixed fractions)** E.g. 1 To add like mixed fractions that are larger than 1, i.e. $2\frac{1}{3}$ and $3\frac{2}{3}$, we write down the sum of the whole numbers and add the fractions; i.e. $2\frac{1}{3}+3\frac{2}{3}=5+\frac{1}{3}+\frac{2}{3}$, $=5\frac{1+2}{3}=5\frac{3}{3}=6$. E.g. 2 To subtract like-fractions that are larger than 1, i.e. $2\frac{1}{3}$ and $3\frac{2}{3}$, we change the mixed fractions into improper fractions and subtract; i.e. $3\frac{2}{3}-2\frac{1}{3}+=\frac{11}{3}-\frac{7}{3}+=\frac{11-7}{3}=\frac{4}{3}.=1\frac{1}{3}$ E.g. 3 To add or subtract improper fractions with different denominators, ($2\frac{1}{3}$ and $3\frac{2}{5}$) we need find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions. The LCD is 15 and the equivalent fractions are $2\frac{5}{15}$ and $3\frac{6}{15}$; their sum is $2\frac{1}{3}+3\frac{2}{5}=2\frac{5}{15}+3\frac{6}{15}=5\frac{5+6}{15}$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.3.1 **Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions CONT'D**	which is $5\frac{11}{15}$; and difference $3\frac{2}{5} - 2\frac{1}{3} = 1\frac{6-5}{15} = 1\frac{1}{15}$ **B5.1.3.1.5 Use models to explain the result of multiplying a whole number by a fraction** E.g. 1 Multiplying a whole number by a fraction, e.g. $5 \times \frac{2}{3}$ or finding five two-thirds means $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{10}{3} = 3\frac{1}{3}$  E.g. 2 To multiply a whole number by a mixed fraction (e.g. $3 \times 2\frac{2}{3}$) one can multiply the whole number by the whole number and then whole number by the fraction and add the products or change the mixed fraction to improper fraction and multiply; i.e. $3 \times 2\frac{2}{3} = (3\times2) + 3\times\frac{2}{3}) = 6 + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = 6\frac{6}{3} = 8$ or $3 \times 2\frac{2}{3} = 2\frac{2}{3} + 2\frac{2}{3} + 2\frac{2}{3} = 6\frac{2+2+2}{3} = 6\frac{6}{3} = 8$ E.g. 3 To multiply a whole number by a fraction (e.g. $3 \times 2\frac{2}{3}$) first change all into common fractions, then multiply the numerators separately and multiply the denominators separately and simplify; i.e. $3 \times 2\frac{2}{3} = \frac{3}{1} \times \frac{8}{3} = \frac{3\times8}{1\times3} = \frac{24}{3} = 8$ **B5.1.3.1.6 Use models to explain the result of multiplying a fraction by whole number** E.g. 1 Multiplying a fraction by a whole number the 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

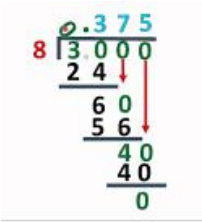
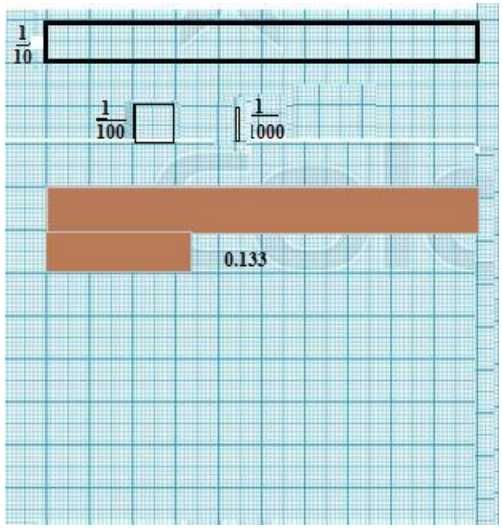
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.3.1 **Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions CONT'D**	multiplication is interpreted as "of"; e.g. $\frac{2}{3} \times 5$ means shade $\frac{2}{3}\ of\ 5$; i.e. finding two-thirds of each of five objects; i.e. $\frac{2}{3} \times 5$ can be illustrated by shading $\frac{2}{3}\ of\ 5$ sheets of paper, which leads to the shading of 10 thirds, $\frac{2}{3} \times 5 = \frac{2}{3}\ of\ 5 = 10(\frac{1}{3}) = \frac{10}{3} = 3\frac{1}{3}$ E.g. 2 To multiply a mixed fraction by a whole number (e.g. $4\frac{2}{5} \times 5$) first change all into common fractions, then multiply the numerators separately and multiply the denominators separately and simplify; i.e. $4\frac{4}{5} \times 5 = \frac{24}{5} \times \frac{5}{1} = \frac{120}{5} = \frac{24}{1} = 24$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

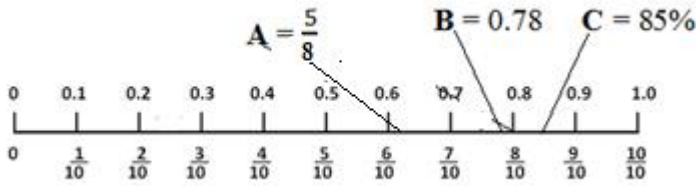
<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.1.4.1
Demonstrate understanding of decimals fractions and strategies for comparing, adding and subtracting decimal fraction</td>
<td>
B5.1.4.1.1 Describe and represent decimals (up to the thousandths) concretely, pictorially, and symbolically and relate them to fractions

E.g. 1 Use several pictorial representations or number line to introduce tenths and thousandths and ask pupils to identify the fractions (i.e. A, B, C, D, E, & F)


E.g. 2 Use the tenth to thousandth place value chart to illustrate how to write the fraction as a base ten number with the introduction of the decimal point “·” after ones place in the place value chart
<table>
<tr><th colspan="6">Tenth to Thousandth Place Value Chart</th></tr>
<tr><th>Fraction</th><th>1s</th><th>·</th><th>$\frac{1}{10}^s$</th><th>$\frac{1}{100}^s$</th><th>$\frac{1}{1000}^s$</th></tr>
<tr><td>A</td><td>$\frac{1}{4}=\frac{25}{100}$</td><td>0</td><td>·</td><td>5</td><td></td><td></td></tr>
<tr><td>B</td><td>$\frac{1}{8}=\frac{125}{1000}$</td><td>0</td><td>·</td><td></td><td></td><td></td></tr>
<tr><td>C</td><td>$2\frac{1}{40}$</td><td>0</td><td>·</td><td></td><td></td><td></td></tr>
<tr><td>D</td><td>$1\frac{3}{8}$</td><td>0</td><td>·</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.4.1 **Demonstrate understanding of decimals fractions and strategies for comparing, adding and subtracting decimal fraction CONT'D**	**B5.1.2.1.1. Multiply multi-digit numbers by 2-digit numbers efficiently** E.g. 3 Give pupils several common fractions (including improper fractions) to convert into hundredths and thousandths and write their decimal names; e.g. $\frac{3}{8}$  E.g. 4 Ask pupils to use graph sheets to model the decimal number 0.133 by shading the graph sheet squares as shown in the figure, where 2cm×20cm square represents $\frac{1}{10}$ units, 2cm×2cm square represents $\frac{1}{100}$ units, and 1mm×10mm square represents $\frac{1}{1000}$ units,  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.4.1 **Demonstrate understanding of decimals fractions and strategies for comparing, adding and subtracting decimal fraction CONT'D**	**B5.1.4.1.2 Compare and order decimal fractions and a mixture of common and decimal fractions (up to the thousandths) using the symbols <, >, or =** E.g. 1 To compare and order a mixture of common, decimal and percent fractions, express them in one form (i.e. either common, decimal or percent); e.g. to order 0.758, $\frac{5}{8}$ and 73%; we have $\rightarrow\frac{5}{8} = \frac{625}{1000}$ = 62.5%, 0.758 $= \frac{758}{1000}$ = 75.8%, and 73% $= \frac{73}{100}$ = 0.73, Hence the order from least to the largest is $\frac{5}{8}$, 73% and 0.758 E.g. 2 To compare and order a mixture of common, decimal and percent fractions you can locate the fractions on the number and order them  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.4.1 **Demonstrate understanding of decimals fractions and strategies for comparing, adding and subtracting decimal fraction**	**B5.1. 4.1.3 Round decimals to the nearest tenth and hundredth** E.g. 1 Explain the rule for of rounding decimals, which is similar to that of rounding whole numbers. That is, rounding to the nearest tenth means that the rounded figure has one digit after the decimal mark. Rounding to the nearest hundredth means that the rounded figure has two digits after the decimal mark Rounding 85674.875 rounded to 10 ▶ 85670 100 ▶ 85700 1 decimal or $\frac{1}{10}$ place ▶ 85674.9 1 decimal or $\frac{1}{100}$ places ▶ 85674.88 E.g. 2 Use a table with several decimals fractions and explain the rule for of rounding decimals. Give pupils a table of decimal fractions to round to the nearest tenths or hundredths. E.g. 3 Ask students to change fractions to decimal writing their results to the nearest tenths or hundredths.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

	Fraction	Round to Nearest	Result
A	0.38	$\frac{1}{10}$	0.4
B	4.085	$\frac{1}{10}$	
C	56.584	$\frac{1}{10}$	
D	18.096	$\frac{1}{100}$	
E	30.084	$\frac{1}{100}$	

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.4.1 **Demonstrate understanding of decimals fractions and strategies for comparing, adding and subtracting decimal fraction CONT'D**	**B5.1.4.1.4 Use models to explain the result of addition and subtraction of decimals (up to the thousandths)** E.g. 1 To add 0.645 and 0.39, means sum $\frac{645}{1000} + \frac{39}{100}$ which is $\frac{645+390}{1000} = \frac{1035}{1000}$ = 1.035. That is, since one is hundredths and other thousandths (i.e. one has 2 decimal places and the other 3 decimal places) we can line up the decimal points to align the place values and add as whole numbers $\begin{array}{r} 0.645 \\ +\,0.390 \\ \hline 1.035 \end{array}$ E.g. 2 To subtract 0.395 from 0.6 and, one number is in tenths and other is in thousandths (i.e. one has 1 decimal place and the other 3 decimal places) it is important to line up the decimal points to align the place values and add as whole numbers. $\begin{array}{r} 0.6 \\ -\,0.396 \\ \hline 0.204 \end{array}$ **B5.1.4.1.5 Use models to explain the result of multiplying a decimal (up to the thousandths) by a whole number** E.g. 1 Review multiplying a fraction by a whole number. e.g. $\frac{2}{5} \times 10$ means shade $2 \times (\frac{1}{5}\ of\ 10)$; i.e. 2×(2) = 4; E.g. 2 To multiply a decimal fraction by a whole number, change the decimal number to common fraction and multiply e.g. 0.4×10 means $\left(\frac{4}{10}\ of\ 10\right) = 4.0$; Or multiply the whole numbers 4 and 10, and place the decimal point at one decimal place, since 0.4 has one decimal place E.g. 3 To multiply a decimal fraction (up to thousandths) by a whole number, first ignore the decimal point and multiply the whole numbers, check the number of decimal places and place the decimal point	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.5.1 **Demonstrate understanding of percentage of a given number**	**B5.1.5.1.1 Determine the percentage of a given quantity (limit to 2-digit whole number) and vice versa** E.g. 1 Review multiplying a fraction by a whole number. e.g. $\frac{2}{5} \times 10$ means shade $2 \times (\frac{1}{5}\ of\ 10)$; i.e. 2×(2) = 4; E.g. 2 To multiply a percent fraction by a whole number, change the percentage to common fraction and multiply and simplify e.g. $40\% \times 10$ means $\left(\frac{40}{100}\ of\ 10\right) = 4$; E.g. 3 Ask learners to find given percentage of given quantities; e.g. What is 20% of 45? What is 20% of 45? $20\%\ \text{of}\ 45 = 20\% \times 45$ $= \frac{20}{100} \times \frac{45}{1}$ $= 9$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.1.5.1

Demonstrate understanding of percentage of a given number CONT'D</td>
<td>
B5.1.5.1.2 Determine the benchmark percentages from their common fractions and use these to estimate percentages of quantities

E.g. 1 Use pictorial representations and chart to display common or benchmarks percentages and ask pupils to determine these from their equivalent common fractions.

<table>
<tr><td>Percent</td><td>10%</td><td>20%</td><td>25%</td><td>$33\frac{1}{3}\%$</td><td>50%</td><td>$66\frac{2}{3}\%$</td></tr>
<tr><td>Fraction</td><td>$\frac{1}{10}$</td><td>$\frac{1}{5}$</td><td>$\frac{1}{4}$</td><td>$\frac{1}{3}$</td><td>$\frac{1}{2}$</td><td>$\frac{2}{3}$</td></tr>
</table>

E.g. 2 Give learners practice through drills and games to learn the equivalences of the benchmark fractions

E.g. 3 Ask pupils to use the benchmarks for estimating percentages of given quantities. E.g. for "what is 60% of 45?" using the nearest benchmark fraction (i.e. 50%) the learner will know the expected result is close to 30;the learner can use benchmark fractions to determine the result mentally by finding which can easily multiply 45, and in this case $\frac{1}{5}$ to give 9. Since $\frac{1}{5}$ is 20%, 60% required will be 3 times 9 which is 27.

E.g. . Ask pupils to use the benchmarks for estimating and determining the results of finding percentages of given and then verify by working; that is, changing the percentage common fraction and multiplying by the quantity

What is 60% of 45? then the
$60\% \text{ of } 45 = 60\% \times 45$
$= \frac{\cancel{60}^{3}}{\cancel{100}_{5}} \times \frac{\cancel{45}^{9}}{1}$
$= 27$
quantities to
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.1.5.1 **Demonstrate understanding of percentage of a given number CONT'D**	**B5.1.5.1.3 Identify and describe percent from real-life contexts and solve problems using percent.** E.g. 1 Discuss the contexts below in which fractions are used in real life and provide materials for pupils to act them out – In shops – discounts, reduction to clear – 50%, etc. – In exams expressing marks as percentages – Phone battery power used etc.   E.g. 2 Drawing circle graphs that represent that represent various percentages of halves, fourths and eighths. The graph shows the ages of pupils in Primary 4. If there are 40 pupils in the class, ask questions for pupils to interpret the graph 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development

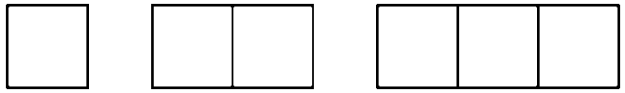
Strand 2. ALGEBRA

Sub-strand 1: Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.2.1.1 **Determine the pattern rule to make predictions about subsequent elements.**	**B5.2.1.1.1 Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one** E.g. 1 Skip count in multiples of 20, 50, 500, etc. is one way to introduce patterns. E.g. 2 Provide students with a thousand number chart or number line with missing numbers and help use the strategy of skip counting to find missing numbers	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

10						70		90	
110		130						190	
					260		280		300
310				350				390	
						470	480		
		530	540					590	
610			640					690	
710				750			780		
		830				870			
		930	940	950					

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.2.1.1
Determine the pattern rule to make predictions about subsequent elements CONT'D</td>
<td>
B5.2.1.1.2 Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more, one more than or less than twice, etc.
E.g. 1 Lines are drawn to intersect two lines in each diagram and the number of points of intersection are counted to form a sequence.
Ask learners to tabulate your results for the next four terms in the sequence and complete the table Find the rule for lines

<table>
<tr><td>Number of lines</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>·</td><td>·</td><td></td></tr>
<tr><td>Intersections</td><td>2</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Guide learners to describe the relationship as "intersection is one less number of lines"
E.g. 2 Consider a design on the wall is being made using square tiles of size 10cm by 10cm

Ask learners to find the number of joints made by the tiles if one, two, three, four, etc. of the squares tiles are used, and use it to complete the following table and describe the relationships.
<table>
<tr><td>Number of tiles</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Number of joints</td><td>0</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving kills;
Critical Thinking;
Justification of Ideas;
Collaborative learning;
Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

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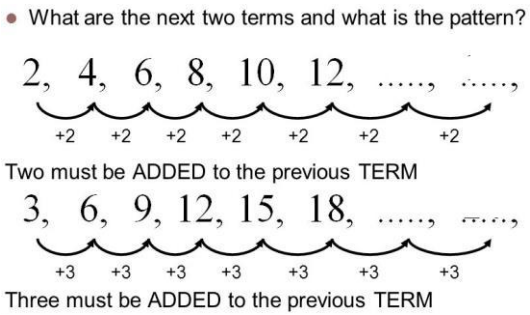
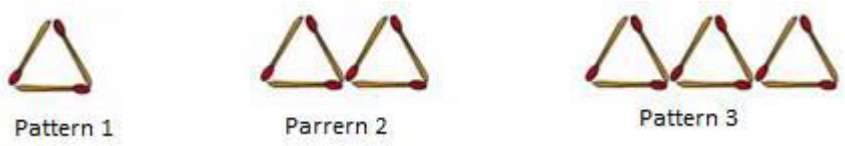
<tr>
<td>B5.2.1.1
Determine the pattern rule to make predictions about subsequent elements CONT'D</td>
<td>
B5.2.1.1.3 Predict subsequent elements in a given pattern
E.g. 1 Ask students to respond to find the next two terms in a pattern and state the rule for the pattern.


