Functional Mathematics

For Junior High Schools

Teacher's Guide

Basic
7

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MASTERMAN
PUBLICATIONS LTD

PREFACE

Functional Mathematics for Junior High Schools, Basic 7 to 9 is a set of three books that have been carefully developed for use by learners in Junior High Schools. These books conform, by all standards to the new Mathematics Curriculum developed by the National Council for Curriculum and Assessment (NaCCA) September, 2020 for the Common Core Programme.

The books are written to assist learners develop the core skills namely:
- Critical Thinking and Problem Solving Abilities.
- Collaborative and Team Work.
- Personal Development and Leadership.
- Attention to Precision.
- Creativity and Innovation.
- Cultural Identity and Global Citizenship.
- Digital Literacy

Signigicant features of the three set of books include:
- The use of simple language and expressions with enough practical activities.
- The use of locally available materials as Teaching and Learning Resources (TLRs).
- Adequate relevant illustrations for easy understanding of the various concepts.
- Enough examples and exercises which could be useful for School Based Assessment (S.B.A)

The guides fulfill the requirement considering the in-depth treatment of the strands in the Mathematics curriculum. In addition, the guides provide activities, diagnostic assessment, progressive assessment and aditional infomation that further enhance both the facilitator's and learner understanding.

It is our hope that the Teacher's Guide and the Learner's Books would meet the needs of both facilitators and learners and help them to translate classroom interactions into effective teaching and learning. Facilitators must always consult the Teacher's Guides when using the Learner's Books so as to conform to the requirement of the Mathematics curriculum.

GENERAL AIM

The general aim of the curriculum is to develop individuals to become mathematically literate. Good problem solvers, have the ability to think creatively and possess the confidence and competence to participate fully in the affairs of the Ghanaian society as a responsible local and global citizen.

RATIONALE

The rationale is that, mathematics forms an integral part of our everyday lives and that development is hinged on mathematics. To provide quality Mathematics education, the teacher must facilitate learning of mathematics in the classroom. This will provide foundations for discovery and understanding the world around us and lay the grounds for mathematics and mathematics-related studies at higher levels of education.

TEACHING PHILOSOPHY

The teaching philosophy is that 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 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

The learning philosophy is that mathematics learning is an active contextualised process of constructing knowledge based on learners' experiences rather than they acquiring new ones. Teachers serve as facilitators by providing the enabling environment that promote the construction of learners` own knowledge based on their previous experiences. Learners are information constructors who operate as researchers. This makes learning more relevant to the learners and leads to the development of critical thinkers and problem solvers.

LEARNING AND TEACHING APPROACHES

The core competencies describe the relevant global skills for learning that helps learners to develop in addition to arithmetic, writing, reading and creativity. The global skills for learning allow learners to become critical thinkers, problem-solvers, creators, good communicators, collaborators, digitally literate and culturally and globally sensitive citizens who are life-long learners with a keen interest in their personal development.

Pedagogical approaches; The common core programme (CCP) emphasises creative and inclusive pedagogies that are anchored on authentic and enquiring-based learning, collaborative and cooperative learning, differentiated learning and holistic learning as well as cross disciplinary learning.

SPECIFIC AIMS

The Mathematics curriculum is designed to help learners to achieve the following:

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 notations of Mathematics.
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.
8. develop abstract, logical and critical thinking abilities to reflect critically upon their work and the works of others.

The Teacher's Guide continues explanation on some of the concepts and methodologies to be used by the teacher in teaching the learners in the classroom. The teacher`s guide is made up of solved questions on strands and sub-strands. It also provides answers to exercises in the Learner's Book as well as appropriate references to the Learner's Book. The teacher is expected to follow carefully all the strands, sub-strands and examples in order to achieve the following core competencies.

CORE COMPETENCIES

1. **Critical thinking and Problem Solving**
   Developing learners' cognitive and reasoning abilities to enable them analyse issues and situations leading to the resolution of problems. This skill enables learners to draw on and discuss what they have learned and from their own experiences.

2. **Creativity and Innovation**
   This competency promotes in learners, entrepreneurial skills through their ability to think of new ways of solving problems and developing technologies for addressing problems at hand.

3. **Communication and Collaboration**
   This competency promotes in learners, skills in making use of language, symbols and texts to exchange information about themselves and their life experiences. Learners actively participate in sharing their ideas, engage in dialogue with others by listening to and learning from them in ways that respect and value the many perspectives of all persons involved.

4. **Cultural Identity and Global Citizenship**
   Developing learners who put country and service foremost through an understanding of what it means to be active citizens. This is by inculcating in them a strong sense of social and economic development awareness. Learners make use of the knowledge, skills and attitudes acquired to contribute effectively towards the socio-economic development of the country and on the global stage.

5. **Personal Development and Leadership**
   Improving self-awareness, skills, building and renewing self-esteem, identifying and developing talents, fulfilling dreams and aspirations, learning from the mistakes and failures of the past and developing other people or meeting other people's needs. It involves the recognition of values such as honesty and empathy, seeking the well-being of others, distinguishing between right and wrong, fostering perseverance, resilience and self-confidence and developing love for lifelong learning.

6. **Digital Literacy**
   Developing learners to discover, acquire, use and communicate through Information and Communication Technology (I.C.T) to support their learning and to make use of digital media responsibly.

Table of Content

STRAND 1: NUMBER

Sub-Strand 1: Number And Numeration Systems

Refer to Pages 1-40 of Learner's Book

Content Standard *(B7.1.1.1.)*
Demonstrate understanding and the use of place value for expressing quantities recorded as base ten numeral and rounding these numerals to given decimals places and significant figures..

Learning Expectations:
After studying this sub-strand, the learner will be able to;
  i.   model number quantities more than 1,000,000,000
  ii.   compare and order whole numbers more than 1,000,000,000 and represent the comparison using '>','<' or '='
  iii. round (off, up, down) whole numbers more than 1,000,000,000 to the nearest hundred thousand, tenthousands, thousands, hundreds and tens.
  iv.   round decimals to the nearest tenths, hundredth, thousandth
  v.   express decimal numerals to given significant figures and decimal places.

Keywords: *Refer to Learner's Book, Page 1*
Guide learners to use their dictionaries or the internet to find the contextual meaning of the keywords.

number quantities, greater than, less than, equal to, round off, round down, round up, place values, significant figures, decimals

Teaching and Learning Resources (TLRs): Multi-base block, paper made currency note, graph sheet, isometric grid paper.

Core Competencies:
  7.   Critical Thinking and Problem Solving
  8.   Communication and Collaboration
  9.   Personal Development
  10. Digital Literacy

Presentation of Lesson:
Introduce the lesson by revising learner's knowledge on place value and also counting on by 10's, 20's, 50's, 100's and 200's. Use the multi-base blocks to demonstrate how to write

numerals in expanded form. For example:

$$
\begin{aligned}
256{,}710 \quad &= \quad 2\ 0\ 0\ 0\ 0\ 0 \\
&+\ 5\ 0\ 0\ 0\ 0 \\
&+\ 6\ 0\ 0\ 0 \\
&+\ 7\ 0\ 0 \\
&+\ 1\ 0
\end{aligned}
$$

Guide learners to use the multi-base blocks to model other numbers, refer to Learner's Book 7, pages 2 to 4.

Using token (or paper-made currency) to model a given amount up to one billion: *Refer to Learner's Book, Page 7*

Teaching Strategy:
Ask learners to mention some of the currency notes that are used in everyday transactions. Examples are; $GH¢20.00, GH¢10.00, GH¢100.00, GH¢50.00, GH¢200.00$, etc. Now, use the paper-made currency token to model how many $GH¢50, GH¢100$ and $GH¢200$ notes will make 1,000,000.

Example: How many $GH¢50$ notes will give $GH¢500{,}000$?

> *Solution:*
> Divide the total amount (i.e. $GH¢500{,}000$) by the given note $GH¢50$.
> $= \dfrac{500\,000}{50} = 10{,}000$

This means that 10,000 notes of $GH¢50$ will make $GH¢500{,}000.00$. *Refer to page 7 of the Learner's Book 7.*

Diagnostic Assessment:
Let learners solve questions one to five of Exercise 3 at page 9 of LB individually and the rest of the questions in groups*.*

Compare and order whole numbers more than 1,000,000,000 using $>, <$ o*r* $=$.

When skip counting numbers, some numbers are mentioned and other numbers are skipped. By definition, skip counting is counting by adding the same number interval each time. A learner can skip count by any number other than 1. For instance, we can skip count by 1, 3, 5, 7 etc. We can also skip count by 10, 20, 30, 40, 50 etc.
   k.   Skip count forwards in 25s, 50s, 100, 150, 200, 250 etc.

l.   Skip count backwards.
       500, 475, 450, 425, 400 etc.
Refer to Example 1 of page 10 in Learner's Book 7.
Refer to Examples 2, 3, 4, 5 and 6 on pages 11 to 12 of Learner's Book 7.

Note that when skip counting forwards, you add a certain number and when counting backwards, you subtract a certain number.

Identify numbers which are for instance 500, 000 more than or less than a given 8-digit or 9-digit number.
Example: 1,295,800,000 is 500, 000 more than 1,295,300,000 and 1,295,300,000 is 500,000 less than 1,295,800,000.

Use phrases such as "is equal to" "is greater than" and "is less than" thus "=" '>' and '<' to compare any two numbers.
Examples: Compare the numbers below using '>' '<' or '='.
       i.   1, 300, 850, 700.................................1, 300, 850, 700
       ii.   5, 223, 487, 637................................ 5, 113, 487, 637
       iii. 2, 111, 300, 271............................... 3, 222, 100,300 etc.
Refer to pages 15 to 18 of Learner's Book 7.

Identify, read and write Numbers in given positions in a Number Chart.
Guide learners to locate a given number from the table either above, below, to the left or to the right. Refer to the table (Example 1) at page 18 of the Learner's Book 7.

Diagnostic Assessment

518, 600	2, 113, 500	4, 482, 400	363, 700
999, 600	1, 332, 100	2, 444, 600	5, 717, 500
3, 566, 900	2, 224, 500	815, 300	1, 293, 800

13.   Involve learners to identify and write the numbers below; from the table.
       i.   1, 332, 100
       ii. 5, 717, 500
       iii. 999, 600
2.   Let learners write the number to the left of
       i.   2, 224, 500
       ii. 4, 482, 400
       iii. 1, 293, 800
3.   Ask learners to write the numbers stated at question 1 above in words.

Round (off, up, down) whole numbers more than 1, 000, 000, 000 to the nearest Hundred-thousand, Ten-thousand, thousands. Hundreds and Tens.
Guide the learners to explain the following:

What is Rounding off?
Rounding off means, a number is made simpler by keeping its value intact but closer to the next number. It is done for whole numbers and for decimals at various places of hundreds, tens, tenths, etc. Rounding off is done to preserve the significant figures. Rounding off is a type of estimation. Estimation is used in everyday life and also in subjects like Mathematics, physics and Chemistry. Many physical quantities like the amount of money, distance covered, length measured, etc. are estimated by rounding off the actual number to the nearest possible whole number. *Refer to pages 20-21, example 1 of Learner's Book 7.*

Examples:
1. Round off 5, 828, 683 to the nearest ten.
   5,828,683 = 5, 828,680 to the nearest ten.