E.g. 2 Ask learners to complete the table below for the number of match sticks used in this geometric pattern. Guide learners to describe the relationship.


E.g. 3 Ask learners to write questions based on number or geometric patterns for their friends to find answers to; e.g. how many match sticks will be used for the 9th geometric pattern?
<table>
<tr><td>Number of triangles</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td></td><td></td><td></td><td>n</td></tr>
<tr><td>Number of match sticks</td><td>3</td><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
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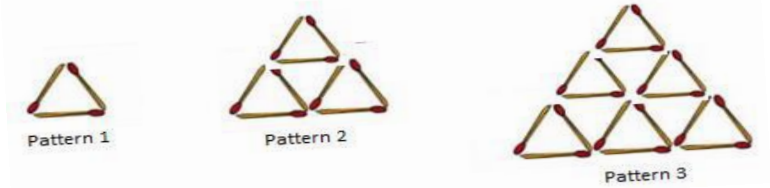
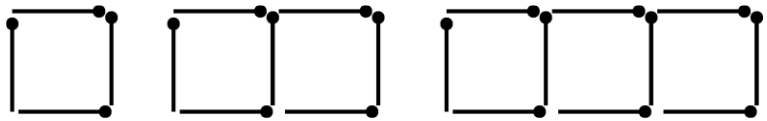
<tr>
<td>B5.2.1.1
Determine the pattern rule to make predictions about subsequent elements CONT'D</td>
<td>
B5.2.1.1.4 Represent a given pattern visually to verify predictions

E.g. 1 Ask learners to examine the pattern in the table below which shows the number of match sticks used in making a pattern of triangles.


<table>
<tr><td>Pattern Number (sticks in side)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>Number of match sticks</td><td>3</td><td>9</td><td>18</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Ask learners to use match sticks to make the patterns of triangles and complete the table. Guide learners to describe the relationship

E.g. 2 Ask learners to examine the pattern in the table below which shows the number of match sticks used in making a pattern of squares

Ask learners to use match sticks to make the patterns of triangles and complete the table. Guide learners to describe the relationship

<table>
<tr><td>Pattern Number (sticks in side)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>Number of Pattern 1 triangles</td><td>1</td><td>4</td><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
E.g. 3 Ask learners to write questions based on number or geometric patterns for their friends to find answers to; e.g. how many match sticks will be used for the 9th pattern of squares? How many match sticks will be used for the 8th pattern of squares?
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.2.1.1
Determine the pattern rule to make predictions about subsequent elements CONT'D</td>
<td>
B5.2.1.1.5 Solve a given problem by using a pattern rule to determine subsequent elements
E.g. 1. Ask learners to describe the pattern rule for each example and determine the next three elements of each:
(i) 1, 10, 7, 70, 67, 670, ...
(ii) 10, 12, 16, 22, 30 ...
(iii) 50, 48, 47, 45, 44 ...

E.g. 2. Ask learners to describe the pattern rule for each of the patterns and determine the next three elements:
(i) .25, .5, .75, ___, ___, ___,
(ii) 2.50, 5, 7.50, ___, ___, ___,
(iii) 64, 32, 16, , ___, ___, ___,
(iv) 900, 450, 225, , ___, ___, ___,

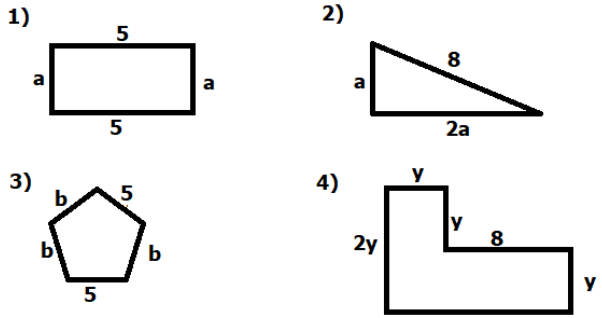
B5.2.1.1.6 Determine and explain why a given number is or is not the next element in a pattern
E.g. 1 Ask students to respond to the following prompt: Shika filled bags with marbles. She placed two marbles in the first bag, four marbles in the second bag, six marbles in the third bag, eight marbles in the fourth bag and twelve in the fifth bag.
Her friend Ayerko noticed an error in the pattern. Can you identify and describe the error?
<table>
<tr><td>Bags</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Marbles</td><td>2</td><td>4</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
B5.2.1.1.7 Write a rule in words and in algebra to represent a given pattern
E.g. 1. E.g. 1. Ask learners to state the rules in words and in algebra to represent a given increasing linear patterns.
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.2.1.1
Determine the pattern rule to make predictions about subsequent elements CONT'D</td>
<td>
<table>
<tr><th>Term/Input</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>Rule for n in words</th><th>Rule for n in Algebra</th></tr>
<tr><td>Result/Output A</td><td>7</td><td>14</td><td>21</td><td></td><td></td><td></td><td>7 times n</td><td>7n</td></tr>
<tr><td>Result/Output B</td><td>0</td><td>4</td><td>8</td><td>12</td><td></td><td></td><td>4 times one less n</td><td>4(n-1)</td></tr>
<tr><td>Result/Output C</td><td>4</td><td>7</td><td>10</td><td></td><td></td><td></td><td>1 more than 3 times n</td><td>1 + 3n</td></tr>
<tr><td>Result/Output D</td><td>5</td><td>9</td><td>13</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Result/Output E</td><td>5</td><td>11</td><td>17</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Result/Output F</td><td>0</td><td>6</td><td>12</td><td>18</td><td></td><td></td><td></td><td></td></tr>
</table>
B5.2.1.1.8 Describe the relationship in a given table or chart, using a mathematical expression
E.g.1 This table shows the pattern of cost of boxed lunches for students on a field trip. Ask learners to: (i) explain the pattern of how the cost of lunches changes as more students go on the trip; (ii) use the pattern to determine how many students went on the trip if the cost of lunches is GHC90.
<table>
<tr><td>Number of students</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>?</td></tr>
<tr><td>Cost of lunch in cedis</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>90</td></tr>
</table>
E.g. Ask learners to write questions based on the pattern for their friends to find answers.
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

Sub-Strand 2: Algebraic Expressions

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.2.2.1 **Demonstrate understanding of algebraic expressions**	**B5.2.2.1.1 Demonstrate understanding of algebraic expressions as mathematical phrases that can contain letters which represent ordinary numbers and operators (like add, subtract, multiply, and divide).** E.g. 1. Write algebraic expressions for word problems: 1) Sum of 8 and s 2) 8 times the sum of c and 7 3) Take away 4 from m 4) Subtract 4 from 7 times g E.g. 2. Write algebraic expressions for the perimeter of the following shapes: 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

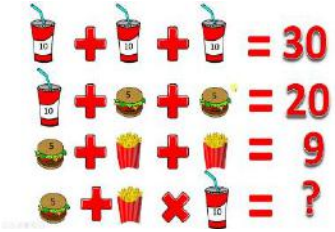
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	E.g. 2. Simplify basic algebraic expressions by grouping like terms. E.g. 1) m + 5 m 2) b + (–3b) + b 3) –7 n + 6 n 4) 9 w – 4 – 10 w 5) 8 w + 5 w 6) – m + 9 – 5 m E.g. 3. Substitute a value for an unknown into an expression and correctly calculate the answer. E.g. Find the values of these algebraic expressions using the values given in the following: 1) z + 7d use z = 7 and d = 4 2) 4 - 5s + 3b use s = 6 and b = 2 3) 8k + d use k = 2 and d = 3 4) -7 - 2b + 6 - 3r use b = 3 and r = 4 5) 7(5f - 3n) - 8 use n = 3 and f = 7 6) -5d - k 7 _ use k = 14 and d = 5	

Sub-Strand 3: Variables and Equations

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.2.3.1
Solve problems involving single-variable, one-step equations with whole number coefficients</td>
<td>
B5.2.3.1.1 Express a given problem as an equation where the unknown is represented by a letter to variable.
E.g.1. Ask learners solve word problems; e.g..
i. The cost of two pens is twenty ¢15. If one costs ¢5.50, what is the cost the other pen?
ii. The product of two numbers is 120. If one of the numbers is 24, what is the other number?

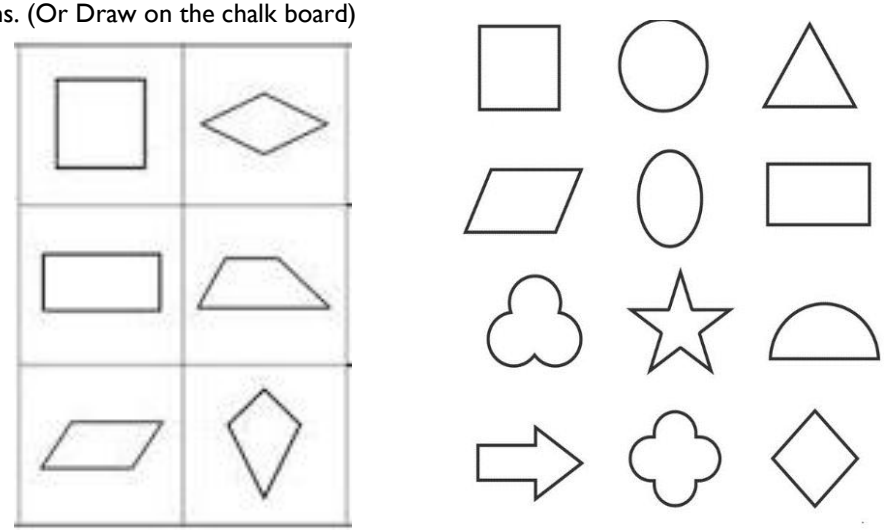
E.g.2. Ask learners to read Ama's problem below, complete the table and solve the problem
<table>
<tr><td>Days (d)</td><td>Days</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td></td></tr>
<tr><td>Height (h)</td><td>Height</td><td>5cm</td><td>7cm</td><td></td><td></td><td></td><td></td></tr>
</table>
Ama is tracking the progress of her plant's growth. Today the plant is 5cm tall. The plant grows 2cm a day
(i) Write a mathematical sentence that represents the height of the plant after d days;
(ii) What will the height of the plant be after 20 days?
(iii) How many days will the height take to reach 75cm?
</td>
<td>Learners develop:

Problem Solving skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.2 **Perform a single transformation (translation and reflection) of a 2D shape**	**B5.2.3.1.2 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.** E.g.1 Learners use concrete materials, such as blocks or counters and the balance scales, to find the value of p in the following equations. If necessary, model the use of guess and test as one strategy. By observing patterns in their results, students become more systematic in the guesses they make 1. 3 + p =11 2. 14 - p = 8 3. p - 9 = 16 4. 3p = 12 5. p + 5 = 17 6. 24 = p + 9 **7.** 25 = 35 - p **B5.2.3.1.3Create a problem for a given equation** E.g.1 Ask students to describe two different stories that the equation 5 + k = 9 could represent E.g.2. Ask learners to solve puzzle in the figure, by solving the equations in each line 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning Look for Patterns and Relationships

Strand 3: GEOMETRY AND MEASUREMENT

Sub-Strand 1: Lines and Shapes

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.1.1 **Identify and sort quadrilaterals, including rectangles, squares, trapezoids, parallelograms, and rhombuses, according to their attributes**	**B5.3.1.1.1 Demonstrate an understanding of the properties (e.g. sides, angles, and diagonals) of squares and rectangles** E.g. 1 Give learners photocopied worksheets with shapes to identify squares and rectangles and give reasons. (Or Draw on the chalk board) 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning Look for Patterns and Relationships

Sub-strand 3: Measurement **– Perimeter, Area, Capacity/Volume and Angle**

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.3.1.1

Identify and sort quadrilaterals, including rectangles, squares, trapezoids, parallelograms, and rhombuses, according to their attributes CONT'D</td>
<td>B5.3.1.1.2 Use paper folding with cut-out squares and rectangles to investigate sides, angles, and diagonals properties

E.g. 1 Give learners foldable cut-out 2D squares and rectangles to investigate the properties in terms of sides, angles, and diagonals and complete the table

<table>
<tr><td>Properties</td><td>Rectangle</td><td>Square</td></tr>
<tr><td>Sides</td><td></td><td></td></tr>
<tr><td>All sides are congruent</td><td>No</td><td>Yes</td></tr>
<tr><td>Opposite sides are congruent</td><td></td><td></td></tr>
<tr><td>Opposite sides are parallel</td><td></td><td></td></tr>
<tr><td>Angle</td><td></td><td></td></tr>
<tr><td>Opposite angles are congruent</td><td></td><td></td></tr>
<tr><td>All angles are right angles</td><td></td><td></td></tr>
<tr><td>Diagonals</td><td></td><td></td></tr>
<tr><td>Diagonals bisect each other</td><td></td><td></td></tr>
<tr><td>Diagonals are congruent</td><td></td><td></td></tr>
<tr><td>Diagonals meet at right angles</td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
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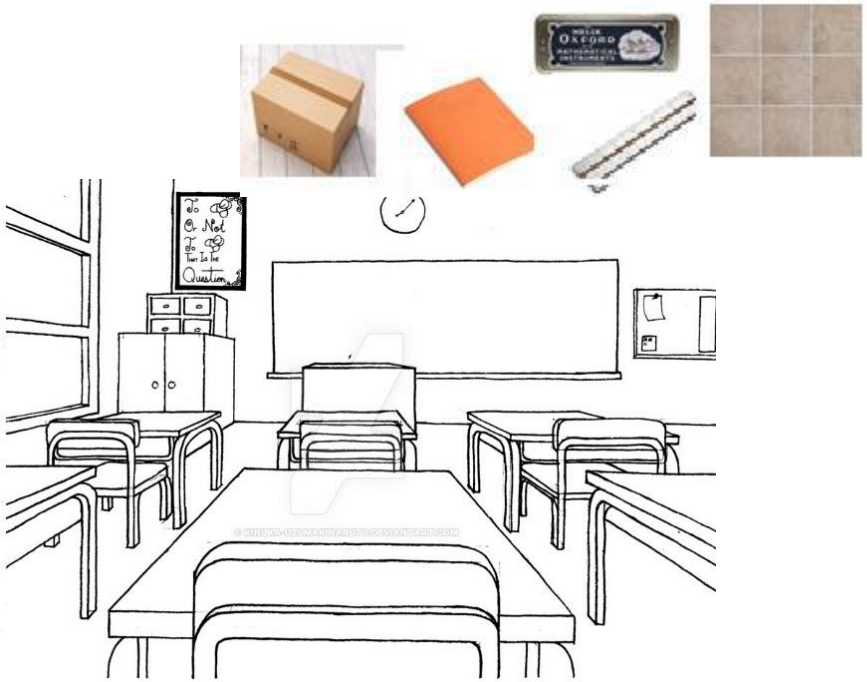
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B5.3.1.1

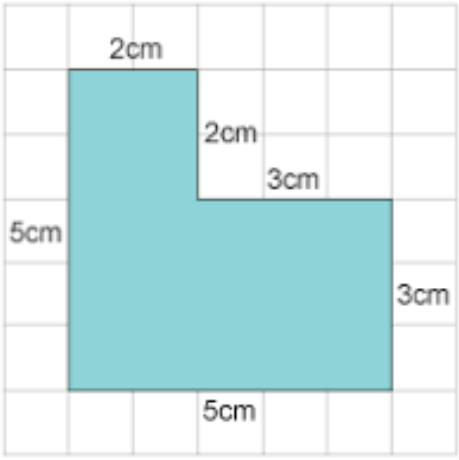
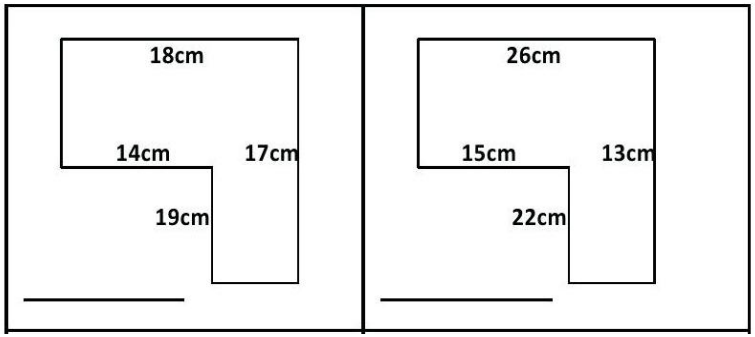
Identify and sort quadrilaterals, including rectangles, squares, trapezoids, parallelograms, and rhombuses, according to their attributes CONT'D</td>
<td>
B5.3.1.1.3 Prove that a polygon is regular by measuring the sides and angles or by folding and superimposing

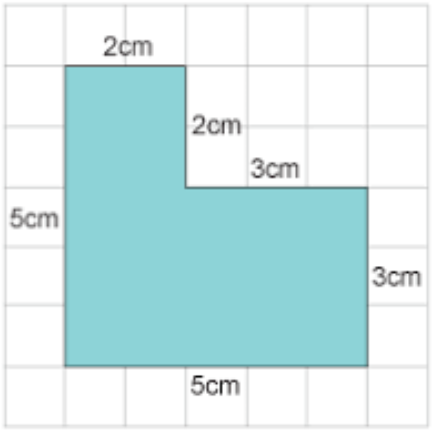
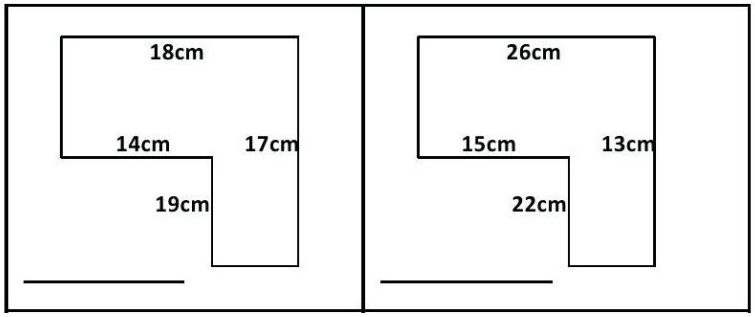
E.g. 1 Give learners foldable cut-out 2D quadrilaterals - rectangles, squares, trapezoids, parallelograms, and rhombuses - to investigate the properties in terms of sides, angles, and diagonals and complete the table
<table>
<tr><th>Properties</th><th>Rectangle</th><th>Square</th><th>rhombuses</th><th>trapezoids</th><th>parallelograms</th></tr>
<tr><td>Sides</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>All sides are congruent</td><td>No</td><td>Yes</td><td></td><td></td><td></td></tr>
<tr><td>Opposite sides are congruent</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Opposite sides are parallel</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Angle</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Opposite angles are congruent</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>All angles are right angles</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Diagonals</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Diagonals bisect each other</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Diagonals are congruent</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Diagonals meet at right angles</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Learners develop:

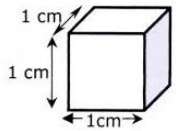
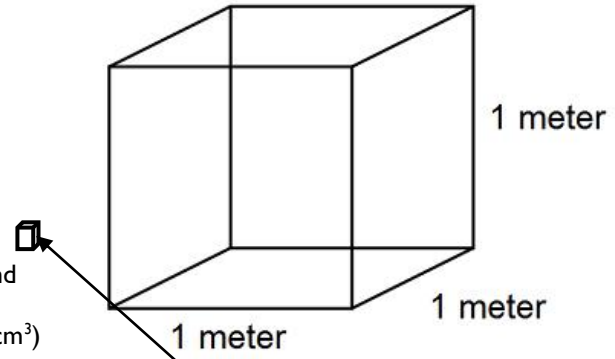
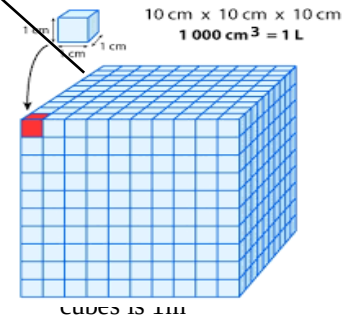
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

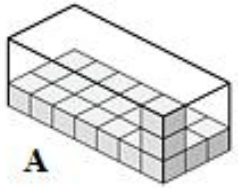
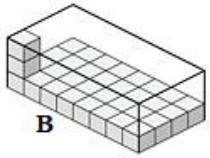
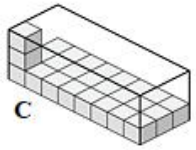
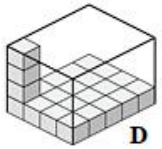
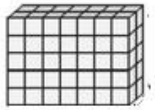
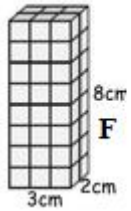
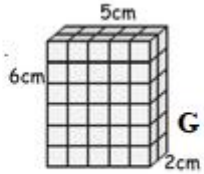
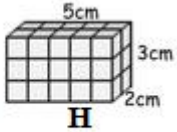
Sub-Strand 2: Measurement

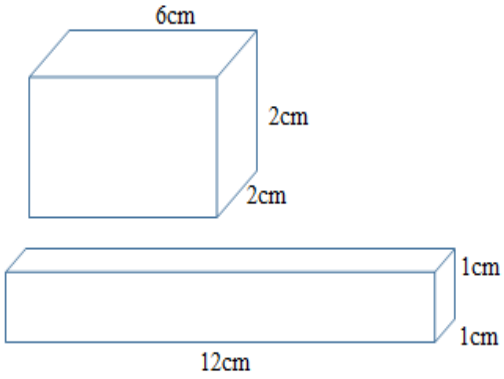
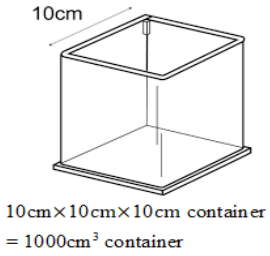
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.1 **Estimate and measure perimeter and surface area of 2-D shapes using centimetre and metre**	**B5.3.2.1.1 Estimate perimeter using referents for centimetre and metre, and calculate the actual perimeter and compare.** E.g. 1 Using pupils' referents for centimetre (hand span and thumb width) or metre (two strides or pace steps) estimate and calculate perimeter of any object in the classroom (e.g. exercise book, floor tiles, math set, teacher's table, classroom floor, etc.) then measure with a ruler of tape and calculate the actual perimeter and compare the answers. 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.1 **Estimate and measure perimeter and surface area of 2-D shapes using centimetre and metre CONT'D**	**B5.3.2.1.2 Calculate perimeter of given shapes in centimetres and metres.** E.g. 1 Give learners 2D shapes with given dimensions to find the perimeter by adding the distance around the shapes   	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

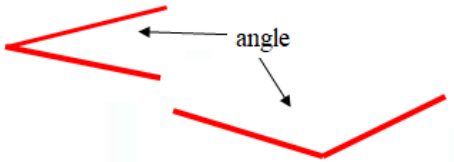
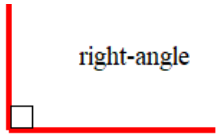
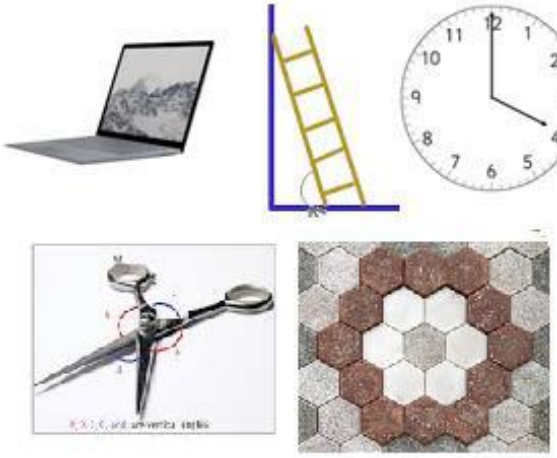
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.1 **Estimate and measure perimeter and surface area of 2-D shapes using centimetre and metre CONT'D**	**B5.3.2.1.3 Calculate surface area of given shapes in centimetres and metres.** E.g. 1 Give learners compound 2D shapes that can be spilt to many rectangles with given dimensions to find the surface area by adding areas of the various rectangles  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership, Attention to Precision

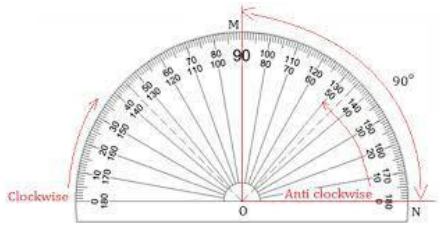
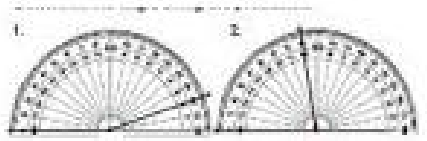
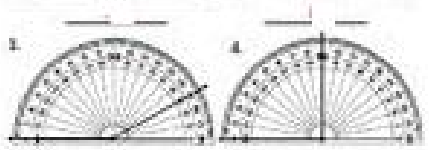
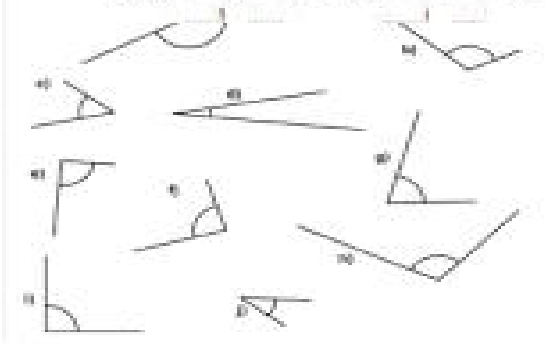
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.2 **Demonstrate an understanding of volume of common 3D shapes**	**B5.3.2.2.1 Select and justify referents for cm^3 or m^3 units.** E.g. 1 Show learners an object which is a **cubic centimetre (or 1 cm^3) and** another object which is a **cubic metre (or 1 m^3)**  Volume = 1 cm^3  E.g. 2 Let learners explore the classroom and compound to find that can be used as referents for the cubic centimetre (1cm^3) and cubic metre (1m^3). Example of 1$m^3$is polytank; and 1$cm^3$is cube sugar. E.g. 3 Ask learners identify containers in the classroom and compound that can be measured using cubic centimetre (cm^3) and cubic metre (m^3)  E.g. 4 Ask learners to explore and state the relationship between 1cm^3 and 1m^3; that is, a cubic is the volume of a cube with measurements 1cm×1cm×1cm, and is equal to1/1,000,000of a cubic meter,1/1,000 of a litre (**i.e.** 1m^3=100cm×100cm×10cm =1,000,000cm^3). cubes is 1m	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.2 **Demonstrate an understanding of volume of common 3D shapes CONT'D**	**B5.3.3.2.2 Determine the volume of boxes by finding how many cubes of sizes 1cm³ each contains** E.g. 1 Ask learners to determine the volume of different sizes of boxes by investigating how many cubes of sizes 1cm³ can fill the containers. i.e. for box A, the base can take 2 by 7 1cm³, and to fill it this arrangement will done 3 times, hence Volume of A is base area × height = 2×7×3=42cm³  A E.g. 2 Ask learners to determine the volume of the boxes B, C, D and E  B  C  D  E E.g. 3 Guide learners to deduce the rule for volume of a box, and use is to calculate volumes of given boxes – F, G and H. That is, if the base area is $l \times w$ and the height is h, then the. Volume of box is given by $l \times w \times h$  8cm F 3cm 2cm  5cm 6cm G 2cm  5cm 3cm 2cm H	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

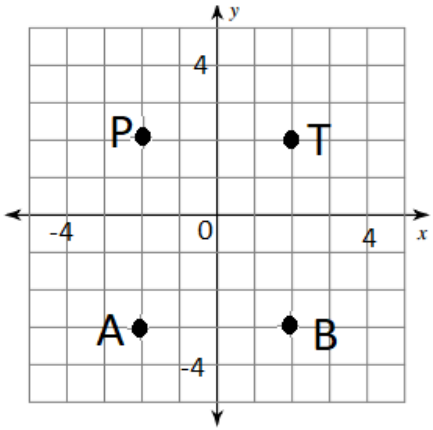
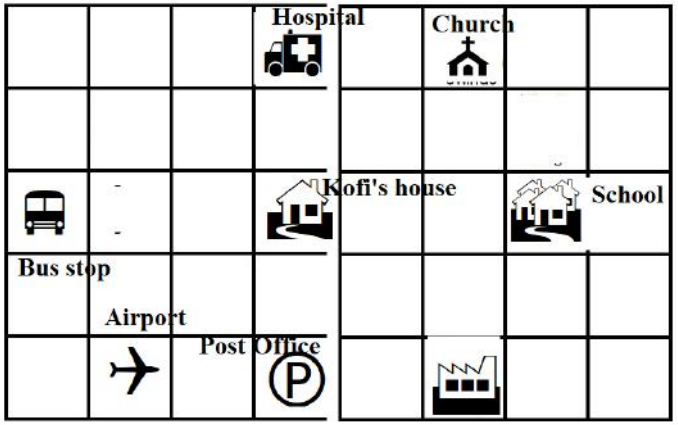
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.2.2 **Demonstrate an understanding of volume of common 3D shapes. CONT'D**	**B5.3.2.2.3Determine different sizes of boxes that have the same volume.** E.g. 1 Given 12 centimetre cubes, ask learners to find the different dimensions of boxes that can take the cubes. For 12 cubes the boxes can be of dimension 1cm×1cm× 12cm or 2cm×2cm×6cm. Can we find any more drawings.  E.g. 2 Ask learners to investigate with 20, 24, 30 and 48 centimetre cubes and draw all possible boxes	Learners develop: Problem solving skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision
	B5.3.3.2.4 Demonstrate an understanding of capacity by describing the relationship between capacity and volume as well as litre and 10cm^3 E.g. 1 Give learners a litre container and a 10cm×10cm×10cm container (i.e. a 1000cm^{3}container. Ask them to fill one with water and empty it into the other; and ask them to explore and state the relationship between 1cm^3 and 1m^{3}i.e. 10cm×10cm×10cm =1000cm^3 = 1*litre*. [see B5.3.2.2.1 i.e. 1000litres is 1m^3]   10cm×10cm×10cm container = 1000cm^3 container Note: the volume is the actual amount of something which covers a definite space. Capacity is the potential amount of a substance which an object is able to hold (units are litres and millilitres , gallons, etc).	