2. Round off 172, 836, 529 to the nearest hundred.
   172,836,529 = 172,836,500

Refer to pages 22 to 27 of Learner's Book and lead learners to work further examples on round off, round up and round down.

Express whole numbers to significant figures *(Refer to pages 27 and 29 of Learner's Book 7)*
The term significant figures refers to the number of important single digits from Zero (0) to nine (9) inclusive in the co-efficient of an expression in scientific notation. The number of significant figures in an expression indicates the confidence of precision with which an engineer or scientist states a quantity.

Guide learners through the given examples.

All the zeros that are on the right of the last non-zero digit, after the decimal point are significant. For example, 0.0079800 has five significant figures. The zeros before the non-zero digits are not significant. *Refer to page 36 Example 1.*

Express decimal numbers to a given number of decimal places.
All digits that appear after the decimal point are considered to give the number of decimal places for a given decimal number. For example, 0.02568 has five decimal places. 4.2577 has four decimal places. *Refer to page 39, example 1 in Learner's Book 7.*

It should be noted that, the first digit after the decimal point represents the tenths place. The second digit after the decimal point represents the hundredths place. Thus, 1.237 means that 1 represents the whole number part.

2 represents the tenths place $\frac{2}{10}$.

3 represents the hundredths place $\frac{3}{100}$ and

7 represents the thousandths place $\frac{7}{1000}$.

Sub-Strand 2: Number Operations

Refer to pages 42 - 90 of Learner's Book 7

Content Standard *(B7.1.2.1)*
Apply mental Mathematics strategies and number properties to solve problems.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
  i.   apply mental Mathematics strategies and number properties to solve problems;
  ii.   multiply and divide given numbers by powers of 10 including decimals and benchmark fractions;
  iii. apply mental Mathematics strategies to solve word problems.

Keywords: *Refer to Learner's Book 7 page 42*
Guide learners to explain each keyword.
benchmark, fraction, powers of 10, decimals, halving, doubling

Core Competencies
  1.   Communication and Collaboration.
  2.   Creativity and Innovation.
  3.   Critical thinking and Problem Solving.

Teaching and Learning Resources (TLRs): Multiplication charts

Lesson Presentation:

Involve learners to construct a multiplication table of numbers from 1 to 12.

×	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Refer to multiplication table at page 43 of Learner's Book 7.

Guide and supervise learners to use the multiplication table to do the multiplication of given numbers. For examples; $12 \times 8 = 96$, $9 \times 11 = 99$ etc. Also, $36 \div 9 = 4$.

Let learners locate 9 on the left side of the table and trace it to 36. Then trace from 36 upwards to obtain 4 as the answer. Hence, the multiplication table can also be used to perform division. *Refer to page 43 of Learner's Book 7.*

Apply the halving and doubling techniques to determine the product of two given numbers.

Guide learners to work out the following examples.

For example:

1. 28×5

    Half of 28   = 14
    Double of 5   = 10
    Hence, 28×5 = 140
    14×10 = 140

2. 105×4

   Double of 105 $\quad = 210$

   Half of 4 $\qquad = 2$

   Hence, $105 \times 4 = 420$

   $210 \times 2 \qquad = 420$

Apply the distributive property to determine the product of two given numbers.

For example:

1. 7×15

   $7 \times 15 = 7 \times (10 + 5)$

   $\qquad = 70 + 35$

   $\qquad = 105$

2. 520×12

   $(500 + 20) \times 12$

   $6000 \times 240 = 6240$

3. 6×18

   $6 \times (20 - 2)$

   $120 - 12 = 108$

Convert Bench Mark Fraction to decimals or Percentage and vice versa.

Lead and guide learners to express the following fractions as; (a). decimals and (b) percentage.

i. $\frac{3}{10}$ as decimal, $\frac{3}{10} = 0.3$

Thus, $10 \overline{)\, 30\,}^{\,0.3}$

$\qquad \underline{30}$

$\frac{3}{10}$ as percentage, $\frac{3}{10} \times 100 = 30\%$

ii. $\frac{1}{5}$ as a decimal

$\frac{1}{5} = 0.2 \qquad 5\overline{)\,10\,}^{\,0.2}$

$\qquad\qquad \underline{10}$

$\qquad\qquad\quad --$

$\frac{1}{5}$ as a percentage, $\frac{1}{5} \times 100 = 20\%$

Refer to pages 45 and 46 for worked examples in Learner's Book 7.

iii. Express 25% as a fraction.

$$25\% = \frac{25}{100} = \frac{1}{4}$$

iv.   Express 70% as a fraction

$$70\% = \frac{70}{100} = \frac{7}{10}$$

Involve the learners to solve exercises 1-3 on page 47 of the Learner's Book 7.

Multiply Decimals by power of 10
When multiplying a decimal by 10, we move the decimal point one place to the right. For each zero, the power of 10 moves the decimal point one place to the right.

For example: $29.27 \times 10 = 292.7$
$$9.9168 \times 100 = 991.68$$
$$23.743912 \times 1000 = 23743.912$$
Refer to page 48 of Learner's Book 7.

Dividing Decimals by powers of ten (10) or multiplying Decimal Numbers by Negative powers of ten (10).
When dividing a decimal by 10, we move the decimal point one place to the left. For each zero, the power of 10 moves the decimal point to the left.
For example: $9236.14 \div 10 = 923.614$
$$3.156 \div 100 = 0.03156$$
$$5.101 \div 1000 = 0.005101$$
Refer to pages 49 - 51 of Learner's Book 7.

B7.1.2.1.3 Apply mental Mathematics strategies to solve word problems
Example: Kwame and Rose shared GH₵410.00 between them. Kwame received GH₵100.00 more than Rose. How much money did Rose receive?

Solution
The two people Kwame and Rose are sharing GH₵410 of which Kwame received GH₵100.00 more than Rose. Subtract GH₵100.00 from GH₵410.00 and divide the rest into two.
$410 - 100 = 310$
$310 \div 2 = 155$
This means that Rose received GH₵155.00
Kwame received GH₵100.00 + GH₵155.00
$$= GH₵255.00$$
Refer to pages 54 - 56 of Learner's Book.

Use partitioning (or expanded form) and place value system to add and subtract whole and decimal numbers. *Refer to pages 56 and 57 of Learner's Book 7.*
Use the concept of place value to expand the numbers and add or subtract them according to their place value.

Example: Add 725 and 346

725	=	700	+	20	+	5		
+ 346	=	+ 300	+	40	+	6		
		1000	+	60	+	11		
		1000	+	60	+	10	+ 1	
		1000	+	70	+	1		
10,071	=	1000	+	70	+	1		

Subtracting up to four–digit Numbers
Example: Subtract 258 from 473

Solution
473 – 258

473	=	400	+	70	+	3
	=	+ 400	+	60	+	13
– 258	=	200	+	50	+	8
215	=	200	+	10	+	5

Guide learners to perform the subtraction. Refer to page 58 of Learner's Book 7.

Addition of Decimals
Example 1: Add 13. 4 and 42.9

Solution:

$$13.4 \; = \; 10 \; + \; 3 \; + \; \frac{4}{10}$$

$$\textbf{+}\ 42.9 \; = \; 40 \; + \; 2 \; + \; \frac{9}{10}$$

$$50 \; + \; 5 \; + \; \frac{13}{10}$$

$$55 \; + \; 1 \; + \; \frac{3}{10}$$

$$56\frac{3}{10} \; + \; 70 \; + \; 1$$

10

$$= \quad 56.3$$
$$\therefore 13.4 + 42.\,9 = 56.3$$

Refer to pages 59 of Learner's Book 7.

Using Lattice Method
1. Lead learners to draw the lattice table
2. Demonstrate how to use the lattice method to do muliplication..

Example: Find the product of 56 and 342.

Therefore, 342 × 56 = 19152.

Refer to pages 62 and 63 of Learner's Book 7.

Diagnostic Assessment
Find 426 × 125 using the lattice method

Solution

Therefore, $426 \times 126 = 53250$

11

Distributive Property Method
Guide learners to use the distributive property method to multiply numbers. *Refer to page 64 of Learner's Book 7.*

Example: Multiply 325 by 15

> *Solution:*
> $325 \times 15 = 325(10 + 5)$
> $= (325 \times 10) + (325 \times 5)$
> $= 3250 + 1625$
> $= 4875$

Also, lead learners to use the vertical place value method to multiply numbers.
For example 315 x 12

$$
\begin{array}{r}
3\,1\,5 \\
\times\,1\,2 \\
\hline
6\,3\,0 \\
3\,1\,5 \\
\hline
3\,7\,8\,0
\end{array}
$$

Hence, 315 x 12 = 3780

Investigate and determine basic division facts including divisibility test.
Involve and guide learners to do the following:
4. How to determine that a number is divisible by 2.
5. Explain the following steps to learners so that they can use them to determine that, a number is divisible by 2.
    i. Find the numbers which are divisible by 2.
    ii. The number must be an even number such as 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 etc.
    iii. The last digit (that is those at the ones place) should be divisible by 2. For instance; 2, 4, 6, 8, etc.
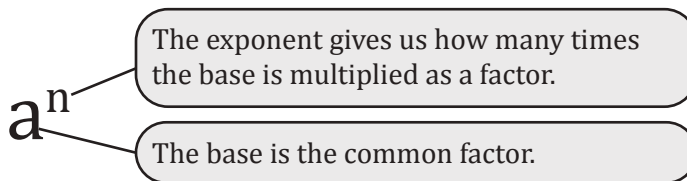   iv. When the last digit is zero (0). For instance; 10, 20, 30, 270, etc.

Refer to pages 65-67 of Learner's Book 7. For the divisibilities of 3, 4, 5, 6, 7, 9, 10 and 11 refer to pages 65 to 67 of Learner's Book 7.

Meaning of repeated factors using counting objects such as bottle tops or bundle of sticks.
Guide the learners to model repeated factors using counters or bottle tops.
Refer to pages 72 to 75 of Learner's Book 7.

Power of a factor *(Refer to page 77 of Learner's Book 7).*

$$a^n$$

The exponent gives us how many times the base is multiplied as a factor.

The base is the common factor.

1. $2^3 = 2 \times 2 \times 2$
2. $5 \times 5 \times 5 \times 5 = 5^4$
3. $3 \times 3 \times 3 \times 2 \times 2 \times 2 = 3^3 \times 2^3$

The power of a number is the number of times a factor of a number is used in multiplication. Two or more numbers that are multiplied together to form a product are called factors.