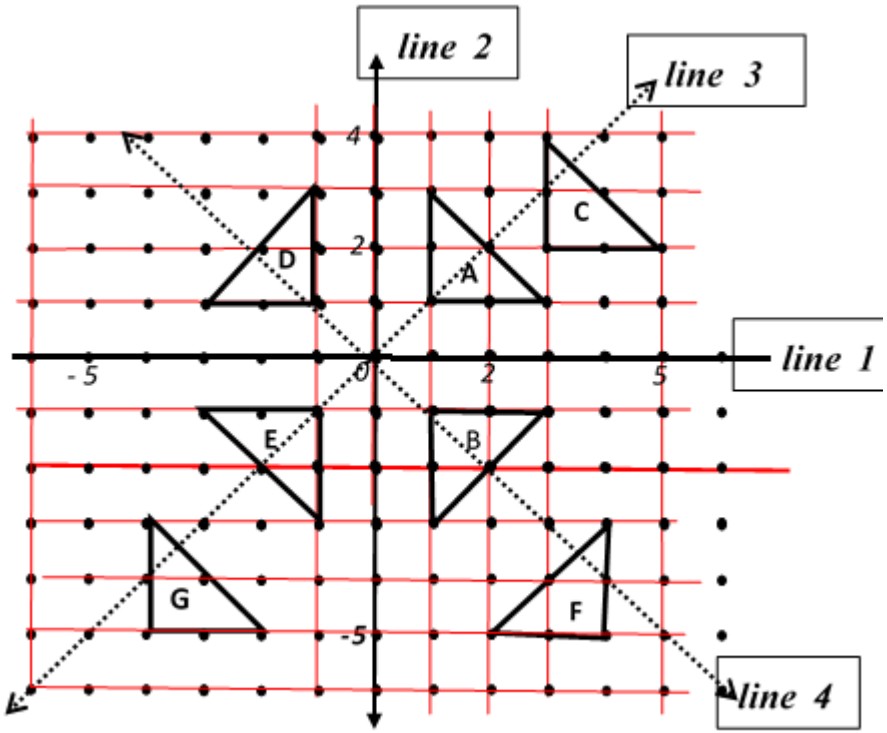
Sub-Strand 3: Measurement - Angles

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.3.3 **Demonstrate an understanding of angles**	**B5.3.3.3.1 Identify examples of angles in the environment that are equal to, less than or larger than, a right angle** E.g. 1 Review the definition of angles: angles as the region formed in a plane when two lines meet or cross, they form an Angle. And ask learners to identified angles in the classroom and compound. E.g. opening laptop, door, window, pair of scissors, pavement floor, etc.  E.g. 2 Guide learners to see right angles and fold right angles from paper. Ask learners to identify examples of angles in the classroom and compound that are equal to, less than or larger than, a right angle  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.3.3 **Demonstrate an understanding of angles CONT'D**	**B5.3.3.3.2 Measure given angles with a protractor and classify them according to their measured sizes – right, acute, obtuse and reflex** E.g. 1 Review with learners how to use the protractor to measure angles  E.g. 2 Give learners photocopied worksheets with protractor in position measuring angles; ask them to read the angles or place their protractors on it and read it  E.g. 4 Give learners photocopied worksheets with several angles to measure and sort into those which are – right, acute obtuse angles.  E.g. 5 Ask learners to draw various angles such as 30°, 45°,60°, 75°, 90°, 120°, 150°,270°, etc. 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

Sub-Strand 3: Geometric Reasoning

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.4.1 **Describe the position of objects in space using the cardinal points**	**B5.3.4.1.1 Tell the position and motion of objects in space using the cardinal points north, south, east and west** E.g. 1. Pupils describe the position and motion of objects from one point to another using the 4 main cardinal points: e.g. The point **P** is to the west of point **T** but to the north of the **A** E.g. 2. Pupils describe the position of places in a grid from a given location. E.g. from Kofi's house - the school is East of Kofi's house; the hospital is North of Kofi's house E.g. 3. Ask learners to give directions from Kofi's house the various locations. E.g. Move 2 squares to the east and 2 squares to the north to get to the church  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Attention to Precision; Look for Patterns and Relationships

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.3.4.2 **Perform a single transformation (i.e. reflection) on a 2D shape**	**B5.3.4.2.2 Identify images of a single transformation (i.e. reflection) of a 2D shapes in a plane** E.g. 1. Ask learners to identify images of reflections of given 2D shapes in a given plane. Ask learners to study the shapes and the mirror line and state which are objects and their images in the given four mirror lines. Shape E is the image of Shape B in mirror line 2 or the line $x = 0$; shape A is a reflection of shape E in the line $y = x$.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Attention to Precision; Look for Patterns and Relationships

Strand 4: Data
Sub-Strand 1: Data Collection, Organisation, Presentation, Interpretation and Analysis

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.4.1.1

Differentiate between first-hand and second-hand data</td><td>
B5.4.1.1.1 Explain the difference between first-hand and second-hand data.

E.g. 1. Explain first-hand data as data that you collect on your own; and second-hand data is data that has been collected and organized by somebody else.

E.g. 2. Mrs. Acquaye's class studied the weather. The learners measured the rainfall for 5 days (Monday to Friday). For her class these results are first-hand data. But for another class these results are second-hand data.

B5.4.1.1.2 Find examples of second-hand data in print and electronic media, such as newspapers, magazines, and the internet.

E.g. 1. Look for examples of second-hand data in the newspaper or website; You can find data on league table, price list, sales, rainfall, etc.

E.g. 2. Ask learners to study the second-hand data on the league table and write questions for their friends to read and interpret the data. E.g. Which team has not lost in a match? Which team has won only one match?

<table>
<tr><th>Team</th><th>P</th><th>W</th><th>D</th><th>L</th><th>F</th><th>A</th><th>Pts</th></tr>
<tr><td>Hearts</td><td>2</td><td>2</td><td>0</td><td>0</td><td>4</td><td>1</td><td>6</td></tr>
<tr><td>Kotoko</td><td>2</td><td>1</td><td>0</td><td>1</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Dwafts</td><td>2</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>Gold Feilds</td><td>2</td><td>0</td><td>1</td><td>1</td><td>0</td><td>2</td><td>1</td></tr>
</table>
</td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td></tr>
</table>

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.4.1.1

Differentiate between first-hand and second-hand data. CONT'D</td><td>E.g. 3. Ask learners to study the second-hand data on suggested number of 30 minutes periods that Ghanaian primary school children learn certain subjects every week. Ask them to write questions for their friends to read and interpret the data.

<table>
<tr><th></th><th colspan="3">Number of weekly periods in each class</th></tr>
<tr><th>Subject</th><th colspan="3">Upper primary</th></tr>
<tr><th></th><th>P4</th><th>P5</th><th>P6</th></tr>
<tr><td>English</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>Mathematics</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>National language</td><td>6</td><td>6</td><td>6</td></tr>
<tr><td>Environmental studies</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>Integrated sciences</td><td>5</td><td>5</td><td>5</td></tr>
</table></td><td>Learners develop:

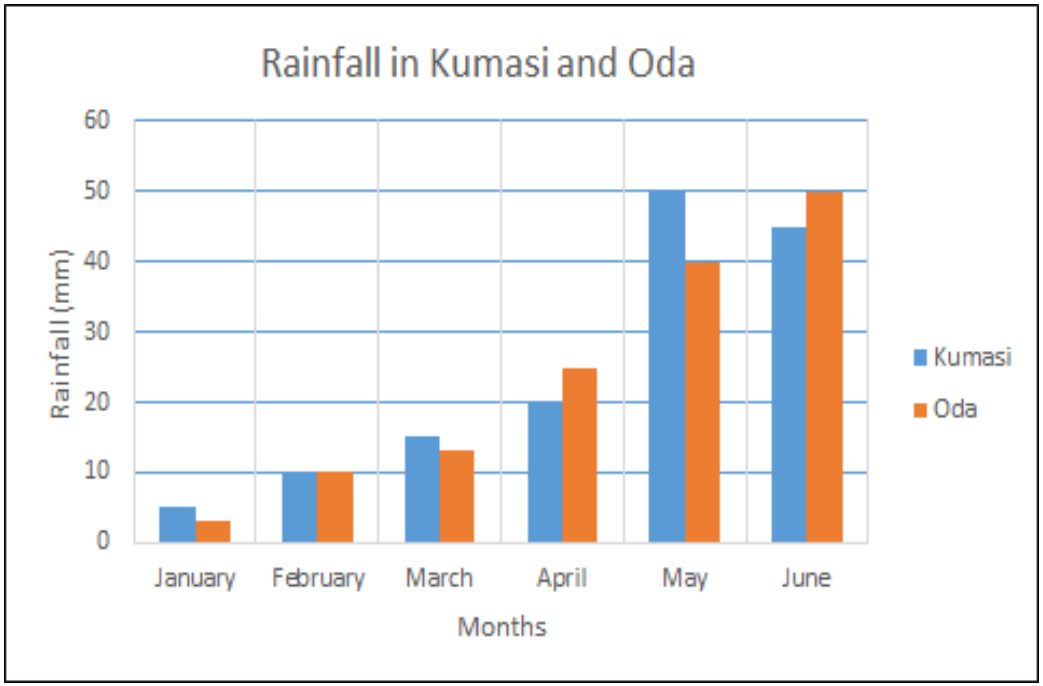
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td></tr>
<tr><td>B5.4.1.2

Construct and interpret double bar graphs to draw conclusions</td><td>B5.4.1.2.1. Draw double bar graphs, complete with title, labelled axes, key or legend, to represent data collected (up to 3 pairs of categories of data and use it to solve problems.

E.g. 1. Give students data presented in a table on rainfall in mm for two towns to draw a double bar graph complete with title, labelled axes, key

<table>
<tr><td></td><td>January</td><td>February</td><td>March</td><td>April</td><td>May</td><td>June</td></tr>
<tr><td>Kumasi</td><td>5</td><td>10</td><td>15</td><td>20</td><td>50</td><td>45</td></tr>
<tr><td>Oda</td><td>3</td><td>10</td><td>13</td><td>25</td><td>40</td><td>50</td></tr>
</table></td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning Look for Patterns and Relationships</td></tr>
</table>

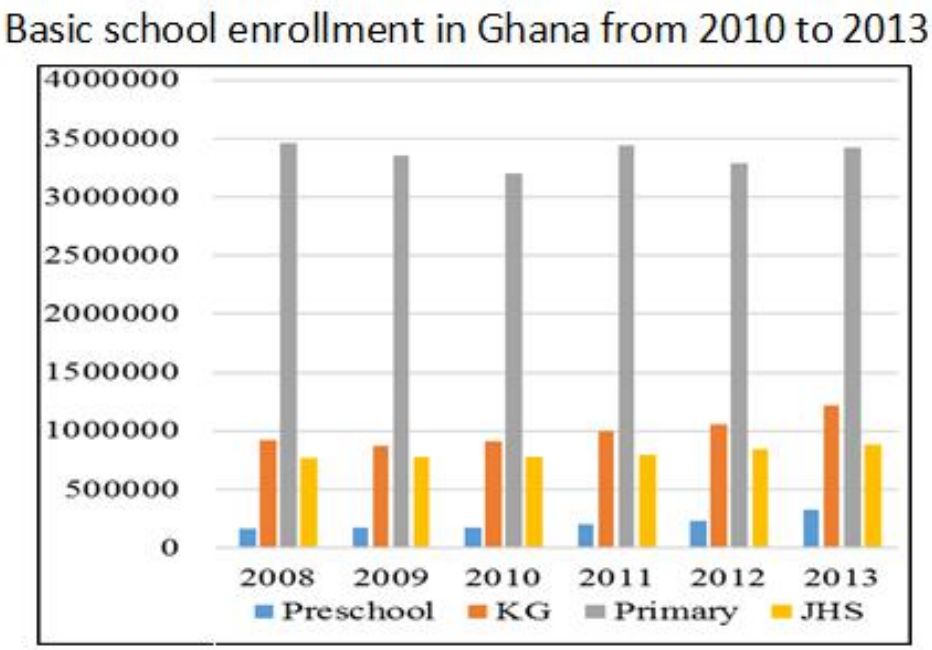
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.4.1.2 **Construct and interpret double bar graphs to draw conclusions** **CONT'D**		Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

<table>
<tr><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B5.4.1.2
Construct and interpret double bar graphs to draw conclusions
CONT'D</td><td>E.g. 2. Give students more paired data presented in a tables. Ask them to study the paired data in the tables and ask them questions based on them. Also ask them to write questions for their friends to read and interpret the data. For instance some questions can be (i) In which subject was Fusena's worse performance? (ii) How many pupils are in the upper primary classes in Presby? (iii) When was the best day for Senasco shop?

E.g. 3. Ask learners to draw double bar graphs complete with title, labelled axes, key for the paired data presented in the tables on (i) percentage test scores of 2 students; (ii) enrolment in 2 schools in a town; sales of two of bread in two shops in a week; etc.

(i) test scores of 2 students
<table><tr><th>Student</th><th>Maths</th><th>English</th><th>Ghanaian Language</th><th>Science</th><th>Social Studies</th></tr><tr><td>Fusena</td><td>75</td><td>60</td><td>80</td><td>60</td><td>65</td></tr><tr><td>Alidu</td><td>55</td><td>70</td><td>75</td><td>70</td><td>55</td></tr></table>
(ii) enrollment in 2 school in a town
<table><tr><td>School</td><td>P1</td><td>P2</td><td>P3</td><td>P4</td><td>P5</td><td>P6</td></tr><tr><td>Presby</td><td>35</td><td>30</td><td>40</td><td>30</td><td>35</td><td>45</td></tr><tr><td>Roman</td><td>45</td><td>50</td><td>55</td><td>50</td><td>65</td><td>60</td></tr></table>
(iii) Sales of bread in two shops in a week
<table><tr><td>Shop</td><td>Monday</td><td>Tuesday</td><td>Wednesday</td><td>Thursday</td><td>Friday</td></tr><tr><td>Abijak</td><td>25</td><td>22</td><td>20</td><td>24</td><td>24</td></tr><tr><td>Senasco</td><td>25</td><td>18</td><td>16</td><td>22</td><td>26</td></tr></table></td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning
Look for Patterns and Relationships</td></tr>
</table>

CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.4.1.2 **Construct and interpret double bar graphs to draw conclusions** **CONT'D**	 **B5.4.1.2.2 Identify examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines, and the internet.** E.g. 1. Provide opportunities for learners to access, read and interpret examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines and the internet	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

Sub-Strand 2: Chance (Probability)

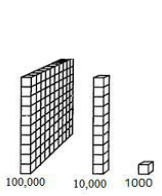
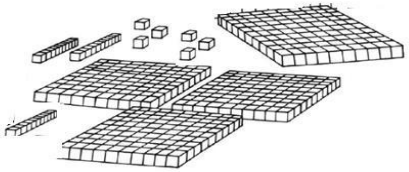
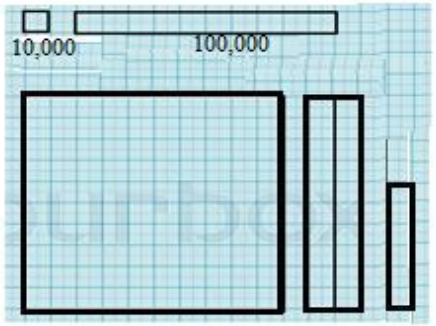
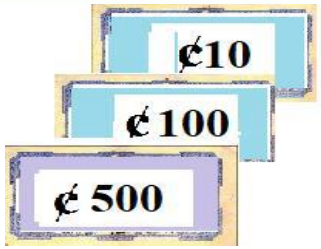
CONTENT STANDARDS	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B5.4.2.1 **Describe the likelihood of a single outcome occurring using words such as impossible, possible, and certain**	**B5.4.2.1.1 Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain** E.g. In a Ludo competition with a die, the event of "obtaining the number 1" is possible; the event of "obtaining the number 7" is impossible; the event of "obtaining the number 1 or 2 or 3 or 4 or 5 or 6" is certain.  **B5.4.2.1.2 Design and conduct an experiment in which the likelihood of a single outcome occurring is impossible, possible (likely or unlikely), certain.** E.g. In a bag containing 10 red, 4 green and 1 pink bottle tops, let a learner pick one bottle top from the bag. 1. Picking a black bottle top is impossible 2. Picking a red bottle top is possible (likely) 3. Picking a pink bottle top is possible (unlikely) 4. Picking a red or green or pink bottle top is certain. Explain each of the four outcomes **B5.4.2.1.3 Conduct a given probability experiment a number of times, recording the outcomes, and explaining the results.** E.g. Ask 5 learners of their expectations/predictions about the outcome of tossing a coin three times. Teacher tosses a coin three times and records the outcome. (e.g. head, head, tail) Does the outcome match their expectation? Either way the teacher should explain. In pairs, learners should repeat the experiment several times, record the outcomes and compare the number of heads turning up	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

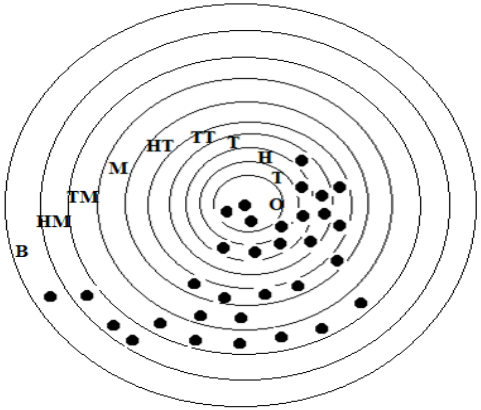
BASIC 6

Basic 6

Strand 1: Number

Sub-Strand 1: Counting, Representation, Cardinality & Ordinality

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion**	**B6.1.1.1.1 Model number quantities up to 1,000,000 using graph sheets and multi-base block** E.g.1. Ask pupils to model number quantities up to 1000,000 using graph sheets or multi-base materials. For instance, with multi-base block, a cube = 1000 unit; a rod = 10,000; a flat = 100,000 and a block = 1,000,000; learners model 436,000 with the appropriate materials E.g.2 Ask pupils to model the number 137,000 shading graph sheet square as shown below    E.g.3. Give learners teacher-make token currency notes [¢10, ¢100 & ¢500 notes] on different coloured-paper and ask them work out how many will be required to model given amounts up to ¢1,000,000; e.g. ¢123,480.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.1 **Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion** **CONT'D**	**B6.1.1.1.2 Read and write numbers in figures and in words up to 1,000,000,000** E.g. 1 Play the place value number wheel game: Use the million number wheel to generate 7-digit numbers and represent the number generated on a place value frame. Throw a number of pebbles (or stones) onto the number wheel, identify the number of pebbles landing in each place value ring, and state the number generated in the wheel (i.e. 5 landed in the hundred-thousands' ring making the number twenty-thousand or 500,000). NB: The representations to use also include verbal, and numerals. Learners must match number word cards to the figures  Place value number wheel Place value chart | Billion	Hundred Million	Ten Million	Million	Hundred-thousands	Ten-thousands	Thousand	Hundreds	Tens	Ones
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1	3	6	2	5	2	4	5	1	3 | E.g. 2. Ask pupils to write given numbers on the expanded form of the number : 1,362,524,513 = 1,000,000,000 × 1 + 100,000,000 × 3 +10,000,000× 6 1,000,000 × 2 + 100,000 × 5 +10,000× 2 + 1,000 × 4 +100 × 5 + 10 × 1 + 1× 3 = 1,000,000,000 + 300,000,000 + 60,000,000 + 2,000,000 + 500,000 + 20,000 + 4000 + 500 + 10 + 3	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.1.1.1

Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion CONT'D</td>
<td>B6.1.1.1.3 Identify numbers in different positions around a given number in a number chart

E.g. 1 Display a number chart in multiples of 1,500 between 10,000 and 50,000 and lead learners identify numbers in different positions around a given number. Put learners in pairs and give each group a number grid and have them identify numbers in different positions around a chosen number
<table>
<tr><td>10,000</td><td>11,500</td><td>12,000</td><td>13,500</td><td>15,000</td><td>16,500</td></tr>
<tr><td>20,000</td><td>21,500</td><td>22,000</td><td>23,500</td><td>24,000</td><td>25,500</td></tr>
<tr><td>30,000</td><td>31,500</td><td>33,000</td><td>34,500</td><td>36,000</td><td>37,500</td></tr>
<tr><td>40,000</td><td>41,500</td><td>43,000</td><td>44,500</td><td>46,000</td><td>47,500</td></tr>
<tr><td>50,000</td><td>51,500</td><td>53,000</td><td>54,500</td><td>56,000</td><td>57,500</td></tr>
<tr><td>60,000</td><td>61,500</td><td>63,000</td><td>64,500</td><td>66,000</td><td>67,500</td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership, Attention to Precision</td>
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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.1 **Demonstrate understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion CONT'D**	**B6.1.1.1.4 Compare and order whole numbers up to 100,000 and represent the comparison using ">, <, or ="** E.g. 1 Learners identify numbers which are 10,000 more or 10,000 less than a given six-digit number. E.g. 123,400 is 10,000 less than133,400 Learners use words such as: "equal to" "greater than" "less than" and later use symbols such as "<", "=", ">" to compare numbers up to 10,000 taking into consideration the place value of each digit in the given number. E.g. $100200 = 100200, \quad 2746794 > 2646796$ E.g. 2 Learners work together in their groups to order a given set of numbers in ascending or descending order verbally and in writing. E.g. For instance; $140230, 17025, 75 \ 267389, 287368,$ E.g. 3 Give two numbers between 10,000 and 100,000 to each group and encourage learners to say as many things as possible about the two numbers. For instance 234675 and 253874; 234675 is less than (smaller than) than 253874 or 253874 is bigger than (greater than) 234675, or 234675 is almost 20000 less than 253874 etc.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership. Attention to Precision

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Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion CONT'D</td><td>B6.1.1.1.5 Round (off, up, down) whole numbers up to 100,000 to the nearest ten thousands, thousands, hundreds and tens

E.g. 1 Learners round off numbers to the nearest 100,000, 10,000 and 1000. For instance; 129,500 is approximately 130,000 and 19100 as approximately 19,000

E.g. 2 Learners round up and round down to estimate sums and differences.

NB: To round down learners consider the smaller of the two approximated numbers, while round up considers the bigger of the two numbers. The table below may bring the meaning of these two concepts clearer

<table><tr><th>214765</th><th>Round up</th><th>Round down</th><th>Round off</th></tr><tr><td>to the nearest ten</td><td>214770</td><td>214760</td><td>214970</td></tr><tr><td>to the nearest hundred</td><td>214800</td><td>214700</td><td>214800</td></tr><tr><td>to the nearest thousand</td><td>215000</td><td>214000</td><td>215000</td></tr></table>
E.g. 3 Give two numbers between 10,000 and 1000,000 to each group and encourage learners to compare and say as many things as possible about the two numbers. For instance 234675 and 253874; 234675 is less than (smaller than) than 253874 or 253874 is bigger than (greater than) 234675, or 234675 is almost 20000 less than 253874 etc.

E.g. 4 Ask learners to work together to round up and round down to estimate sums and differences.</td><td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership to Precision</td></tr>
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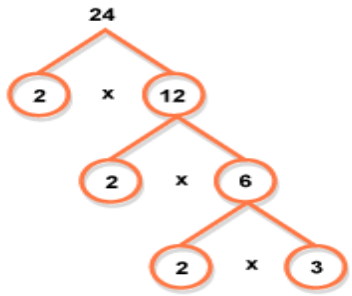
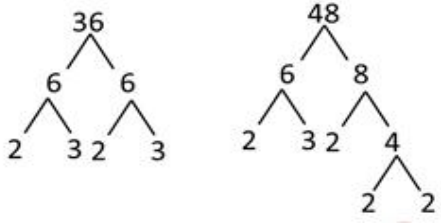
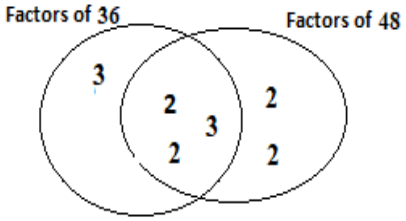
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.1 **Demonstrate understanding of quantities and place value for multi-digit numerals up to 1,000, 000,000 or 1 billion CONT'D**	**B6.1.1.1.6 Skip count forwards and backwards in 5000s, 10,000s etc. up to and from 1,000,000.** E.g. 1 Put learners into convenient groups. A learner mentions a number and another makes skip count in 5000s or 10000s to include the fifth count. For instance. Learner 1: Shout out "287940" Learner 2: 292940, 297940, 312940, 317940, etc. Learner 3; Shout out "827685" Learner 4; 817685, 807685, 797685, 787685, 777685….etc. E.g .2 Skip count forwards and backwards by 5000s and between 10000 and 100000, but make an error or leave out a number. Challenge learners to identify or correct error	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision
B6.1.1.2 Demonstrate understanding of Roman Numerals up to C **(i.e. 100)**	**B6.1.1.2.1 Recognise Roman Numerals system up to C (i.e. 100)** E.g. 1 Display roman numeral charts (1-100) arranged in sequential order and lead learners to identify the numerals. Learners identify the main characters of the roman numerals used to build the table up to 30 i.e. I, II, III, IV, V, X, L and C Call out a numeral and have learners point at it from the chart E.g. 2 Have learners match the Roman numerals to the Hindu-Arabic numerals for instance I = 1; V= 5: IX= 9, XV= 15, XXX = 30, XL = 40, LVI = 56, XCIX = 99. Mention some numerals randomly and have learners point at it on the chart.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.2 Demonstrate understanding of Roman Numerals up to C **(i.e. 100)** **CONT'D**	**B6.1.1.2.2 Count and convert Hindu Arabic numbers to Roman numerals up to 100 (C) and vice versa** E.g. 1 Learners read the chart sequentially forwards and backwards, vertically (up and down), zig-zag, diagonally and randomly without pointing to the numbers. Invite 2-3 learners to read to the class. Call a Roman numeral and ask learners to write E.g. 2 Give learners a numeral in the Hindu Arabic system and have learners convert to roman numeration and vice versa for instance XXIV = 24, LX = 60, XCIV = 94, CCCXXXIII = 333, etc. E.g. 3 Challenge learner to find missing numbers in addition and subtraction sentences involving roman numerals. Ask learners to write similar puzzles for their friends to solve. 1) X + ☐ = XV 2) X + ☐ = XX 3) XXX + ☐ = XXXV 4) XL + ☐ = L 5) V + ☐ = XX 6) XX - ☐ = X 7) XXV - ☐ = XX 8) X - ☐ = V 9) XXX - ☐ = XXVII 10) L - ☐ = XX	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.3 **Demonstrate understanding of factors, multiples and prime numbers from 1 to 100** **CONT'D**	**B6.1.1.3.1 Determine the HCF and the LCM of two or three numbers using prime factors** E.g. 1 Have learners revise the use of the factor tree method to determine prime factors of any given whole number. For example the prime factors of 24. For instance, from the figure: 24 = 2×2×2×3 so 2 and 3 are the prime factors of 24. Ask learners to list the factors of two or more given whole numbers using the factor tree; for 36 and 48 we have 36= 2×3×2×3 =2×2×3×3 and 48= 2×3×2×2×2 = 2×2×2×2×3.  E.g. 2 Learners use the prime factorization by inspection to determine the HCF by underlining the common factors in each product 36=**2×2×3**×3 48= 2×2×**2×2×3**  → which is 2×2×3=12; E.g. 3 Learners use the prime factorization by inspection to determine the LCM and underlining the largest number of factors in each product 36=2×2×**3×3** 48= **2×2×2×2**×3 → which is 2×2×2×2×3×3=144 E.g. 4 Learners place factors in a Venn diagrams to find the HCF and LCM of 36 and 48. i.e. the HCF is product of factors in both circles →2×2×3=12; and the LCM is product of factors in the diagram →3×2×2×3×2×2 =144 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.1.3 **Demonstrate understanding of factors, multiples and prime numbers from 1 to 100 CONT'D**	E.g. 5 Learners use the prime factorisation to determine the LCM and HCF of three numbers using table and dividing through by prime factors. Example 1, find the LCM and HCF these sets of numbers: 18, 24 and 30. Using prime factorization table – (see figure), i.e. HCF = 2×3 = 4, = 2×2×2×3×3×5 = 360.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

*2	18	24	30
2	9	12	15
2	9	6	15
*3	9	3	15
3	3	1	5
5	1	1	5
	1	1	1

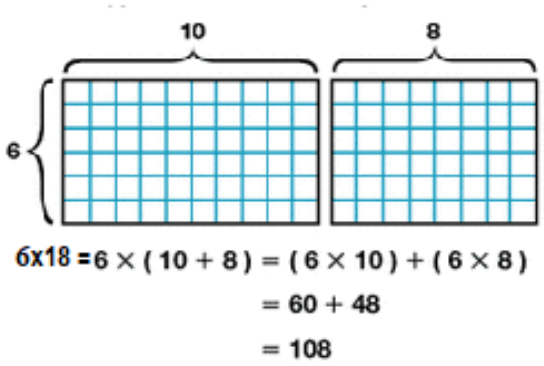
The prime factor which can divide all the numbers is starred. The product of all the starred prime factors is the HCF. In this case the starred numbers are 2 and 3, and HCF = 6

The product of each prime factor which divided any of the numbers is the LCM

method in and LCM

Sub-Strand 2: Number Operations

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.1 Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 144 and related division facts	**B6.1.2.1.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact, using doubling or halving, using patterns in the 9s and 11s facts, using repeated doubling or halving, to determine answers for basic multiplication facts to 81 and related division facts.** E.g. 1 Describe the mental Mathematics strategies used to determine a given basic fact, such as – skip count up by one or two groups from a known fact (e.g., if 5 × 7 = 35, then 6 × 7 is equal to 35 + 7 and 7 × 7 is equal to 35 + 7 + 7) – skip count down by one or two groups from a known fact (e.g., if 8 × 8 = 64, then 7 × 8 is equal to 64 – 8 and 6 × 8 is equal to 64 – 8 – 8) – doubling (e.g., for 8 × 3 think 4 × 3 = 12, and 8 × 3 = 12 + 12) – patterns when multiplying by 9 (e.g., for 9 × 6, think 10 × 6 = 60, and 60 – 6 = 54; for 7 × 9, think 7 × 10 = 70, and 70 – 7 = 63) – repeated doubling (e.g., if 2 × 6 is equal to 12, then 4 × 6 is equal to 24 and 8 × 6 is equal to 48) – repeated halving (e.g., for 60 ÷ 4, think 60 ÷ 2 = 30 and 30 ÷ 2 = 15) – relating division to multiplication (e.g., for 64 ÷ 8, think 8 × … = 64) E.g. 2 Recall multiplication facts to 81and related division facts	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.1 Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 144 and related division facts CONT'D	**B6.1.2.1.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero halving and doubling using the distributive property** E.g. 1 Determine the products when one factor is a multiple of 10, 100, or 1000 by annexing zero or adding zeros (e.g., for 3×200 think of 3×2 and then add two zeros) E.g. 2 Apply halving and doubling when determining a given product (e.g., 32×5 is the same as 16×10) E.g. 3 Apply the distributive property to determine a given product involving multiplying factors that can be written in the expanded form (e.g., 6×18 = (6×10) + (6×8) = 60+48 = 108. Or apply distributive property to determine a given product involving multiplying factors that are close to multiples of 10 (e.g., 29×7 = (30×7) – (1×7) = 203.  E.g. 4 Explain the property for determining the answer when multiplying numbers by iii. one iv. zero.	Learners develop: Problem Solving skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.2 **Demonstrate understanding of multiplication of a 2 or 3-digit number by a 2 or 3-digit number.**	**B6.1.2.2.1. Multiply multi digit numbers by 2 or 3-digit numbers efficiently** E.g. 1. Multiplication of whole numbers using the "expand and box" method (partial decomposition method). Lead learners to multiply a 3-digit number by a 1-digit number as shown below, for example $448 \times 2 = ?$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

×	400	40	8
2	800	80	16

$$448 \times 2 = (400 \times 2) + (40 \times 2) + (8 \times 2) = 800 + 80 + 16 = 800 + 80 + (10 + 6)$$
$$= 800 + 90 + 6 = 896$$

E.g. 2. Multiplication of whole numbers using the Column or vertical method; i.e. 25×32

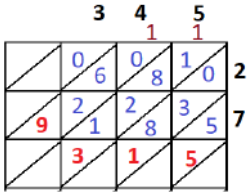
$$\begin{array}{r} 25 \\ \times 32 \\ \hline 50 \\ +750 \\ \hline 800 \end{array}$$

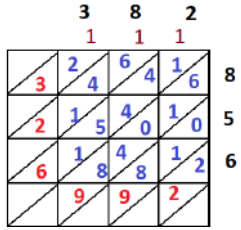
E.g. 3. Multiplication of whole numbers using the Distributive property; i.e. 25×32

$$25 \times (32) = 25(30 + 2)$$
$$= 25(30) + 25(2)$$
$$= 750 + 50$$
$$= \mathbf{800}$$

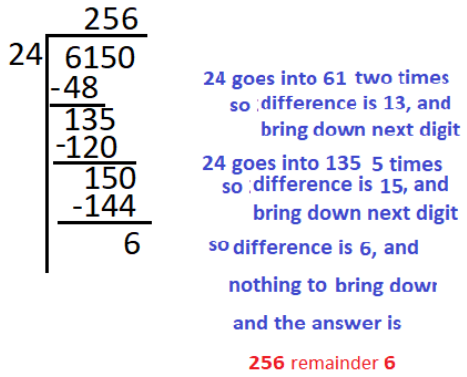
$$\begin{array}{rr} 25 & 25 \\ \times 30 & \times\ 2 \\ \hline 750 & 50 \end{array} = \mathbf{800}$$

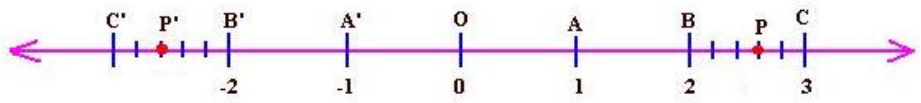
E.g. 4. Multiplication of whole numbers using the lattice method. Have learners draw a 2 by 3 lattice for solving 345 × 27; and 3 by 3 and 3 by 3 lattice for solving 382 × 856.