Features of power of a number *(Refer to page 78 of Learner's Book 7).*

Assessment
Let learners write the power of the following factors:
1. $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$
2. $25 \times 25 \times 25 \times 25 \times 25$
3. $16 \times 16 \times 16 \times 16 \times 16$
4. $121 \times 121 \times 121 \times 121 \times 121$
5. $324 \times 324 \times 324 \times 324$

Express a given number as a product of a given number or numbers as well as in the form of a power or two such as product of powers. *Refer to Learner's Book page 79*

Lesson Presentation
Revise learner's knowledge about what prime numbers are. Prime numbers are numbers that have exactly two factors, that is, the number itself and one. Examples are 2, 3, 5, 11, 17, etc.

Let learners provide the prime factors of certain given numbers using the concept of factor tree. For instance: 24
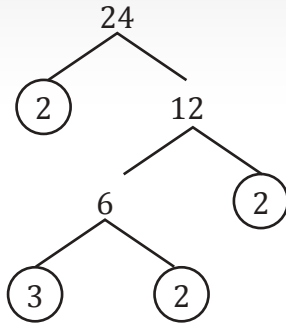
Hence, the prime factors of $24 = 2 \times 2 \times 2 \times 3$
$$= 2^3 \times 3$$

Also, we can divide 24 by the prime factor (product) until we obtain 1.

2	24
2	12
2	6
3	3
	1

Hence, $24 = 2 \times 2 \times 2 \times 3$
$$= 2^3 \times 3$$

Show that the value of any natural number with zero as its exponent or index is 1 and use it to solve problems. *Refer to page 81 of Learner's Book 7.*

Note that for any fraction in the form $\frac{x}{x} = 1$. Hence, $\frac{3}{3} = 1$, $\frac{40}{40} = 1$, $\frac{23}{23} = 1$, etc.

We can also say that, using the law of indices .
$$\frac{x^1}{x^1} = x^{1-1} = x^0 = 1$$

Therefore, any value or expression with zero as its exponent or index is 1.

Examples; $(3x + 3)^0 = 1$, $2^0 = 1$, $\left(\frac{y}{2}\right)^0 = 1$, $(2 \times y)^0 = 1$

Expand a given number using product of prime factors. *(Refer to pages 83 - 85 of Learner's Book 7.)*
Learners are expected to use the concept of factor tree to enable them to write the prime factors (prime products) of given numbers.

Diagnostic Assessment

Write the prime factor product of the following numbers: 20, 16, 32 and 81.
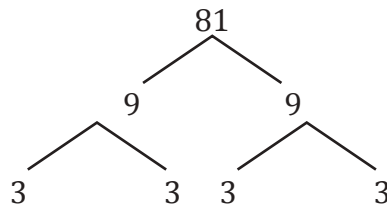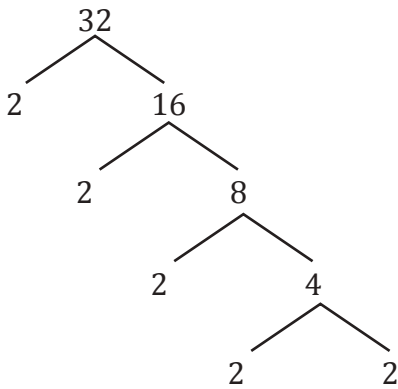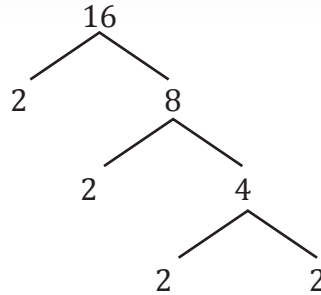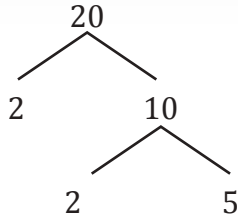
$$20 = 2 \times 2 \times 5$$
$$= 2^2 \times 5$$

$$16 = 2 \times 2 \times 2 \times 2$$
$$= 2^4$$

$$32 = 2 \times 2 \times 2 \times 2 \times 2$$
$$= 2^5$$

$$81 = 3 \times 3 \times 3 \times 3$$
$$= 3^4$$

Finding the Highest Common Factor (HCF) using Prime Factorisation.

Lesson Presentation *Refer to pages 85 - 88 of Learner's Book 7.*

Guide learners to understand the following steps for finding the highest common factor of given numbers.

1. Find the product prime factors of the given numbers.
2. Find the product of the prime factors.

3. Compare the products of the prime factors of the respective numbers.
4. Choose the prime factors with the least (smallest) idex or exponents and having the same base.

Example: Find the H.C.F of 36 and 72

Solution

$$36 = 2 \times 2 \times 3 \text{ x } 3$$
$$= 2^2 \times 3^2$$
$$72 = 2 \text{ x } 2 \text{ x } 2 \text{ x } 3 \text{ x } 3$$
$$= 2^3 \times 3^2$$
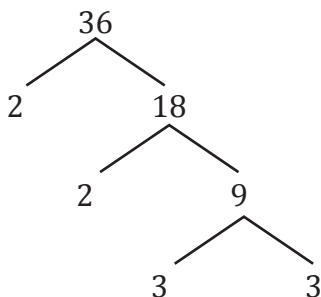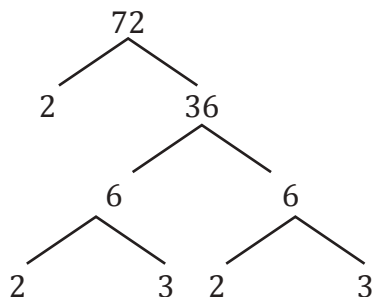
By comparison

$$36 = 2^2 \times 3^2$$
$$72 = 2^3 \times 3^2$$

$2^2 \times 3^2$ are the common prime factors with the least exponents or index having the same base.

Therefore, H.C.F $= 2^2 \times 3^2$
$$= 4 \times 9 = 36$$

Involve learners to practice solving other examples and exercises given in the Learner's Book.

Least Common Multiple (L.C.M). *Refer to pages 89-90 of Learner's Book 7.*
It should be noted that for L. C. M, you have to *select the prime factors that have the highest exponents or index after comparing* the respective prime products of the factors. For example, Find the L. C. M. of 24 and 18.

Solution:
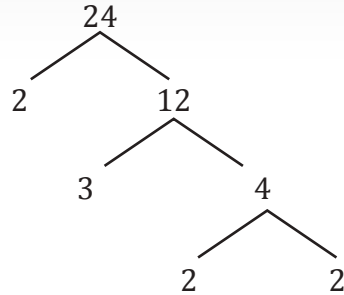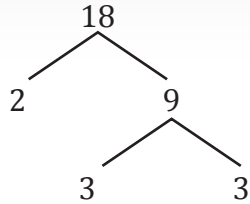
$$18 = 2 \times 3 \times 3$$
$$= 2 \times 3^2$$
$$24 = 2 \text{ x } 2 \text{ x } 2 \text{ x } 3$$
$$= 2^3 \times 3$$

By comparing, we have

$$18 = 2 \times 3^2$$
$$24 = 2^3 \times 3$$

The common prime factor that have the highest exponents or index are;
3^2 and 2^3
$3^2 \times 2^3$
9×8
72

Hence, the LCM of 18 and 24 is 72.

Sub-Strand 3: Fractions, Decimals And Percentages

Refer to pages 92-156 of Learner's Book

Content Standard *(B7.1.3.1)*
Simplify, compare and order a mixture of positive fractions.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
  i.   simplify, compare and order a mixture of positive functions (that is, common fractions, percent and decimal) by changing all fractions to equivalent fractions, decimals and percentages;
  ii. determine the percentages and decimals of benchmark fractions and use them to compare quantities.

Keywords: *Refer to page 92 of Learner's Book*
simplify, percentages, decimals, common fraction

Core Competencies
  5.   Critical Thinking and Problem Solving.
  6.   Creativity and Innovation.
  7.   Communication and Collaboration.
  8.   Digital Literacy.
Teaching and Learning Resources (TLRs): paper cut-outs, ruler, different colours

WHAT IS A FRACTION? *(Refer to page 92 of Learner's Book)*
Begin the lesson by revising learners' previous knowledge on fractions. Ask them to mention some food items they share with their friends or siblings and also state how the sharing is done.

Assist learners to explain that a fraction is an equal part of a whole. A fraction can be expressed as a quotient, have a numerator and a denominator. It can be expressed as a decimal and also as a percentage. For instance, the fraction $\left(\frac{2}{3}\right)$ has the numerator as 2 and the denominator as 3.

A fraction such as $\frac{1}{2}$ has 0.5 as its decimal form and 50% as the percentage form.

How to simplify fractions
To simplify fractions, requires that we use a number (common factor) to divide both the numerator and the denominator and write it in simplest or lowest form as possible.
For instance, simplify $\frac{20}{120}$

$$\frac{20^1}{120_6} = \frac{1}{6}$$

This means that we are reducing (not breaking) the fraction into its lowest form.

Types of fractions *(Refer to page 93 of Learner's Book.)*
The four different types of fractions are

    i.   Common fractions: e.g $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}$, etc.

    ii.   Proper fractions: e.g $\frac{5}{7}, \frac{3}{5}, \frac{11}{29}$, etc.

    iii.   Improper fractions: e.g $\frac{7}{3}, \frac{13}{2}, \frac{35}{20}$, etc.

    iv.   Mixed fractions: e.g $3\frac{1}{2}, 11\frac{2}{5}, 10\frac{1}{3}$, etc.

As part of the lesson presentation, guide learners in an activity whereby the learners draw certain shapes e.g square, rectangle and rhombus, divide them into equal fractional parts and shade them.

For example: Shade $\frac{1}{6}$ of the square below
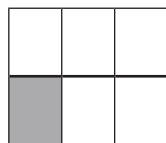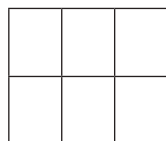
$\frac{1}{6}$.

Equivalent Fractions *(Refer to pages 95-96 of Learner's Book.)*
Equivalent fractions are fractions that have different numerators and denominators but are equal to the same value.

For instance, $\frac{2}{4}$ and $\frac{3}{6}$ are equivalent fractions because both are equal to $\frac{1}{2}$.

A fraction is part of a whole. Equivalent fractions represent the same portion of the whole. We can form equivalent fractions by multiplying the numerator and the denominator by the same factor. For example, forming an equivalent fraction to $\frac{2}{3}$, we multiply both numerator and denominator by 3.

Thus, $\frac{2 \times 3}{3 \times 3} = \frac{6}{9}$. Hence, $\frac{6}{9}$ is equivalent to $\frac{2}{3}$.
Again, we can multiply both numerator and denominator by 2.

Thus, $\frac{2 \times 2}{3 \times 2} = \frac{4}{6}$. Hence, $\frac{4}{6}$ is equivalent to $\frac{2}{3}$.