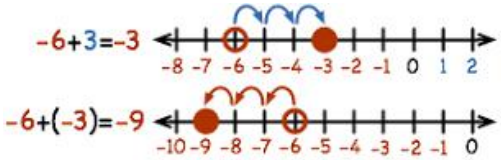


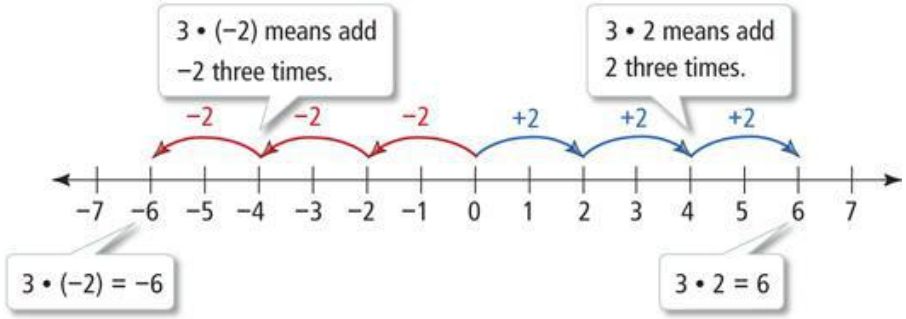


CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.3 **Manipulate numbers, using basic division fact up to 144**	**B6.1.2.3.1 Determine basic division fact up to 81** E.g. 1. Investigate numbers that are multiples of 6, 8, 9 and 11. How do you know a number is divisible by 6, 8, 9 and 11? (This is also known as the divisibility test). E.g. 2. Draw a 6 by 6 multiplication chart and use it as a game board to play the 3-in-a-line game with a pair of dice or playing cards. Players take turns in throwing a one dice and mark (or cover) a number that can be divided by the results (i.e. a quotient). The winner is the one who obtains three numbers in a line.   		5	6	7	8	9	10
---	---	---	---	---	---	---
5	10	15	20	25	30	35
6	12	18	24	30	36	42
7	14	21	28	35	42	49
8	16	24	32	40	48	56
9	18	27	36	45	54	63
10	20	30	40	50	60	70		Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership; Attention to Precision

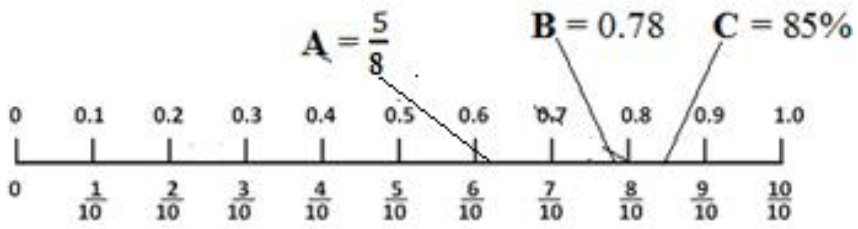
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.4 **Demonstrate understanding of division of a 2 or 3-digit number by a 1 or 2-digit number**	**B6.1.2.4.1 Divide 3-digit numbers by 1-digit number efficiently** E.g. 1. Division as repeated subtraction (using the long division method). Explain division as a way of repeatedly subtracting a divisor number from a given dividend until there is none left and then determining the number of times the divisor is taken from the dividend. 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision
B6.1.2.5 **Translate word problems into mathematical sentences and solve**	**B6.1.2.5.1. Solve multi step word problems involving the four basic operations** E.g. 1. Learners model mathematical statements from a given word problem involving addition and multiplication and solve using the strategies learnt E.g. 2. Learners model mathematical statements from a given word problem involving division and subtraction and solve using the strategies learnt E.g. 3. Learners role play a given word problem involving addition and multiplication and solve E.g. 4. Learners role play a given word problem involving subtraction and division and solve E.g. 5. Learners model mathematical statements from a given word problem involving division and multiplication and solve using the strategies learnt. The relationship between operations and the use of calculator and spreadsheet to assess the reasonableness of answers should be stressed.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.6 **Demonstrate an understanding of integers**	**B6.1.1.6.1 Locate, compare and order sets of integers using the number line and symbols "< or >"** E.g. 1. Use number line to help learners to identify integers as opposites of whole numbers by answering the following questions: i. Which integer is at the point marked B^1? ii. Which integer is larger than B^1 and which is smaller? iii. How many steps away from B is B^1?  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.6 **Demonstrate understanding of integers CONT'D**	**B6.1.2.6.2 Solve simple addition and subtraction problems involving integers (excluding subtraction of negative numbers)** E.g. 1. Use number line to help learners to do the following types (addition) (1) 9 + -4 = _____ (2) -8 + 4 = _____ (3) -3 + -5 = _____ (4) 1 + -3 = _____ (5) -6 + 5 = _____ (6) 6 + -2 = _____ (7) -6 + 8 = _____ (8) -2 + 9 = _____  E.g. 2. Learners do the following types (subtraction) (9) -5 – 1 = ___ (10) -2 – 1 = ___ (11) 8 – 7) = ___ (12) 2 – 6) = _____ (13) -1 – 7 = ___ (14) -5 – 7) = ___ (15) -8 – 8 = ___ (16) 4 – 6 = ____ E.g. 3. Solve word problems; e.g. (i) Some number added to 5 is equal to -11. Find the number. (ii) Ben and Cam are diving. Ben is 15.8 meters below the surface of the water. Cam is 4.2 meters above Ben. What is Cam's position relative to the surface of the water?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership; Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.2.6 **Demonstrate an understanding of integers CONT'D**	**B6.1.1.4.3 Perform simple multiplication with integers** E.g. 1. Use number line to help learners to multiply integers; learners should always start from zero and skip/hop to the left or write on the number line. For instance, to multiply 3 by (-2), have learners start from zero and hop to the left 3times in an interval of 2.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

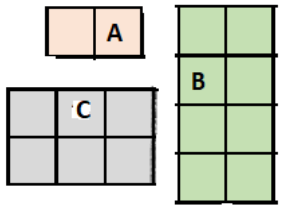
Sub-Strand 3: Fractions

Content Standard	Indicators and EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND Core Competencies
B6.1.3.1 **Demonstrate an understanding of strategies for comparing, adding, subtracting, multiplying and dividing common, decimal and percent fractions**	**B6.1.3.1.1 Compare and order a mixture of fractions: common, percent and decimal fractions (up to thousandths)** E.g. 1. To compare and order a mixture of common, decimal and percent fractions, express them in one form (i.e. either common, decimal or percent); e.g. to order 0.758, $\frac{5}{8}$ and 73%; we have $\rightarrow\frac{5}{8}$ $= \frac{625}{1000}$ = 62.5%, 0.758 $= \frac{758}{1000}$ = 75.8%, and 73% $= \frac{73}{100}$ = 0.73, Hence the order from least to the largest is $\frac{5}{8}$, 73% and 0.758 E.g. 2. To compare and order a mixture of common, decimal and percent fractions you can locate the fractions on the number and order them 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.3.1 **Demonstrate understanding of strategies for comparing, adding, subtracting, multiplying and dividing common, decimal and percent fractions. CONT'D**	**B6.1.3.1.2 Add and subtract unlike and mixed fractions** E.g. 1. To add like mixed fractions that are larger than 1, i.e. 2 1/3 and 32/3 we write down the sum of the whole numbers and add the fractions; i.e. 2 1/3 + 32/3 = 5 + 1/3 + 2/3, = 5 (1+2)/3 = 53/3= 6. E.g. 2. To subtract like-fractions that are larger than 1, i.e. 2 1/3 and 32/3 , we change the mixed fractions into improper fractions and subtract; i.e. 32/3 − 2 1/3 + = 11/3- 7/3 + = (11-7)/3 = 4/3. = 1 1/3 E.g. 3. To add or subtract improper fractions with different denominators, (2 1/3 and 32/5) we need find the Lowest Common Denominator (LCD) and use this to express the equivalent fractions. The LCD is 15 and the equivalent fractions are 2 5/15 and 3 6/15; their sum is 2 1/3 + 32/5 =2 5/15+ 3 6/15 = 5 (5+6)/15 which is 5 11/15; and difference 32/5 −2 1/3 = 1 (6-5)/15 = 1 1/15	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.3.1 **Demonstrate understanding of strategies for comparing, adding, subtracting, multiplying and dividing common, decimal and percent fractions. CONT'D**	**B6.1.3.1.3 Use models to explain the result of multiplying a fraction by whole number, a whole number by a fraction and a fraction by fraction** E.g. 1. To multiply a whole number by a mixed fraction (e.g. 3 × 2 2/3) one can multiply the whole number by the whole number and then whole number by the fraction and add the products or change the mixed fraction to improper fraction and multiply; i.e. 3 × 2 2/3 = (3×2) + 3× 2/3) = 6 + 2/3+2/3+2/3 = 66/3 = 8 or 3 × 2 2/3 = 2 2/3+2 2/3+2 2/3 = 6 (2+2+2)/3 = 66/3 = 8 E.g. 2. To multiply a fraction by a whole number the multiplication is interpreted as "of"; e.g. 2/3 ×5 means shade 2/3 of 5 ; i.e. finding two-thirds of each of five objects; i.e. 2/3 ×5 is 2/3 of 5 quantities, which leads 10 thirds, i.e. 2/3 ×5 = 10(1/3) = 10/3 = 31/3 E.g. 3. To multiply a fraction (i.e. common or mixed) by a whole number (e.g. 4 2/5 × 5) first change all into common fractions, then multiply the numerators separately and multiply the denominators separately and simplify, i.e. 4 4/5 × 5 = 24/5 × 5 / (1) == (24×5)/5 = 120/5 = 24/1 = 24. [Note, the product can be simplified before multiplying the numerators separately and multiplying the denominators separately].	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Sub-Strand 4: Ratios and Proportion

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.4.1 **Demonstrate understanding of the concept of ratios and its relationship to fractions and to the multiplication and division of whole numbers**	**B6.1.4.1.1 Use concrete models and pictorial representations to explain a ratio as a concept that shows the number of times one quantity can be obtained in another and write this symbolically and in its simplest form** E.g. 1. Use concrete objects and/or pictorial representations to explain **ratio** as a number which tells the number of times a quantity can be obtained in another. In the figures, the area of the shape A is $\frac{1}{4}$ of the area of the shape B; so they are in the ***ratio 1:4***. Shape C is three times the size of A so the ratio of C to A is 3:1.  E.g. 2. Use concrete objects and/or pictorial representations to explain *simplest form of a ratio.* Shape C is made up of 6 squares, the areas squares and shape A is made up of 2 of the shapes C and A are in the ratio 6:2; and since C is three times A, the ratio 3:1 is the simplest form of 6:2. The simplest form of a ratio is obtained by dividing through by the highest common factor. The ratio of C to B is 6:8 and its simplest form is 3:4. E.g. Simplify (i) 10m : 1000km (ii) Write 4 : 12 in the form 1 : n (iii) Express 15 : 20 in the form n : 1. E.g. 3. Solve simple problems that involve ratios and finding total ratios. E.g. (i) Out of 24 students in a class, 10 are girls. Find its simplest form the ratio of boys to girls. (ii) A boy's mass is 50kgs, and his sister's is 45kg. Find the ratio of their masses. (iii) If an orange drink is made from concentrate and water in the ratio 3:8, what fraction of the mixture is concentrate?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.4.1 Demonstrate understanding of the concept of ratios and its relationship to fractions and to the multiplication and division of whole numbers CONT'D	**B6.1.4.1.2 Express ratios in equivalent forms, compare and order ratios** E.g. 1. Use the concept of ratio as a fraction to find equivalent ratios that can be easily compared. The ratio 2:3 can be expressed as 2/3 ; to determine which ratio is larger/largest change to equivalent ratios with same denominator and compare or order. E.g. Afia, Bedu and Caro each mix orange squash (S) and water (W) in the ratio 3:14, 2:7 and 1:4 respectively. Whose drink tastes strongest of squash? To determine the one Whose drink tastes strongest of squash we need to have the same unit of water, hence Bedu's. E.g. 2. Solve simple problems that involve simplifying, comparing, finding missing and total ratios. E.g. (i) Given that 10: q = 2 : 3, find q. (ii) The ratio of boys to girls in a class room is 7 to 11. If there are a total of 49 boys in the classroom, then how many boys and girls are there altogether? E.g. 3. Solve simple problems that involve ratios and finding total ratios. E.g. (i) Out of 24 students in a class, 10 are girls. Find its simplest form the ratio of boys to girls. (ii) A boy's mass is 50kgs, and his sister's is 45kg. Find the ratio of their masses. (iii) If an orange drink is made from concentrate and water in the ratio 3:8, what fraction of the mixture is concentrate?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

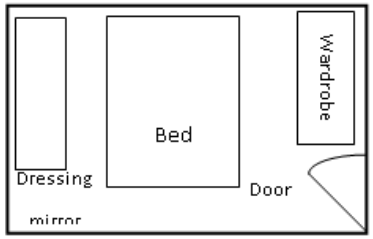
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.1.4.2 **Understand the concept of proportion and its relationship to ratios and rates. Use proportional reasoning and rates to solve real-world and mathematical problems.**	**B6.1.4.2.1 Use models to explain proportion as a comparison between quantities with equal ratios** E.g. 1. Use mapping diagram to explain the concept of proportion as equal fractions or equivalent ratios. The mapping diagram shows that the ratio of number of goats to number of legs are equal, hence the number of goats is proportional to the number of legs. The proportion can be written as equal fractions or ratios, i.e. 3/12 = 4/16 or 3:12 = 4:16 E.g. 2. Give learners mappings to identify those that are proportional and those that are not E.g. 3. Work out proportion in given contexts and use them in solving problems; e.g. 200 bottles of equal capacity hold 350 litres of water. How much water does each bottle hold?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership; Attention to Precision

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.1.4.2

Understand the concept of proportion and its relationship to ratios and rates. Use proportional reasoning and rates to solve real-world and mathematical problems. CONT'D</td>
<td>
B6.1.4.2.3 Use various strategies to solve proportional reasoning problems involving rates and scales

E.g. 1. Use diagrams to explain the concept of rate a ratio that compares two different quantities measured in different units; e.g. the ratio → cost : weight = 8:2 = 4:1. This ratio is the unit ratio and show the rate for selling a unit or 1kg of the meat.

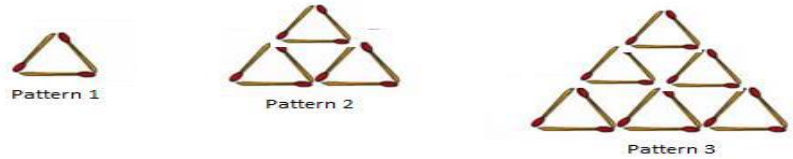
Two kilograms of meat cost ¢8. What is the cost of (i) 5kg (ii) 12kg and (iii) 25kg.
<table>
<tr><td>Meat (kg)</td><td>2</td><td>5</td><td>12</td><td>25</td></tr>
<tr><td>Cost (l)</td><td>8</td><td></td><td></td><td></td></tr>
</table>
E.g. 2. Work out rates and use them in solving problems. E.g. A litre of sachet water costs 40p. Find the cost of (i) $\frac{1}{2}$ litre (ii) 7 litres (iii) 9 litres

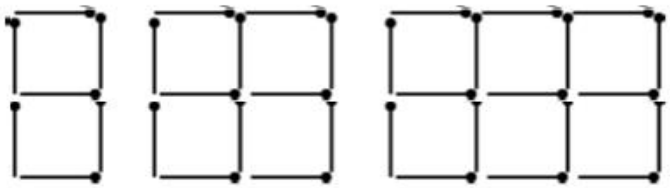
E.g. 3. Use diagrams to explain the concept of scale as a ratio that compares two different sizes – an object and its model; e.g. plan of a house or room. [Here is the plan of a bedroom. The scale is 1:100, which means that 1cm in the drawing represents 100 cm in the actual room. What is the actual length of (i) the room if it measures $4\frac{1}{2}$cm; (ii) the bed if it measures 1.8cm?]


E.g. 4. Work out scales and use them in solving problems; e.g. If 10cm on a map stands for 10km, what distances on the map stands for (i) 1km (ii) 7km (iii) 41km?
</td>
<td>Learners develop:
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

Strand 2: Algebra
Sub-Strand 1: Pattern and Relationships

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.2.1.1

Determine the pattern rule to make predictions about subsequent elements. CONT'D</td>
<td>
B6.2.1.1.4 Represent a given pattern visually to verify predictions
E.g. 1. Ask learners to examine the pattern made with match sticks below


E.g. 2. Ask learners to examine the pattern in the table below which shows the number of match sticks used in making a pattern of squares.
<table>
<tr><td>Pattern Number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>Match sticks in the perimeter</td><td>3</td><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Match sticks enclosed in the pattern</td><td>0</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Ask learners to use match sticks to make the patterns of triangles and complete the table. Guide learners to describe the relationship

</td>
<td>Learners develop:
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership;
Attention to Precision</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td></td><td>E.g. 3. Ask learners to write questions based on number or geometric patterns for their friends to find answers to; e.g. how many match sticks will be used for the 9th pattern of triangles? How many match sticks will be used for the 8th pattern of squares?

<table><tr><td>Number of triangles</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>Match sticks</td><td>7</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>Learners develop:
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership
Attention to Precision</td></tr>
</table>

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>CORE COMPETENCIES</th></tr>
<tr>
<td>B6.2.1.1
Determine the pattern rule to make predictions about subsequent elements. CONT'D</td>
<td>
B6.2.1.1.7 Write a rule in words and in algebra to represent a given pattern

E.g. 1. Ask learners to state the rules in words and in algebra to represent a given linear patterns
<table>
<tr><th>Term/Input</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>Rule for n in words</th><th>Rule for n in Algebra</th></tr>
<tr><td>Result/Output A</td><td>9</td><td>18</td><td>27</td><td></td><td></td><td>9 times n</td><td>9n</td></tr>
<tr><td>Result/Output B</td><td>0</td><td>4</td><td>8</td><td>12</td><td></td><td>4 times 1 less than n</td><td>4(n-1)</td></tr>
<tr><td>Result/Output C</td><td>4</td><td>7</td><td>10</td><td></td><td></td><td>1 more than 3 times n</td><td>1 +3n</td></tr>
<tr><td>Result/Output D</td><td>20</td><td>18</td><td>16</td><td></td><td></td><td>20 minus 2 times 1 less than n</td><td>20-2(n-1)</td></tr>
<tr><td>Result/Output E</td><td>15</td><td>19</td><td>23</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Result/Output F</td><td>12</td><td>17</td><td>22</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>100</td><td>85</td><td>70</td><td></td><td></td><td></td><td></td></tr>
</table>

B6.2.1.1.8 Describe the relationship in a given table or chart, using a mathematical expression

E.g.1. This table shows the pattern of cost of boxed lunches for students on a field trip. Ask learners to: (i) explain the pattern of how the cost of lunches changes as more students go on the trip; (ii) use the pattern to determine how many students went on the trip if the cost of lunches is GHC90.
<table>
<tr><td>Number of students</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>?</td></tr>
<tr><td>Cost of lunch in Cedis</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>90</td></tr>
</table>
E.g. 2. Ask learners to write questions based on the pattern for their friends to find answers
</td>
<td>Learners develop:
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

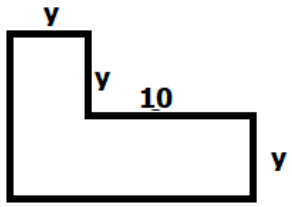
Sub-Strand 2: Algebraic Expressions

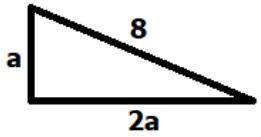
<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.2.2.1

Demonstrate understanding of algebraic expressions</td>
<td>B6.2.2.1.1

Demonstrate understanding of algebraic expressions as mathematical phrases that can contain letters which represent ordinary numbers and operators (like add, subtract, multiply, and divide).

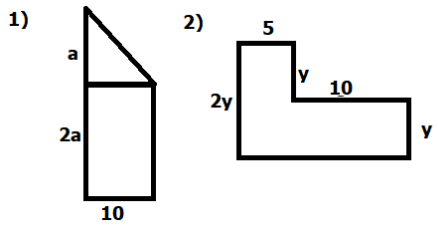
E.g. 1. Write algebraic expressions for word problems:
<table>
<tr><td>1) Sum of 8 and s</td><td>2) Take away 4 from m</td></tr>
<tr><td>3) 9 times the sum of 8 and q</td><td>4) Subtract 4 from 7 times g</td></tr>
<tr><td>5) One-sixth of n is added to the product of 9 and y</td><td>6) Three-fourths of the sum of c and 2</td></tr>
<tr><td>7) 8 divided by r</td><td>8) 8 times the sum of c and 7</td></tr>
</table>
E.g. 2. Write algebraic expressions for the perimeter of the following shapes:

1)
 

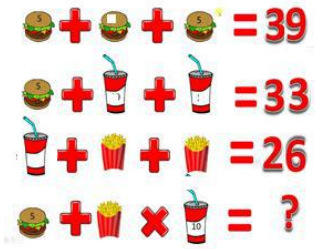
2)
 

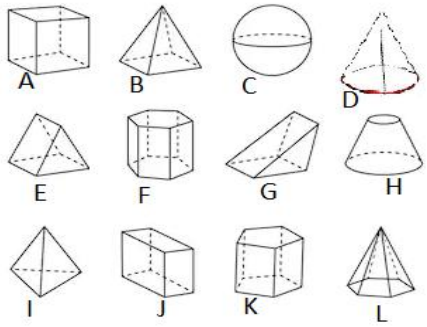
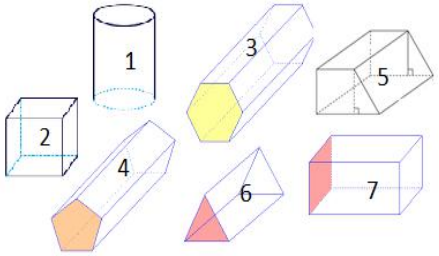
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

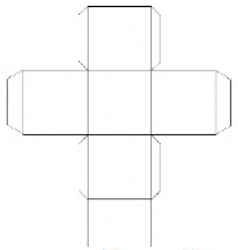
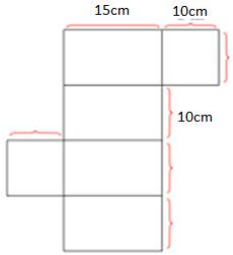
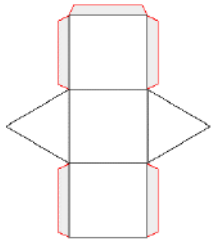
CONTENT STANDARD	INDICATORS AND EXEMPLARS	CORE COMPETENCIES
B6.2.2.1 **Demonstrate understanding of algebraic expressions.** **CONT'D**	E.g. 3. Write algebraic expressions for the area of the following shapes:  E.g. 4. Simplify basic algebraic expressions by grouping like terms. E.g. *1)* $5 + 4z - 1 + 2z$ *2)* $10s - 1 + 3 - 5s$ *3)* $-6t - 7 - 2 - 3t$ *4)* $2 - z - 1 + 4z$ *5)* $-9c + 7c + 8 - 3c$ *6)* $-5p + 3px - 7 - 5px + 10x$ E.g. 5. Substitute a value for an unknown into an expression and correctly calculate the answer. E.g. Find the values of these algebraic expressions using the values given in the following: 1) z + 7d use z = 7 and d = 4 2) 8k + d use k = 2 and d = 3 3) 7(5f - 3n) - 8 use n = 3 and f = 7 4) 7d - 2f + 9 use d = 2 and f = 5 5) -5f + 8b + 4 - 9 use f = 9 and b = 3 6) -6(2x - 7h) use h = 2 and x = 4 (i) (ii) If Sena used 13 match sticks in making next pattern squares, (i) write a mathematical sentence that represents the matchsticks. (ii) how may match sticks will she need to make the pattern with 10 squares? how may squares did she make if she used 64 match sticks?	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Sub-Strand 3: Variables and Equations

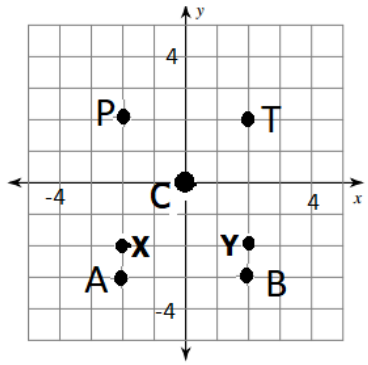
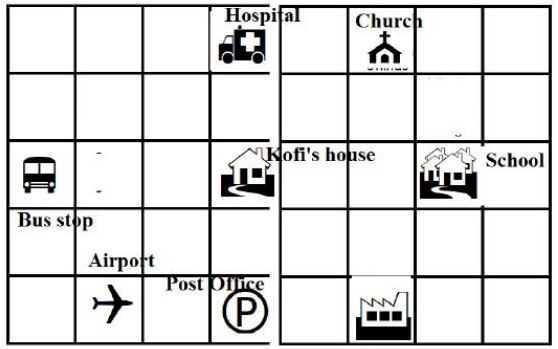
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.2.3.1 **Solve problems involving single-variable, one-step equations with whole number coefficients. CONT'D**	**B6.2.3.1.2 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically.** E.g. 1 Learners find the value of *x* in equations. 8. $4 + x = 11$ 9. $x - 3 = 10$ 10. $4x = 12$ 11. $24 = 3x$ **12.** $\frac{x}{2} = 5$	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision
B6.2.3.1 **Solve problems involving single-variable, one-step equations with whole number coefficients. CONT'D**	**B6.2.3.1.3 Create a problem for a given equation.** E.g. 1 Ask students to describe two different stories that the equation $4 - x = 9$ could represent. E.g. 2. Ask learners to solve puzzle in the figure, by solving the equations in each line; 	

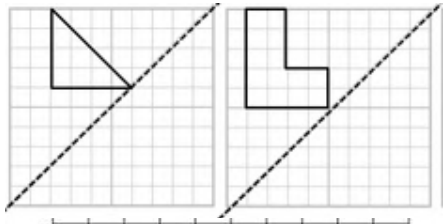
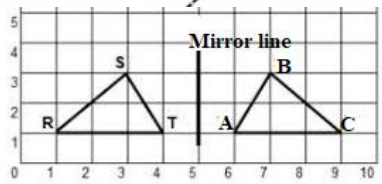
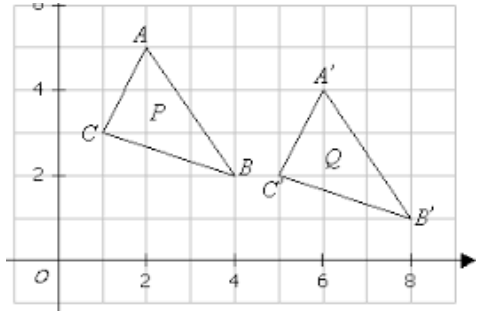
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.3.1.1 **Demonstrate understanding of prisms**	**B6.3.1.1.1 Identify examples of rectangular and triangular prisms in the classroom and the community** E.g. 1 Give learners models of 3-D shapes made from cardboard to examine and describe their cross sections (i.e. the surface or shape exposed by making a straight cut through something, especially at right angles to an axis). Ask learners to draw and complete the table for the description of the cross sections of the 3-D objects  E.g. 2 Ask learners to sort 3-D shapes with uniform cross sections; these are prisms and they are named after their uniform cross sections. Ask them to identify and name the following prisms  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

		Cross Section	
		Shape	Uniform/Not-Uniform
A.	Cube	square	uniform
B.	Pyramid	rectangle	not uniform
C.			
D.			
E.			
F.			

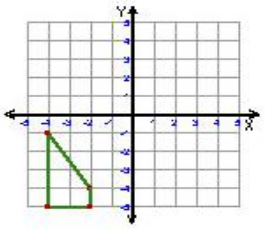
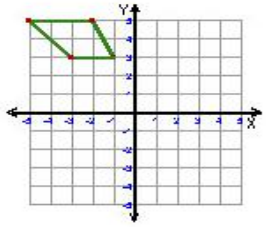
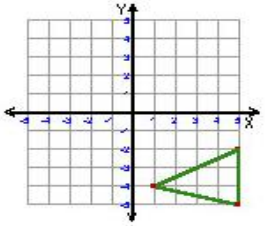
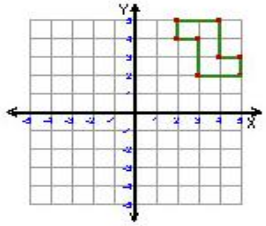
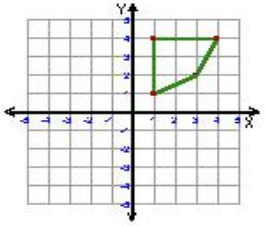
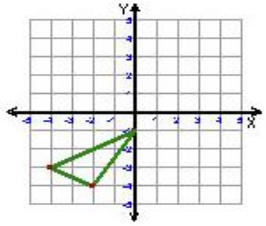
CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.3.1.1 **Demonstrate an understanding of prisms. CONT'D**	**B6.3.1.1.2 Construct rectangular and triangular prisms from their nets.** E.g. 1 Give the learners rectangular and triangular prisms made from cardboard by yourself (or cardboard packing cases from shops) to open and examine their nets  E.g. 2 Give the learners some cardboard or manila card to draw a net of a square prism whose cross section is a square with sides 10cm by 10cm and height 10cm. After drawing add tabs so that it can be folded so that the tabs are glued inside  E.g. 3 Give the learners some cardboard or manila card to draw a net of a rectangular prism whose cross section is a square with sides 10cm by 10cm and height 15cm. After drawing add tabs so that it can be folded so that the tabs are glued inside  E.g. 4 Give the learners some cardboard or manila card to draw a net of a triangular prism whose cross section is an equilateral triangle with side 10cm and height 10 cm. After drawing add tabs so that it can be folded so that the tabs are glued inside 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

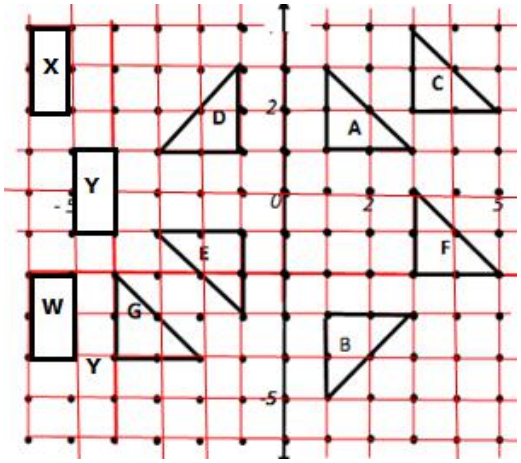
Sub-Strand 3: Geometric Reasoning

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.3.3.5 **Describe the position of objects in space using the cardinal points**	**B6.3.3.5.1 Tell the position and motion of objects in space using the cardinal points north-east, north-west, south-east and south-west** E.g. 1. Pupils describe the position and motion of objects from one point to another using the 4 main cardinal points and the half-betweens: e.g. The point **P** is north of the point **P** X but north-west of point C. Y is south of T but south-west of C.  E.g. 2. Pupils describe the position of places in a grid from a given location. E.g. the church is north-east from Kofi's house; the hospital is north-west from Kofi's house. E.g. 3. Ask learners to give directions from Kofi's house the various locations. E.g. Move 2 squares to the east and 2 squares to the north to get to the church.  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.3.3.5 **Perform a single transformation (i.e. reflection translation) on a 2D shape**	**B6.3.3.5.1 Perform and identify images of a single transformation (i.e. reflection) on 2D shapes in a plane** E.g. 1. Give learners photocopied worksheets with several incomplete 2D shapes to review the drawing of images of objects when reflected in line of symmetry which is outside the object  the E.g. 2. Review the properties of images under reflection, i.e. object and image sizes and shape, distances from mirror line and shape  **△RST is the image of △ABC in the reflection in the in the mirror line** E.g. 3 Use a grid or graph board to demonstrate the 'horizontal followed by vertical' movements called translation. E.g. In the figure is *'the movement which takes each point four units horizontally to the right and one unit vertically down' or 4 right, one down',* is a vector or translation vector (2→, 1↓) and written as $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$. Q is the image of P under the translation by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$  	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.3.3.5 **Perform a single transformation (i.e. reflection translation) on a 2D shape. CONT'D**	E.g. 4 Discuss the properties of images under translations, i.e. object and image sizes and shape E.g. 5 Give learners photocopied worksheets with several 2D shapes and ask them to draw images of each under the translation vector given **Note: Diagram is on the next page**	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

CONTENT STANDARD	INDICATORS AND EXEMPLARS	CORE COMPETENCIES
B6.3.3.5 **Perform a single transformation (i.e. reflection translation) on a 2D shape.** **CONT'D**	1) Translation: 3 right  2) Translation: 2 right and 3 down  3) Translation: 5 left  4) Translation: 4 left and 3 down  5) Translation: 4 left and 5 down  6) Translation: 3 right and 4 up 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

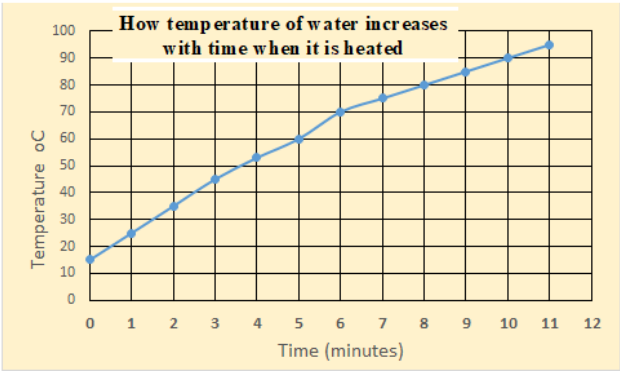
CONTENT STANDARD	INDICATORS AND EXEMPLARS	CORE COMPETENCIES
B6.3.3.5 **Perform a single transformation (i.e. reflection translation) on a 2D shape.** **CONT'D**	**B6.3.3.5.2 Identify images of a single transformation (i.e. reflection and translation) of a 2D shapes in a plane** E.g. 1. Ask learners to identify images of reflections of 2D shapes in the figure. Ask learners to study the shapes, identify their images. E.g. shape D is a reflection of shape E in the line y = 0 or x-axis; shape A is a reflection of shape B in the line $y = -1$; and Shape X is a reflection of shape W in the line $y = 0$ E.g. 2. Ask learners to identify images of translations of given 2D shapes in a given plane. Ask learners to study the shapes, identify their images and the translation vectors. E.g. shape F is a translation of shape A by the translation vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ (or 2 right, 3 three down); and Shape X is a translation of shape W by the translation vector $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$ (or 0 right, 6 up) 	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Strand 4: Data

Sub-strand 1: Data Collection, Organization, Presentation, Interpretation and Analysis

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.4.1.1
Create, label, and interpret line graphs to draw conclusions.
CONT'D</td>
<td>
B6.4.1.1.1 Draw a line graph by determining the common attributes (title, axes and intervals) and draw the graph for a given table of values
<table>
<tr><td>Time (minutes)</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>Temperature (°C)</td><td>15</td><td>25</td><td>35</td><td>45</td><td>53</td><td>60</td><td>70</td><td>75</td><td>80</td><td>85</td><td>90</td><td>95</td></tr>
</table>
E.g. 1. Give learners the data presented in tables and ask them to determine the common attributes (title, axes and intervals) and draw a line graph. Let them understand line graphs are used when we want to show how something changes over time in relation to something else

E.g. 2. Ask learners to draw a line graph by determining the common attributes (title, axes and intervals) and completing the drawing with title and labelled axes for the data below on how temperature of water increases with time when it is heated.