Note also that , we can form an equivalent fraction by adding the numerator to itself and the denominator to itself. For example,
$$\frac{2}{3} = \frac{2+2}{3+3} = \frac{4}{6}, \frac{10}{15} = \frac{10+10}{15+15} = \frac{20}{30}$$

Give more examples to learners to practice as you guide them.

Express fractions in its lowest form. *(Refer to page 97 of Learner's Book 7.)*
Ensure that fractions are expressed in the lowest or simplest form. To do this, we must use a common factor (a number) that can divide both numerator and denominator. For instance, $\frac{24}{36}$. Both numerator and denominator can be divided by 12.
$$\frac{24^2}{36_3} = \frac{2}{3}$$
Therefore, $\frac{24}{36} = \frac{2}{3}$ in its simplest form.

Guide learners to solve further examples.

Convert improper fraction to mixed fraction or mixed number. *(Refer to page 98 of Learner's Book 7.)*
Guide learners to give examples of improper fractions $\frac{5}{2}, \frac{10}{7}, \frac{24}{5}, \frac{15}{3}$,etc. are examples of improper fractions. The numerator is greater than the denominator. To convert an improper fraction to a mixed fraction, we must divide the numerator by the denominator and write the remainder as the new numerator divided by the denominator.

$$\frac{5}{2} = 2\frac{1}{2}, \frac{10}{7} = 1\frac{3}{7}, \frac{24}{5} = 4\frac{4}{5}, \text{ etc.}$$

Convert a mixed fraction to improper fraction *(Refer to page 98 of the Learner's Book).*
A mixed fraction or a mixed number is made up of a whole number part and a proper fraction part. A mixed fraction in the form $x\frac{a}{b}$ means that x is the whole number part and $\frac{a}{b}$ is the proper fraction part with 'a' as numerator and 'b' as denominator.

To convert $x \neq \frac{a}{b}$ to an improper fraction,

$$x\frac{a}{b} = \frac{x \times b + a}{b} = \frac{xb + a}{b}$$

Refer to page 98 of Learner's Book 7.

$$x\frac{a}{b} = x + \frac{a}{b} = \frac{xb + a}{b}$$

Examples:

9. Convert $3\frac{2}{3}$ to an improper fraction.

$$3\frac{2}{3} = 3 + \frac{2}{3}$$
$$= \frac{3 \times 3 + 2}{3} = \frac{9 + z}{3} = \frac{11}{3}$$

10. Convert $5\frac{4}{7}$ to an improper fraction.

$$5\frac{4}{7} = 5 + \frac{4}{7}$$
$$= \frac{5 \times 7 + 4}{7} = \frac{35 + 4}{7} = \frac{39}{7}$$

Let learners solve questions in the exercises given in the Learner's Book pages 99-100.

Diagnostic Assessment

Let learners answer the exercise questions individually and present their solutions. Let them explain how they arrive at their answers. *Refer to pages 101-102 of Learner's Book 7.*

Let learners put themselves in groups of five to answer the questions in the exercise at page 107-108 of Learner's Book 7.

Fraction cards *(Refer to pages 92-95 of Learner's Book 7).*
Prepare cards with fractions and display them for learners to identify them
Involve learners to practise how to solve the questions and the examples provided.

Give other examples for learners to do.

Compare fractions using '>', '<' or '=' *(Refer to pages 105 - 108 of Learner's Book)*
To compare fractions using either greater than '>', less than '<' or equal to '='. Guide learners to use the following strategies to help them compare fractions:

i. Using the Least Common Multiple (LCM) strategy

Example $\frac{1}{3}$ and $\frac{2}{5}$

Solution $\frac{5 \; and \; 6}{15}$

$\frac{5}{15}$ and $\frac{6}{15}$

Hence, by comparing the numerators of $\frac{5}{15}$ and $\frac{6}{15}$, having a common denominator, we can say that $\frac{5}{15}$ is less than $\frac{6}{15}$.

Hence, $\frac{1}{3} < \frac{2}{5}$ or $\frac{2}{5} > \frac{1}{3}$.

ii.   Using the percentage strategy to compare $\frac{1}{3}$ and $\frac{2}{5}$ we have to multiply each fraction by 100% and then compare. Thus,

$\frac{1}{3} \times 100\% = \frac{100\%}{3} = 33\frac{1}{3}\%$

$\frac{2}{5} \times 100\% = \frac{200\%}{5} = 40\%$

It can be realised that 40% is greater than $33\frac{1}{3}\%$.
Hence, $\frac{2}{5} > \frac{1}{3}$ or $\frac{1}{3} < \frac{2}{5}$

Let learners solve the exercises on pages 107-108 of the Learner's Book 7 in groups and discuss their answers.

Compare and order benchmarks fractions (i.e. common fractions, percentage and decimal fractions) up to thousandths
Refer to pages 108-112 of the Learner's Book 7.

Guide learners to work through the examples at these pages and also answer the exercises.

Note that using the Least Common Multiple (LCM) strategy and the percentage strategy are explored earlier at page 37 of this guide and can be most approppriate and useful.

Converting decimals to fractions *(Refer to page 112 - 114 of Learner's Book 7)*
Teaching Method:
To convert a given decimal to a fraction,
   i.   Write down the decimal and divide it by 1.
   ii.   Multiply both numerator and denominator by 10 for each number or digit after the decimal point. For instance, if there are two digits after the decimal point, then you

have to multiply by 100. If there are three digits after the decimal point, you have to multiply by 1000, and so on.

iii. Lastly, simplify the resulting fraction to obtain the required fraction.

Example: Convert 0.45 to a fraction.

Solution: $\frac{0.45}{1}$

Since we have two digits after the decimal point, we will multiply both the numerator and denominator by 100.

$\frac{0.45 \times 100}{1 \times 100} = \frac{45}{100}$

We now simplify $\frac{45}{100}$ to the simplest form. Hence, $\frac{45}{100} = \frac{9}{20}$

Diagnostic Assessment

Write the following decimals in the form $\frac{a}{b}$ where b≠0 and state which one is greater.

i. 0.45 and 0.55
ii. 0.99 and 0.976
iii. 0.025 and 0.056

Refer to pages 113-114 of Learner's Book 7.

Let learners solve these questions individually. Give further examples for learners to do.

Ordering decimal numerals from the least to the greatest. *(Refer to pages 114-118 of Learner's Book 7)*

Involve learners to solve the questions at these pages.

Addition and subtraction of two or three unlike and mixed fractions. *(Refer to pages 118-120 of Learner's Book 7)*

Addition of mixed fractions

Lesson Presentation:

Revise learners' previous knowledge on addition of whole numbers and simple common fractions. For instance,

k. $3 + 5 = 8$

l. $\frac{3}{5} + \frac{2}{5} = \frac{5}{5} = 1$

m. $\frac{1}{3} + \frac{2}{5} = \frac{5+6}{15} = \frac{11}{15}$

23

After revising their Previous Knowledge (P.K), guide learners to explain the following steps to perform addition of mixed fractions:

1. Add the whole numbers or convert each fraction to an improper fraction.
2. Find the equivalent fraction of each of the fractions so that the fractions involved will have a common denominator as their Least Common Multiple (LCM).
3. Add the fractions.
4. Rewrite the answer by adding the whole number part to the fraction part.

Example: Add the following:

$$2\frac{3}{5} + 1\frac{7}{10}$$

Solution: $2\frac{3}{5} + 1\frac{7}{10}$

$$= 2 + 1 + \left(\frac{3}{5} + \frac{7}{10}\right)$$

$$= 3 + \left(\frac{3 \times 2}{5 \times 2} + \frac{7}{10}\right)$$

$$= 3 + \left(\frac{6}{10} + \frac{7}{10}\right)$$

$$= 3 + \frac{13}{10}$$

$$= 3 + 1 + \frac{3}{10}$$

$$= 4 + \frac{3}{10}$$

$$= 4\frac{3}{10}$$

Lead and guide learners through these examples and exercises. Let learners do the exercises in groups and discuss among themselves how they are able to arrive at their answers.

Alternative Method

$$2\frac{3}{5} + 1\frac{7}{10}$$

Solution: We have to convert the mixed fractions to improper fractions.

$$2\frac{3}{5} + 1\frac{7}{10}$$

$$\frac{13}{5} + \frac{17}{10}$$

Now, use the LCM strategy

$$\frac{26 + 17}{10} = \frac{43}{10} = 4\frac{3}{10}$$

Explain the two procedures carefully to learners so that they can adopt their choice.

Subtraction of Mixed Fractions *(Refer to pages 120-124 of Learner's Book 7)*
1. Convert each mixed fraction to improper fraction.
2. Find the Least Common Multiple (LCM) using equivalent fraction strategy or otherwise.
3. Subtract the numerators and write the result out of one of the denominators.
4. Write your answer in proper fraction form or in a mixed number form.

Solve word problems involving Addition or Subtraction of fractions *(Refer to page 125 of the Learner's Book)*

Lesson Presentation
To lead and guide learners to be able to solve word problems involving addition or subtraction, the following steps should be followed:
1. Read the problem carefully.
2. Identify and list or note the facts.
3. Figure out exactly what the problem is asking for.
4. Eliminate excess or irrelevant information.
5. Pay attention to sub-strands of measurement.
6. Think carefully about what it is asking you to do.
7. Think about the strategy or method you need.
8. Solve it.
9. Simplify the result if necessary.
10. Check whether your solution makes sense.
Involve learners in solving all the examples at pages 125-128 of Learner's Book 7.

Put learners in groups to answer the questions or exercise and discuss their solutions in class. *Refer to page 129 of the Learner's Book.*

Multiplication of a Common Fraction by a Whole Number. *(Refer to pages 130-131 of Learner's Book 7)*
Let learners follow the steps as a guide to solve multiplication of a common fraction by a whole number.
1. Write the whole number as a fraction with a denominator.
2. Multiply the numerators.
3. Multiply the denominators.
4. Simplify the result if necessary.

Examples:

1. Simplify $10 \times \frac{2}{5}$

   Solution: $\frac{10}{1} \times \frac{2}{5} = \frac{20}{5} = 4$

2. Simplify $12 \times \frac{9}{4}$

   Solution: $\frac{\cancel{12}^{\,3}}{1} \times \frac{9}{\cancel{4}_{1}} = 27$

Multiplication of a whole number by a mixed number

Guide learners to follow the steps below:

1. Convert the mixed numbers into an improper fraction.
2. Multiply the numerators of the fraction and multiply the denominators of the fraction.
3. Simplify the result, if ncessary.

Multiplication of mixed numbers

Lead and guide learners through the following steps:

1. Convert the mixed numbers into improper fractions.
2. Multiply the two fractions by multiplying the numerators and the denominators.
3. Simplify the results if necessary.

Examples:

1. Simplify $2\frac{1}{3} \times 3\frac{2}{5}$

   Solution: $2\frac{1}{3} \times 3\frac{2}{5}$

   $$\frac{7}{3} \times \frac{17}{5} = \frac{7 \times 17}{3 \times 5}$$
   $$= \frac{119}{15}$$
   $$= 7\frac{14}{15}$$

2. Simplify $1\frac{2}{9} \times 4\frac{3}{5}$

   Solution: $1\frac{2}{9} \times 4\frac{3}{5}$

   $$\frac{11}{9} \times \frac{23}{5} = \frac{253}{45}$$
   $$= 5\frac{28}{45}$$

3. Simplify $1\frac{1}{3} \times 2\frac{2}{7}$

   Solution: $1\frac{1}{3} \times 2\frac{2}{7}$

   $$\frac{4}{3} \times \frac{16}{7} = \frac{64}{21}$$
   $$= 3\frac{1}{21}$$

Ensure that learners convert improper fraction result to a mixed fraction as a final answer.

Finding percentage value of given numbers *(Refer to pages 131-132 of Learner's Book 7)*
Guide learners through the following steps:
1. Express the percentage value as a common fraction.
2. Multiply the equivalent form of the percentage by the given number.
3. Express the figures in the simplest form where necessary.
4. Multiply numerator by numerator and denominator by denominator.
5. Simplify the result if necessary.

Examples:
1. Simplify 20% of 40

   Solution: 20% of 40
   $$\frac{2\cancel{0}}{1\cancel{0}\cancel{0}} \times \frac{4\cancel{0}}{1} = 2 \times 4$$
   $$= 8$$

2. Find 0.5% 0f 150

   Solution: 0.5% 0f 150

   $$\frac{0.5}{100} \times \frac{15\cancel{0}}{1} = \frac{\frac{5}{10}}{10} \times \frac{15}{1}$$
   $$= \frac{\cancel{5}^{1}}{10_{2}} \times \frac{1}{10} \times \frac{15}{1}$$
   $$= \frac{\cancel{15}^{3}}{20_{4}} = \frac{3}{4}$$

NB: You may apply the strategy of using long division in your teaching.

Multiplying fraction by fraction *(Refer to pages 133-135 of Learner's Book)*

Lesson presntation

Let learners be in groups of five. Give them few examples of questions on multiplication of a whole number by a fraction. This to serve as a revision of their previous knowledge.
Refer to page 130 of Learner's Book 7.

Now, lead and guide the learners through the following steps to enable them to multiply fraction by a fraction.
1. Change all mixed fractions into improper fractions.
2. Check whether a number can divide each numerator and denominator, either vertically or diagonally.
3. Multiply numerators and denominators .
4. Simplify the results and leave the final answer in either proper fraction or in a mixed fraction form.

Diagnostic Assessment

1. Simplify $\frac{2}{3} \times \frac{5}{8}$

   Solution: $\frac{2}{3} \times \frac{5}{8}$ (diagonally 2 can divide 8)

   $$= \frac{1}{3} \times \frac{5}{4} \text{ (multiply numerators and denominators respectively)}$$

   $$= \frac{5}{12}$$

2. Simplify $\frac{7}{8} \times \frac{2}{21}$

   Solution: $\frac{7^1}{8_4} \times \frac{2^1}{21_3}$

   $$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

Involve learners to solve the questions under the exercise. *Refer to pages 134-135 of the Learner's Book.*

Find a fraction of a given quantity *(Refer to pages 135-138 of the Learner's Book 7)*
To multiply a quantity by a fraction is similar to multiplying a whole number by a fraction.

Example: Simplify the following:

1. $\dfrac{3}{8}$ of GH¢184.00.

$$\dfrac{3}{_1 8} \times \dfrac{\cancel{184}^{23}}{1} = 3 \times 23$$

$$= GH¢69.00$$

2. $\dfrac{3}{4}$ of 1hr 30 mins.

$$\dfrac{3}{4} \times (1\text{hr} + 30\text{mins})$$

$$\dfrac{3}{4} \times (60\text{mins} + 30\text{mins})$$

[NB: Change big units of measurement to smaller units of measurement in all questions]

$$\dfrac{3}{\cancel{4}_2} \times \dfrac{\cancel{90}^{45}\text{mins}}{1} = \dfrac{3 \times 45}{2}$$
$$= \dfrac{135}{2}$$
$$= 67.5\text{mins}$$

Revise the following unit conversions with the learners:

10mm = 1cm	1000mg = 1g	60s = 1min	100Gp = GH¢1.00
100cm = 1m	1000g = 1kg	60mins = 1 hour	
1000mm = 1m	1000kg = 1 tonne	3600s = 1 hour	
1000m = 1km			

Word problems involving multiplying quantity by fraction. *(Refer to pages 138-140 of Learner's Book 7)*

Lesson presentation:
Lead and guide learners through the following steps in solving word problems.

Diagnostic Assessment
A class of 48 childern went to the zoo. If $\dfrac{3}{8}$ of them were girls, how many boys went to the zoo?

Solution: Total number in class = 48

$\frac{3}{8}$ of the class were girls.

If the total fraction is 1, and $\frac{3}{8}$ were girls,

then the fraction of boys $= = 1 - \frac{3}{8} = \frac{5}{8}$

This means that $\frac{5}{8}$ of the class were boys

$$\frac{5}{8_1} \times \frac{48^6}{1} = 5 \times 6$$
$$= 30$$

Hence, 30 children of the class were boys
$48 - 30 = 18$ and 18 of the class were girls.

Interpreting Data *(Refer to pages 141-144 of Learner's Book 7)*
The data is normally represented on a pie chart containing sectors of values. The amount or value at each sector is calculated with respect to $360°$ and the toal amount/value involved in the data. The value that is obtained from the calculation for each sector represents that sector in question.

Interpreting data from pie chart/graph *(Refer to page 152-153 of Learner's Book 7)*

Sub-Strand 4: Ratios and Proportion

Refer to Pages157-191 of Learner's Book

Content Standard *(B7.1.4.1)*
Demonstrate an understanding of the concept of ratios and its relationship to fractions.

> **Learning Expectations:**
> After studying this sub-strand, the learner will be able to;
> i. explain the concept of ratio
> ii. describe proportion
> iii. express two quantities as a ratio
> iv. describe the concept of rate
> v. apply equivalent ratio concept to solve problems involving proportions
> vi. find the percentage of a quantity as a rate per 100.

Refer to page 157 Learner's Book 7.

Keywords: Assist learners to find the contextual meaning of the keywords.
ratio, proportion, rate, equivalent ratio

Core Competencies
3. Critical Thinking and Problem Solving.
4. Communication and Collaboration.
5. Digital Literacy

Ratio *(Refer to page 158 Learner's Book 7)*
A ratio tells the raltionship between two quantities. We can say that, we find the ratio of one number to another.

In this lesson, ratio will be used to determine how many times one number or amount is as large as another, or what part a number or amount is as another, or what number or amount a part is of another.

Proportion
Proportion is a mathematical comparison between two numbers. If two sets of given numbers are increasing or decreasing in the same ratio, then the ratios are said to be directly proportional to each other.

Proportion in general is referred to as a part of share or number considered in comparative relation to a whole. When two ratios are equivalent, they are proportional.

Lesson Presentation:
Most ratio and proportion related problems or questions are in word problem form. In view of this, you have to revise how to solve word problems with learners. *Refer to page 125 Learner's Book 7.*

Diagnostic Assessment
Kwesi visited an art supply store. He bought 8 bottles of blue ink and 5 bottles of red ink. What is the ratio of the number of bottles of blue ink to the number of red ink?

     Solution:

Number of bottles of blue ink	= 8
Number of bottles of red ink	= 5
Ratio of bottles of blue ink to bottles of red ink	= 8 : 5

     Since these numbers cannot be simplified further, the ratio is 8 : 5.
Refer to pages 158-160 Learner's Book 7.

Put learners in groups to practice solving other examples as they present and discuss their solutions with their colleagues.

Express two quantities as a ratio *(Refer to page 162 Learner's Book 7)*
Ratio is a means of comparing two quantities. It can be expressed as a fraction. A ratio, **m** is to **n** can be wtitten as $\frac{m}{n}$ or m : n.

Example:
Express the statement below in the right ratio form.
     Every 1.8kg of flour for 80g of sugar.

     Note: Ensure that you covert the units of measurement to the smaller unit.

     1000g = 1kg
     x = 1.8kg
     [The idea of proportion, if more, less divide or if less, more divide can be applied in explanation to learners]

     x = 1.8×1000
     x = 1800g
     1.8kg : 80g
     1800g : 80g

1800 : 80
[Note that quantities that are expressed in ratio have no unit]

45 : 2
Hence, the ratio of flour to sugar is 45 : 2.

Describe quantities using ratio language/expression *(Refer to pages 163-164 of Learner's Book 7)*

Diagnostic Assessment
Describe the quantities in the statements below in two ratio expressions/languages.

The ratio of Richard's age to his father's age is 1:3. If Richard is 12 years old, the father is 36 years old.

> *Solution:*
> Richard is one-third the age of his father.
> Richard's father is thrice as old as his son

Sub-strand Ratio *(Refer to page 165 of Learner's Book 7)*
A sub-strand ratio is a ratio that compares the first quantity to one sub-strand of the second quantity. The two quantities being compared have different sub-strands. Hence, the second quantity in the comparison is always 1.

Write a given ratio as sub-strand rate $\frac{p}{q}$, q ≠ 0.

Diagnostic Assessment
Refer to Example 1, page 165 of Learner's Book 7. Also, refer to Examples 2, 3, 4 and 5 at pages 166-167 of Learner's Book 7.

STRAND 2: ALGEBRA

Sub-Strand 1: Patterns and Relations

Refer to pages 192-214 of Learner's Book 7

Content Standard *(B7.2.1.1)*
Derive the rule for a set of points of a relation, draw a table of values to graph the relation in number plane.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
    i.   extend a given relation presented with and without symbolic materials and explain how each element differs from the preceding one;
    ii.   describe the rule for a given relation using mathematical language such as one more, one less, etc.;
    iii. identify relation of rule in pattern or mapping presented numerically or symbollically and predict subsequent elements;
    iv. locate points on the number plane, draw a table of values of a given relation, draw graphs for a given relation and use them to solve problems.

Keywords: *Refer to page 192 of Learner's Book 7*
Assit learners to find the contextual meaning of the keywords. *one more than, pattern, relation, symbolic, graph, number plane, one less than*

Core Competencies
    6.   Creativity and Innovation
    7.   Critical Thinking and Problem Smolving.
    8.   Communication and Collaboration.

Lesson Presentation
Give a brief explanation about what Algebra as a branch of Mathematics is. *Refer to Learner's Book 7, pages 192-193.*

Application of Algebra
One application of algebra in real world is ranking in search engines. Another area of application is decision tree induction, testing software code in software engineering, graphics, facial recognition, prediction, etc.

What is Algebra? *(Refer to Page 192 of Learner's Book)*

Algebra is a part of Mathematics that deals with symbols and the standards for controlling those symbols. The more basic parts of algebra are called elementary algebra and the more abstract types are called Abstract Algebra or modern algebra.