E.g. 3. Ask learners to study the line graph and answer questions based on them. For instance, after what time will the water temperature reach 70°C? What is the water temperature after 5 minutes?


</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

<table>
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<tr>
<td>B6.4.1.1

Create, label, and interpret line graphs to draw conclusions.

CONT'D</td>
<td>
B6.4.1.1.2 Determine whether a given set of data can be represented by a line graph (continuous data) or a series of points (discrete data) and explain why

E.g. 1. Through discussion, guide learners to understand the difference between discrete and continuous data. Ask them to sort the following tables of values into the two categories – those with discrete data and those with continuous data

[Discrete data take particular values, while continuous data are not restricted to separate values. Discrete data can take on only integer values whereas continuous data can take on any value. For instance the number of malaria patients treated by a hospital each year is discrete but your weight recorded of over a year is continuous]

(i) The number of match sticks Sena used in making a pattern of squares
<table>
<tr><td>Number of Squares (n)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Matchsticks (s)</td><td>4</td><td>7</td><td>10</td><td>13</td><td>16</td><td>19</td><td>22</td><td>25</td></tr>
</table>
(ii) Progress of plant's growth recorded by Kofi over a week
<table>
<tr><td>Days (d)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Height (h) (cm)</td><td>5</td><td>6.5</td><td>8</td><td>9.5</td><td>11</td><td>12.5</td><td>14</td><td>15.5</td></tr>
</table>
(iii) Number of people in the immediate family of P6 students in a school
<table>
<tr><td>Number of people in family</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>Number of students</td><td>0</td><td>4</td><td>9</td><td>11</td><td>6</td><td>5</td><td>3</td><td>3</td><td>1</td></tr>
</table>
(iv) Abu travelled on a bicycle to buy food, the table shows how far (in kilometres) he was away from the house.
<table>
<tr><td>Time (minutes)</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>Distance (km)</td><td>0</td><td>3</td><td>3.5</td><td>4</td><td>4</td><td>2</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
E.g. 2. Ask learners to write questions for their friends to read and interpret the tables
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
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<tr>
<td>B6.4.1.1

Create, label, and interpret line graphs to draw conclusions.

CONT'D</td>
<td>
B6.4.1.1.3 Apply understanding of how to create a line graph by using a given table of values (or set of data) to draw a line graph and answer questions based on them to interpret and draw conclusions

E.g. 1. Ask learners to draw more line graphs for given data values by determining the common attributes (title, axes and intervals) and pose, as well as answer, questions based on them to interpret the line graphs to draw conclusions

(i) Progress of plant's growth recorded by Kofi over a week
<table>
<tr><td>Days (d)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Height (h) (cm)</td><td>5</td><td>6.5</td><td>8</td><td>9.5</td><td>11</td><td>12.5</td><td>14</td><td>15.5</td></tr>
</table>
(ii) Cost of boxed lunches for students on a field trip.
<table>
<tr><td>Number of students</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Cost of lunch (¢)</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td></tr>
</table>
(iii) Abu travelled on a bicycle to buy food, the table shows how far (in kilometers) he was away from the house.
<table>
<tr><td>Time (minutes)</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>Distance (km)</td><td>0</td><td>3</td><td>3.5</td><td>4</td><td>4</td><td>2</td><td>0</td></tr>
</table>
(iv) Average monthly rainfall in mm recorded for two towns in a year
<table>
<tr><th></th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Kumasi</td><td>5</td><td>10</td><td>15</td><td>20</td><td>50</td><td>45</td><td>55</td><td>35</td><td>40</td><td>50</td><td>35</td><td>10</td></tr>
<tr><td>Oda</td><td>3</td><td>10</td><td>13</td><td>25</td><td>40</td><td>50</td><td>60</td><td>50</td><td>40</td><td>45</td><td>35</td><td>8</td></tr>
</table>
E.g. 3. Ask learners to study the line graph and answer questions based on them. For instance, after what time will the water temperature reach 70oC? What is the water temperature after 5 minutes?

E.g. 3. Ask learners to write questions for their friends to read and interpret the line graphs
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.4.1.2 **Select, justify, and use appropriate methods of collecting data, including questionnaires, interview, observation, experiments, databases, electronic media, etc.**	**B6.4.1.2.1 Select a method for collecting data to answer a given question and justify the choice** E.g. 1. Lead learners (in small groups) to discuss and write down how they would make decisions in the following situations, what facts they would take into account and how they would collect these 'facts'. (a) The type of drinks to buy for a class party (b) The make of sport shoes to buy for all P6 students (c) The make of school bag to buy for all P6 students (d) The number of desks in each classroom (e) How much money P6 students spend on bus fare to school every month? (f) To buy drinks for people in the immediate family of all P6 students at a party. (g) Buy a mobile phone from an online shop E.g. 2. Lead a discussion on the methods of data collection below and ask them to identify which method they will use to gather the facts for each situation (i.e. in E.g. 1. above) • questionnaires • interview • observation • experiments • databases • electronic media or internet	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.4.1.2

Select, justify, and use appropriate methods of collecting data, including questionnaires, interview, observation, experiments, databases, electronic media, etc.

CONT'D</td>
<td>B6.5.2.2 Design and administer a questionnaire for collecting data to answer a given question and record the results

E.g. 1. Guide learners (in small groups) to do surveys; as surveys are useful ways of getting them to interact, produce question forms and collect real information. Ask them to use Question Form below for collecting the class data

Class Survey Question Form
<table>
<tr><td>1)</td><td>Hello, What is your name? _____</td></tr>
<tr><td>2)</td><td>How old are you? _____</td></tr>
<tr><td>3)</td><td>What is your favourite school subject? _____</td></tr>
<tr><td>4)</td><td>What is your worst subject? _____</td></tr>
<tr><td>5)</td><td>What is the most important school subject? _____</td></tr>
<tr><td>6)</td><td>The size of your shoe? _____</td></tr>
<tr><td>7)</td><td>What is your favourite drink? _____</td></tr>
<tr><td>8)</td><td>How much do you spend on bus fare to school every day? _____</td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr><td>B6.4.1.2
Select, justify, and use appropriate methods of collecting data, including questionnaires, interviews, observations, experiments, databases, electronic media, etc.
CONT'D</td><td>E.g. 2. Guide learners in each group to use a table (like the one below) to organize the data obtained with the question form

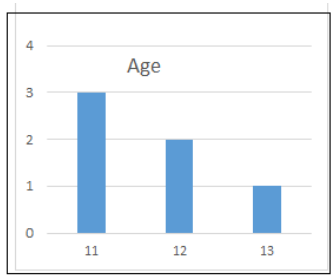
<table>
<tr><th>Name</th><th>Age</th><th>Favourite subject</th><th>Worst subject</th><th>Important subject</th><th>Shoe size</th><th>Favourite mineral</th><th>Daily bus fare (cedis)</th></tr>
<tr><td>Kojo</td><td>12</td><td>English</td><td>Maths</td><td>English</td><td>6</td><td>Coke</td><td>2</td></tr>
<tr><td>Aku</td><td>11</td><td>Science</td><td>P.E.</td><td>English</td><td>6</td><td>Coke</td><td>1</td></tr>
<tr><td>Ami</td><td>11</td><td>Maths</td><td>Art</td><td>Maths</td><td>6</td><td>Fanta</td><td>3</td></tr>
<tr><td>Abu</td><td>13</td><td>Maths</td><td>Art</td><td>Maths</td><td>7</td><td>Sprite</td><td>1</td></tr>
<tr><td>Ama</td><td>12</td><td>Science</td><td>Art</td><td>Maths</td><td>7</td><td>Fanta</td><td>2</td></tr>
<tr><td>Paapa</td><td>11</td><td>Maths</td><td>P.E.</td><td>Science</td><td>6</td><td>Fanta</td><td>1</td></tr>
</table></td><td>Learners develop:

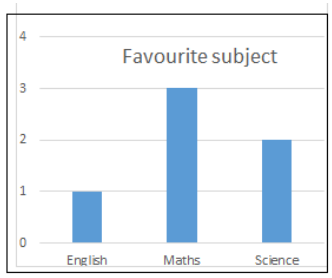
Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td></tr>
</table>

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.4.1.2 **Select, justify, and use appropriate methods of collecting data, including questionnaires, interview, observation, experiments, databases, electronic media, etc. CONT'D**	**B6.4.1.2.3 Design and administer a questionnaire for collecting data to answer given question(s), record the data, analyse and graph the results to solve problems** E.g. 1. Guide learners (in each small group) to use tallies and count the results obtained in the organized data table (see P6.5.2.2.3 above) to do a frequency table for each question. E.g. 2. Ask learners to study the results in the frequency tables to draw bar or line graphs and write their conclusion. E.g. 3. Ask learners to identify questions for a survey, do a question form and collect real data, organize the data obtained into frequency tables and graph it using bar or line graphs and the results to solve problems. They may do surveys on the following situations or issues: (a) The type of drinks to buy for a class party. (b) The make of sport shoes to buy for all P6 students. (c) The make of school bag to buy for all P6 students.	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

Age	Frequency
11	3
12	2
13	1
Total	6

Favourite subject	Frequency
English	1
Maths	3
Science	2
Total	6





Sub-Strand 2: Chance or Probability

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.4.2.2
Demonstrate an understanding of probability by identifying all possible outcomes of a probability experiment, determining the theoretical and experimental probability of outcomes in a probability experiment</td>
<td>
B6.4.2.2.1 List the possible outcomes of a probability experiment, such as tossing a coin, rolling a die with a given number of sides, spinning a spinner with a given number of sectors and determine the theoretical probability of an outcome occurring for a given probability experiment

E.g. 1. Through discussion guide learners to understand that theoretical probability is what we expect to happen, where experimental probability is what actually happens when we try it out. The both probabilities are calculated the same way, using the number of possible ways an outcome can occur divided by the total number of outcomes

E.g. 2. Guide learners (in each small group) to carry out the following experiments 100 times, use tallies to record their results, and transfer it to frequency tables: (i) tossing a coin 100 times; (ii) throwing a dice 100 times

Tossing a coin 100 times
<table>
<tr><th>Outcome</th><th>Number of throws</th></tr>
<tr><td>Head</td><td>42</td></tr>
<tr><td>Tail</td><td>58</td></tr>
</table>

Throwing a dice 100 times
<table>
<tr><th>Outcome</th><th>Number of throws</th></tr>
<tr><td>1</td><td>18</td></tr>
<tr><td>2</td><td>23</td></tr>
<tr><td>3</td><td>21</td></tr>
<tr><td>4</td><td>15</td></tr>
<tr><td>5</td><td>13</td></tr>
<tr><td>6</td><td>10</td></tr>
</table>
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.4.2.2 **Demonstrate an understanding of probability by identifying all possible outcomes of a probability experiment, determining the theoretical and experimental probability of outcomes in a probability experiment.** **CONT'D**	E.g. 3 Guide learners (in each small group) to use the results of the experiments above (recorded in the tables above) to work out the experimental probability and compare to the theoretical probability. E.g. the experiment probability of a head showing up out of the hundred outcomes is given by $\frac{42}{100}$ =0.42; and the theatrical probability is $\frac{50}{100}$ = 0.5. E.g. 4 Ask learners (in each small group) use the results of the experiments above (recorded in the tables above) to work out the experimental probability and compare to the theoretical probability of the following events (i.e. second table) i. rolling a 2 ii. rolling a number greater than 4 iii. rolling a 1 or a 3  E.g. 5 Put the results from all the small groups together ask the class to work out the experimental probabilities and compare to the theoretical probabilities of the events i. rolling a 2 ii. rolling a number greater than 4 iii. rolling a 1 or a 3  E.g. 6 Ask the learners their observations on whether or not the experimental probability is getting closer to the theoretical probability	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

<table>
<tr><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLARS</th><th>SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES</th></tr>
<tr>
<td>B6.4.2.2
Demonstrate an understanding of probability by identifying all possible outcomes of a probability experiment, determining the theoretical and experimental probability of outcomes in a probability experiment. CONT'D.</td>
<td>
B6.4.2.2.2 Predict the probability of a given outcome occurring for a given probability experiment by using theoretical probability

E.g. 1. Guide learners (in each small group) to carry out the following experiments 100 times, use tallies to record their results, and transfer it to frequency tables: (i) spinning a 5-sector spinner 100 times; (ii) spinning an 8-sector spinner 100 times

8-sector spinner
<table>
<tr><th>Outcome</th><th>Number of throws</th></tr>
<tr><td>1</td><td>15</td></tr>
<tr><td>2</td><td>16</td></tr>
<tr><td>3</td><td>15</td></tr>
<tr><td>4</td><td>15</td></tr>
<tr><td>5</td><td>13</td></tr>
<tr><td>6</td><td>10</td></tr>
<tr><td>7</td><td>7</td></tr>
<tr><td>8</td><td>9</td></tr>
</table>

5-sector spinner
<table>
<tr><th>Outcome</th><th>Number of throws</th></tr>
<tr><td>1</td><td>18</td></tr>
<tr><td>2</td><td>23</td></tr>
<tr><td>3</td><td>25</td></tr>
<tr><td>4</td><td>16</td></tr>
<tr><td>5</td><td>18</td></tr>
</table>

E.g. 2 Ask learners (in each small group) to use the results of the experiments above (recorded in the tables above) to work out the experimental probability and compare to the theoretical probability of the following events with each of the spinners (i.e. table above)
i. pinning a 2
ii. pinning a number greater than 4
iii. pinning a 1 or a 3
</td>
<td>Learners develop:

Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision</td>
</tr>
</table>

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B6.4.2.2 **Demonstrate an understanding of probability by identifying all possible outcomes of a probability experiment, determining the theoretical and experimental probability of outcomes in a probability experiment** **CONT'D**	**P6.4.2.2.3 Explain that the experimental probability approaches the theoretical probability of a particular outcome as the number of trials in an experiment increases** E.g. 1 Put the results from all the small groups for (a) spinning the 5-sector spinner, (b) spinning the 8-sector spinner, together. Ask the class to work out the experimental probabilities and compare to the theoretical probabilities of the events i. pinning a 2 ii. pinning a number greater than 4 iii. pinning a 1 or a 3 E.g. 2 Ask learners their observations as to whether or not the experimental probability is getting closer to the theoretical probability. Ask them to explain the difference between theoretical probability and experimental probability	Learners develop: Problem Solving Skills; Critical Thinking; Justification of Ideas; Collaborative Learning; Personal Development and Leadership Attention to Precision

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