Extend a given relation presented with and without symbolic materials and explain how each element differs from preceeding ones.

Refer to page 193 of Learner's Book 7 and involve learners to carefully study and discuss the patterns.

Algebraic Expressions
Consider the marbles below:
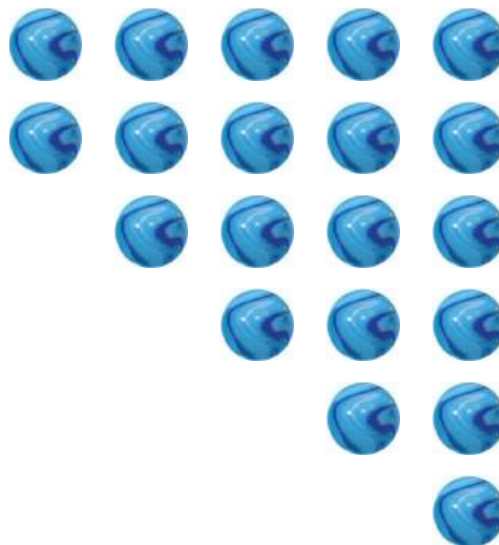
Study the pattern in column by column basis.
- The first column has 2 marbles.
- The second column has 3 marbles.
- The third column has 4 marbles.
- The fourth column has 5 marbles.
- The fifth column has 6 marbles.

It can be seen that the next column will have a column of +1 marbles; hence, the number of marbles will be n + 1 going forward.
You may put learners in groups to do the exercises given at pages 194-196 of the Learner's

Book. Let learners discuss among themselves and supervise them.

Relations

In Mathematics, a relation defines the association between sets of values of ordered pairs. The set of elements in the first set are called domain. The domain is related to a set of elements in another set called the co-domain.

For example, refer to page 197 of Learner's Book 7.

Domain   Co-domain

$$\begin{array}{ll}
1 & \rightarrow 1 \\
3 & \rightarrow 9 \\
5 & \rightarrow 25 \\
7 & \rightarrow 49
\end{array}$$

X   Y
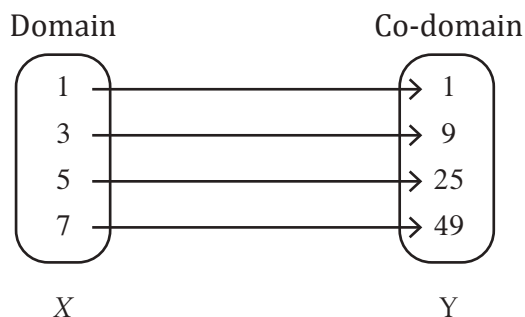
A relation between two sets is a collection of ordered pairs containing one object from each set. If the object x is from the first set, and the object y is from the second set, then the objects are said to be related if the ordered pair. *(x, y)* is in the relation.

From the diagram above, the ordered pairs can be written as {(1, 1), (3, 9), (5, 25), (7, 49)}.

This set of ordered pairs give us a set of input *(x)* values, i.e. domain and output *(y)* values, i.e. co-domain.

Describe a given relation

The diagram can be described by carefully studying the relationship between the elements in the domain and the elements in the co-domain. It can be seen that the elements in the co-domain are squares of the elements in the domain; i.e. square of 1 is 1, square of 3 is 9, square of 5 is 25 and the square of 7 is 49.

Example
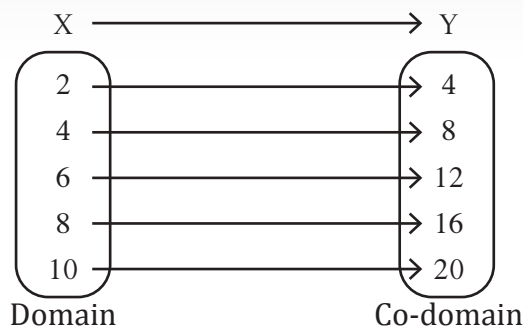
Describe the relation in the diagram above.

It can be observed that each element in the co-domain is double its corresponding element in the domain. We can also say that each element or member of the co-domain is twice each element or member in the domain.
Refer to page 197 of Learner's Book 7.

Let learners do the given exercises in their books and discuss their solutions with the class.
Refer to pages 198-199 of Learner's Book 7.

Describe the rule for a relation using Mathematical language *(Refer to pages 200-202 of Learner's Book 7)*
To describe the rule for a given relation using mathematical language, you can guide learners to carefully study what kind of association is between the elements in one set connecting corresponding element in the other set.

Example: Involve learners to study the table below:

No. of teachers	1	2	3	4	5	6
No. of learners	15	30	45	60	75	90

What can you say about the elements involving the number of teachers and the number of learners?

To do this, you have to ask learners certain probing questions that will enable them to describe the rule for the relation. Give those "Certain probling questions".
  1. From the table, it can be seen that 15 is being added on to each value involving the 'number of learners'.

2. It can be seen also that each element involving 'No. of teachers' has been multiplied by 15 to give the result for the 'No. of learners'.

Now, let, 'No. of teachers' be x and 'No. of learners' be y.

We can say that $y \rightarrow 15x$ or $15x \rightarrow y$

Hence, the rule for the above relation is $y \rightarrow 15x$. *Refer to pages 199-200 of Learner's Book 7.*

Determine the rule for a given numerical pattern *(Refer to pages 203-205 of Learner's Book 7)*

Observe the pattern and determine the rule.

x	0	1	2	3	4
	↓	↓	↓	↓	↓
y	0	1	4	9	16
		(1×1)	(2×2)	(3×3)	(4×4)

To determine the rule, you have to carefully study the elements in the co-domain. Find out whether they have a constant interval. If so, how is the constant varying? Is it by addition? Is it by multiplication by a certain number? Or is it by division? Or is it by exponentiation?

From the above observation, you will be able to formulate the rule. This strategy is referred to as 'by inspection'.

The above mapping shows that each y-value is the square of each corresponding x-value. That is, each x-value multiplied by itself is equal to the corresponding y-value. Hence, the rule is $y \rightarrow x^2$. This can be written as $y = x^2$.

Refer to pages 198-199 of Learner's Book 7.

Another strategy that we can use is by using formular to determine the rule. In this case, find out whether the relation or mapping is linear, quadratic or exponential.

1. If it is linear, we use the formular $y = ax + b$; where $'a'$ and $'b'$ are constants to be determined, and x and y are values or elements in the domain and co-domain respectively.

2. If the mapping is quadratic, we use the formula $y = ax^2 + bx + c$ where $'a'$, $'b'$ and $'c'$ are constants, $a \neq 0$.

3. If the mapping is exponential, we use the formula $y = ab^x, a \neq 0$, b is a positive real number and $b \neq 1$ and the base b is a constant. x and y are the variables for the domain and co-domain respectively.

1. If the difference among the y-values (co-domain) is constant, or if there is a common differnce, then we can use the linear formular $y = ax + b$ to determine the rule.
2. If there is an unequal difference among the y-values, then we can use the quadratic formula, i.e. $y = ax^2 + bx + c$.
3. If there is a common ratio among the y-variables, then we can use the exponential formular, $y = ab^x$.

Diagnostic Assessment

x	0	1	2	3	4	5
↓	↓	↓	↓	↓	↓	↓
y	1	2	3	4	5	6

Determine the rule for the mapping above.

Solution
By inspection, we can say that the rule is $y = x + 1$.

Using the formula
From observation, there is a constant difference of 1 among the y-values. This is a linear mapping $y = ax + b$. To find the constant 'a' we use the concept of finding the gradient of a line $a = \frac{2-1}{1-0} = 1$.
Therfore $a = 1$

To find 'b' we substitute $a = 1$ and any coordidates $(x, y) = (0, 1)$ into the formula.
$$y = ax + b$$
$$1 = 1(0) + b$$
$$1 = 0 + b$$
$$b = 1$$

Hence, the rule is $y = x + 1$

Refer to pages 204-205 of Learner's Book 7 and involve learners to answer the questions.

Determine the value of a variable when given the rule. *(Refer to pages 206-207 of Learner's Book 7)*

Example: Find the value of x if the output of the mapping rule $x : x \longrightarrow 2x + 3$ is 3.

   Solution:

$$2x + 3 = 3$$
$$2x = 3 - 3$$
$$2x = 0$$
$$x = \frac{0}{2}$$
$$x = 0$$

Lead and guide leaners to solve questions on pages 206-207 of Learner's Book 7.

Locate points on the number plane, draw a table of values of a given relation, draw graphs for given relations and use them to solve problems.
Refer to pages 208-214 of Learner's Book 7.

NB: When guiding learners to draw graphs, ensure that the following are well done:
1. Labeling of the axes (ie x-axis and y-axis)
2. Using the correct points.
3. Plotting correct points (coordinates)
4. Labelling the vertices clearly where necessary.

Sub-Strand 2: Algebraic Expressions

Refer to pages 219-245 of Learner' Book 7)

Content Standard *(B7.2.2.1)*
Simplify algebraic expressions involving the four basic operations.

Learning Expectations:
After studying this sub-strand, the learner will be able to;
  i.   simplify algebraic expressions involving the four basic operations.
  ii.   substitute values to evaluate algebraic expressions.
  iii. create and write simple algebraic expressions using simple logic to translate set of instructions into algebraic expressions.
  iv.   perform addition and subtraction of algebraic expressions with rational co-efficient.

Keywords *(Refer to page 219 of Learner's Book 7)*
Assit learners to find the contextual meaning of the keywords.
variable, coefficient, algebraic expression, substitution

Core Competencies
  5.   Communication and Collaboration.
  6.   Critical Thinking and Problem Solving.
  7.   Digital Literacy

Lesson Presentation:
Lead and guide learners to understand the English statements, and phrases and their symbolic interpretation in Mathematics. *Refer to the table at page 220 of Learner's Book 7.*

Let learners practice these expressions in groups and individually. Ensure that they are very conversant with them.
Guide learners to study the examples on pages 220-223 of Learner's Book 7.

Diagnostic Assessment
  1.   When 8 times a certain number is subtracted from 5 and the result is multiplied by 2. Write an algebraic expression for the statement.

       Solution:
       Let the unknown number be x

8 times a certain number $\Rightarrow$ 8x
Subtracted from 5 $\Rightarrow$ 8x is subtracted from 5 thus, (5 – 8x)
and multiplied by 2 $\Rightarrow$ (5 – 8x)2
Hence, we have: 2(5 – 8x) as the required algebraic expression.

2. 2 more than 5 times a certain number. Write an algebraic expression for this statement.

   Solution:
   2 more $\Rightarrow$ 2+
   a certain number $\Rightarrow x$
   5 times a certain number $\Rightarrow 5x$
   Hence the required expression is $(2 + 5x)$

Applications *(Refer to pages 224-226 of Learner's Book 7)*
Guide learners to solve the problems. Let learners participate in the class discussions. Put them in groups to explain and discuss among themselves.

Perform addition and subtraction of algebraic expressions with rational coefficient.
Refer to pages 227-230 of Learner's Book 7.
Involve learners to simplify algebraic expressions having rational coefficients.

Diagnostic Assessment
Simplify;
  1. $4x + 3x + x$

     Solution
     $4x + 3x + x$
     $= (4 + 3 + 1)x$
     $= 8x$

  2. $3abc + 4abc + 2abc$

     Solution
     $3abc + 4abc + 2abc$
     $= (3 + 4 + 2)abc$
     $= 9abc$

Subtraction of Algebraic Expressions
Refer to page 229 of Learner's Book 7.
Involve learners to solve examples.

Diagnostic Assessment
1. Subtract $3x$ from $7x$

    $3x$ from $7x = 7x - 3x$
    $= 4x$
2. Simplify $10y - 2y - 3y$

    $(10y - 2y) - 3y = 8y - 3y$
    $= 5y$
3. Simplify $20m - 15m - 2m$

    $20m - 15m - 2m = 15m - 2m$
    $= 13m$

Let learners write the above expressions in word problem form.
For example:
1. Three times a certain number (x) is subtracted from seven times the same number.
    (ie 7x – 3x)
2. Reduce ten times a certain number by twice the number and thrice the same number
    (ie 10y – 2y – 3y).

Adding and subtracting algebraic expression *(Refer to pages 229-230 of Learner's Book 7)*
Simplify the algebraic expression $5x + 4 - 9y + 3x + 2y - 7$

> *Solution*
> $5x + 4 - 9y + 3x + 2y - 7$
> you have to regroup like terms(common terms)
> $5x + 3x - 9y + 2y + 4 - 7$
> $8x - 7y - 3$

Lead and guide learners to solve similar problems at pages 229-232 of the Learner's Book 7.

Multiplication and division of Algebraic Expressions with rational coefficient.
Refer to pages 233-235 of Learner's Book 7
Involve learners in solving the algebraic expressions at pages 233-236 of Learner's Book 7.

Diagnostic Assessment

1. Simplify $4p \times 8p$

    Solution
    $4p \times 8p$
    $4 \times 8 \times p \times p$
    $32p^2$

2. Simplify $3xy \times 4y$

    Solution
    $3xy \times 4y$
    $3 \times 4 \times xy \times y$
    $12xy^2$

Division of Algebraic Expressions *(Refer to pages 235-236 of Learner's Book 7)*

Simplify $\dfrac{12x^2y}{8xy}$

    Solution

$$\frac{\cancel{12}^3 x^2 y}{\cancel{8}_2 xy} = \frac{3x \times \cancel{x} \times \cancel{y}}{2\cancel{x} \times \cancel{y}}$$
$$= \frac{3}{2}x$$

Guide learners to do the division.
Let leaners divide the coefficients by using a common factor that can divide both numerator and denominator. Ensure that you divide common variables and leave the answer in simplified form.

Substituting Values to Evaluate Algebraic Expressions. *(Refer to pages 238-243 Learner's Book 7)*
When substituting, a variable is replaced by a given number for that variable.
After substitution, the numbers are evaluated and simplified to obtain the required answer.

Diagnostic Assessment
Lead and guide learners to evaluate the following:

Examples:

1. Given that x = 2, y = 4, p = 3 and z = 1, evaluate $3xy \times 5y$

    $3xy \times 5y$
    $3(2)(4) \times 5(4)$
    24×20
    480

2. Evaluate $4p \times 8z^2$

    $4p \times 8z^2$
    $4(3) \times 8(-1)^2$
    $12 \times 8 = 96$

Refer to pages 238-243 of *Learner's Book 7*. Put learners in groups to solve the questions of the page numbers stated and let them discuss among themselves.
Give guidance to learners as they work.

Sub-Strand 3: Variables And Equations

Refer to pages 246-266 of Learner's Book 7

Content Standard *(B7.2.3.1)*
Demonstrate an understanding of linear equations of the form $x + a = b$.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
  i.   write linear equations based on mathematical statements;
  ii.   model problems as a linear equation and solve them concretely, pictorially and symbolically;
  iii. solve linear equations in one variable.

Keywords: *(Refer to page 246 of the Learner's Book 7)*
Guide learners to find the contextual meaning of the keywords.*equations, linear, integer, translate, variable*

Core Competencies
  3.   Communication and Collaboration.
  4.   Critical Thinking and Problem Solving.

Lesson Presentation
What are Variables? (Refer to pages 246-250 of the Learner's Book 7)
Variables are unknown values contained in equations. Normally the unknown (variable) in a given statement must be declared before a decision can be made on whether the statement or equation is true or false.

What are equations?
Equations are mathematical statements that use 'equal to' sign between the algebraic expressions. Equations involve the use of the symbol '='. Also, equation is defined as a numerical statement which includes an equal to sign.

Explain these terms to learners very well.

Diagnostic Assessment

Think of a number, double it and subtract 7. The result is 41. What was the original number?

> *Solution:*
> Using the flag diagram,
> Let the unknown number be x
> Double the number $\quad \Rightarrow 2x$
> Subtract 7 $\qquad\qquad \Rightarrow 2x - 7$
> The result is 41 $\qquad \Rightarrow\, = 41$
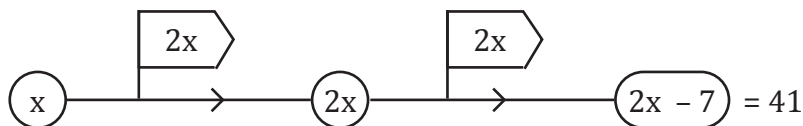
Therefore, we have $2x - 7 = 14$

To solve this linear equation using the flag diagram, we have to move in the opposite direction and do the inverse of the operation. Note that, in the opposite direction, -7 is $+7$, so we add $+7$ to 41 (i.e $41 + 7 = 48$).

We now divide 48 by 2. That is the double will change from multiplication to division. (i.e opposite of multiplication is division) $48 \div 2 = 24$. This means that the original number is 24.
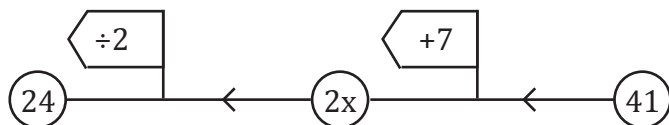
How to translate word problems to linear equations
Lesson presentation

Revise learners' previous knowledge by reviewing the steps enumerated at page 125 of Learner's Book 7 on how to solve word problems involving addition or subtraction of fractions. *Refer to page 249 of Learner's Book 7.*

Diagnostic Assessment

The sum of the ages of two friends is 25 and the older one is 4 times as old as that of the younger one. Write a mathematical equation for the statement.

> *Solution:*
> Let the age of the younger one be x
> The age of the older is $4x$
> The sum of their ages is 25
> Therefore $x + 4x = 25$

Put learners in groups and let them solve the problems in the given examples and discuss them. Let the learners also solve the questions at exercises 1. *Refer to page 251 of Learner's Book 7.*

Modelling and solving linear equations using concrete materials
Refer to pages 251-254 of Learner's Book 7.

Lesson Presentation
This lesson is supposed to be a demonstration lesson or a practical lesson. You need to assemble learning resources such as, a scale or a beam balance, marbles and or pebbles.

Refer to pages 251-254 of Learner's Book 7. Involve learners to carry out the activities and then write the linear equations using the concrete materials and solving it.
Lead and guide learners through these activities. *Refer to pages 251-254 of Learner's Book 7.*

Model and solve Linear Equations set with shapes on a balance *(Refer to pages 254-261 of the Learner's Book 7)*

Involve learners, guide them individually and in groups to solve the questions and discuss them.

STRAND 3: GEOMETRY AND MEASUREMENT

Sub-Strand 1: Shapes and Space

Refer to pages 267-291 of the Learner's Book 7

Content Standard *(B7.3.1.1)*
Demonstrate understanding of angles including adjacent, vertical opposite, complementary, supplementary and use them to solve problems.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
    i.   identify and describe the types of angles;
    ii.   measure and classify angles according to the measured angle size;
    iii. apply the properties of the angles to solve geometrical problems;
    iv. construct a line segment perpendicular to another line segment;
    v.   copy and bisect angles;
    vi. construct angles $(90°, 45°, 60°, 30°, 75°$ and $15°)$.

Keywords: *(Refer to page 267 of Learner's Book 7)*
Assist learners to find the contextual meaning of the keywords. *angles, adjacent, complementary, supplementary, reflex, bisector, perpendicular bisector, construct, line segment*

Core Competencies
    1.   Creativity and Innovation.
    2.   Critical Thinking and Problem Solving.
    3.   Digital Literacy

Learning Presentation
Give a brief explanation about what Geometry is, for learners to appreciate and understand.

What is Geometry? *Refer to page 267 of the Learner's Book 7*
Geometry is a branch of Mathematics that studies the sizes, shapes, positions, angles and dimensions of things.

There are 2-dimension (2D) shapes and 3-dimension (3D) shapes in Geometry.
The 2D shapes in geometry are flat shapes like; squares, circles, triangles, rectangles, etc. the 2D shapes have only two dimensions; the length and the width or breadth.

2D shapes can also be classified as open and closed shapes. Open shapes can be defined as a shape or figure whose line segments and/or curves do not meet. They do not start and end at the same point. Closed shapes are geometric shapes that begin and end at the same point.

3D shapes can be defined as a solid figure or shape that has three dimensions; length, width and height. Unlike 2D shapes, 3D shapes have thickness depth. Examples include, a cube, rectangular prism, sphere, cone and cylinder.

Application of Geometry in Our Lives
1. Construction of buildings
   The best use of geometry in our daily life is the construction of buildings, dams, roads, rivers, temples, etc.

2. Computer graphics
   The audio visuals presentation in different segments such as education, entertainment, etc use geometry as a part of the art and creativity. Computer graphics is a prime application of geometry in day-to-day life. Smart phones, laptops, computers, etc are designed using geometrical concepts.

3. Art
   Another excellent use of geometry is how artists use the concepts of geometry to design the best paintings and express their ideas. The use of colours, brushes and different strokes give result to excellent artwork.

4. Measuring orbits and Planetary Motions
   This concept is used by astronomers to trade stars, measure the orbits and distance between planets and satellites. Scientists also measure the factors and set the path of satellites launched into space.

5. Interior Design
   The application of coordinates geometry in daily life can also be found in interior design. Setting new items in an open space is done very well using the concept of coordinate geometry.

Construction of Angles
Resources needed include: pair of compasses, rule, protractor, pencils and erasers.
Lead and guide learners to construct the angles 90˚, 45˚, 60˚, 30˚, 15˚, and 75˚ using the pair of compasses and a ruler. *Refer to pages 268 of Learner's Book 7.*

Types of angles

Guide learners to explain these types of angles: acute angles, obtuse angles, straight line, right angle, reflex angle, complementary angles and supplementary angles. *Refer to page 268 of Learner's Book 7.*

Angle properties of parallel lines
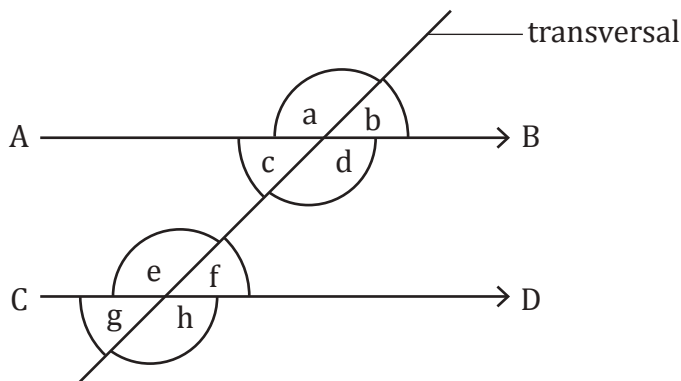
Lead and guide learners to identify and name the angles: vertically opposite angles, alternate angles, corresponding angles, interior angles, co- interior angles and external angles. *Refer to page 268 of Learner's Book 7.*

How to construct a perpendicular to a line *Refer to pages 282 of Learner's Book 7*
Guide learners to do the constructions using a pair of compasses and a ruler.

Construct the perpendicular bisector of a line segment *Refer to pages 282 of Learner's Book 7.*

Sub-Strand 2: Measurement *(Refer to page 292-324 of the Learner's Book 7)*

Content Standard *(B7.3.2.1)*
Demonstrate the ability to find the perimeter of plane shapes, including circles.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
  i.   calculate the perimeter of given shapes whose dimensions are in two unit/sub-strands;
  ii. use the relationship between the diameter and the circumference to deduce the formular for finding the circumference of a circle and use it to solve problems;
  iii. draw in a square grid rectangles and triangles with given dimensions;
  iv. use the relationship between a triangle and a rectangle to deduce the formula for determining the area of a triangle;
  v.   describe the bearing of a point from another point;
  vi. distinguish between scalar vector and vector quantity.

Keywords: Assist learners to find the contextual meaning of the keywords.
perimeter, circumference, diameter, circle, plane figures, rectangles, triangles, Perpendicular, height, rectangle, base, parallelogram, Bearings, cardinal, component, scalar, vector.

Core Competencies
  6. Communication and Collaboration.
  7. Critical thinking and Problem Solving.
  8. Digital Literacy

Teaching and Learning Resources (TLRs)
empty Milo tins, thread, empty plastic water bottels, graph sheets, geoboard, rubber band

Lesson Presentation
Ask learners to measure the length of the table top of their tables in the classroom using their figure span as referent. Let learners also use ruler to measure the length and the width of the table top of their tables and record their values. After these introductory activities, ask learners to define or explain in their own words what measurement is.

Assist learners to explain measurement as the quantification of attributes of an object or event, which can be used to compare with other objects or events. In other words, measurement is a process of determining how large or small a physical quantity is as compared to a basic reference quantity of the same kind – *www.wikipedia.org*

Calculate the perimeter of given shapes whose dimensions are in two sub-strands. Perimeter is the distance around the edge of a shape. *(www.khanacademy.org)*

Lead and guide learners to calculate the perimeter of shapes. *Refer to pages 293-296 of Learner's Book 7*. Involve learners to solve the questions. Discuss learners solutions with the whole class.

Use the relationship between the diameter and the circumference to deduce the formula for finding the circumference of a circle and use it to solve problems. *Refer to pages 296-297 of Learner's Book 7.*
Let learners take part in the activities as set out at the pages stated in the Learner's Book.

Let learners bring such resources as: threads, empty milo tins and empty plastic water bottles. Guide learners to use these learning materials to do the activities in class.

Areas and Perimeters of Shapes
Refer to pages 302-303 of Learner's Book 7.

AREA OF A SHAPE
What is area?
Area is defined as the total space taken up by a flat (2-D) surface or shape of an object. The space enclosed by the boundary of a plane figure is called its area.
Example:
Area of tiling the floor. Area is measured in square units.

Diagnostic Assessment
Draw in the dot square grid another triangle whose area is 3 square.
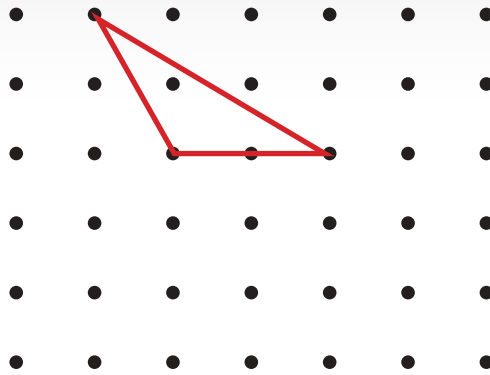
Refer to page 304 of Learner's Book 7.

You can use the geoboard with the rubber band to demonstrate this for learners to learn. Let learners also use the geoboard with the rubber bands to form different kinds of triangle and determine the area.

Determining the Area of a Triangle *Refer to pages 305-308 of Learner's Book 7.*
Lead and guide learners to determine the area of a triangle.
Area of a triangle $= \frac{1}{2} \times base \times height$
Refer to page 305 of Learner's Book 7.

Bearings *(Refer to page 309 of the Learner's Book 7)*
What are bearings?
Barings are angles measured clockwise from the north pole.
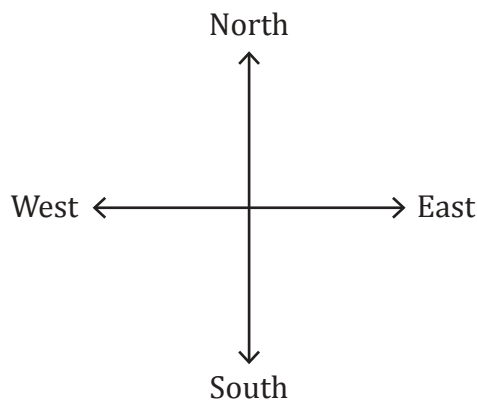
The geographic north is shown on the four cardinal points. When we have to measure the required angle in a clockwise direction, we do so and record all bearings in three figures/ digits.

If the angle measured is less than 100, it is recorded with zero(s) preceding the non-zero digit. Example: 006°, 025°, 099°, 060°, etc.
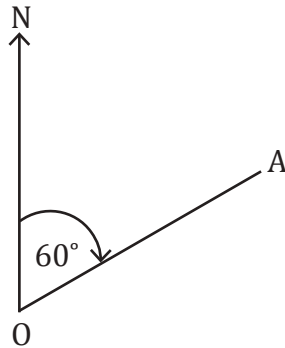
The angle is 60°
The bearing is 060°

Back Bearings *(Refer to page 315 of Learner's Book 7)*
When a given bearing is less than 180 (degrees) we add 180 (degrees) to obtain the back bearing.

For instance, if the bearing of B from A is 060°, the back bearing will be 180° + 60° = 240°
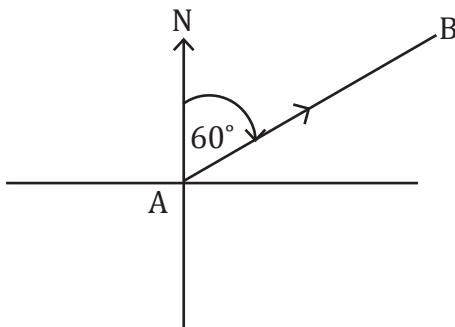
Bearing of B from A
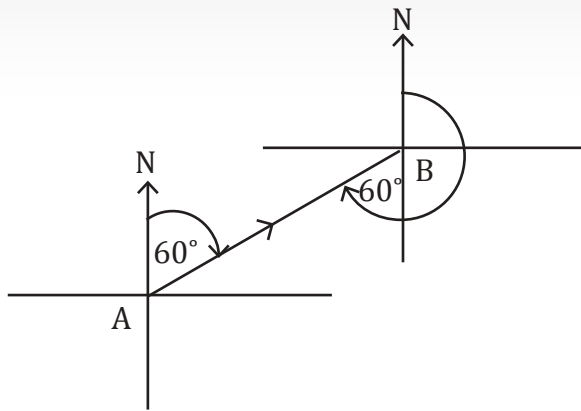
Since 60° alternates, we add 180° to 60°. Hence, the back bearing is $60° + 180° = 240°$.

The bearing of A from B is now 240°.

Refer to page 309 of Learner's Book 7

Diagnostic Assessment

Find the bearing of A from B if the bearing of B from A is 195°.

Solution
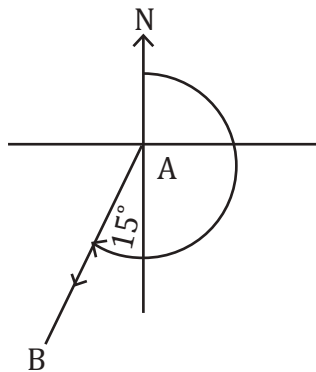
Bearing of B from A is $15° + 180° = 195°$

Now the bearing of A from B
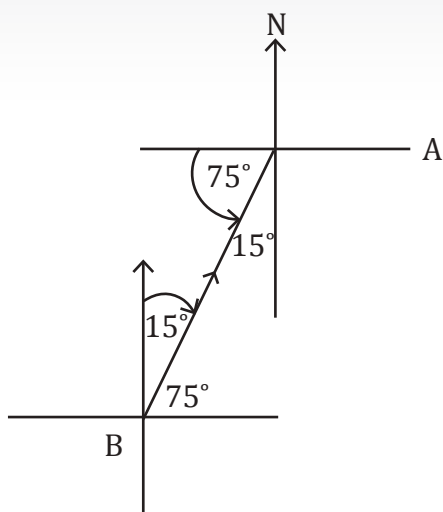
The bearing A from B is $015°$.

Refer to page 315 of Learner's Book 7.

Convert vectors in Column (component) form to magnitude Bearing form and vice versa. *Refer to page 321 of Learner's Book 7.*

Revise the Pythagoras theorem.
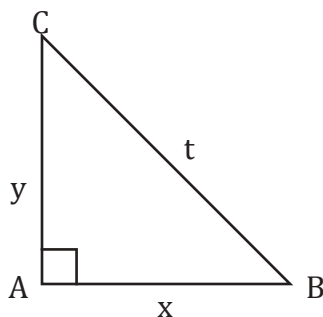
$|BC|^2 = |AB|^2 + |AC|^2$

$\quad t^2 = x^2 + y^2$

$\quad t = \sqrt{x^2 + y^2}$

Hence the length of side |BC| is $t = \sqrt{x^2 + y^2}$.

Given that $A = \begin{pmatrix} x_1 \\ y_1 \end{pmatrix}$ and $B = \begin{pmatrix} x_2 \\ y_2 \end{pmatrix}$, then

$|\overrightarrow{AB}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Sub-Strand 3: Position and Transformation

Refer to pages 326-339 of Learner's Book 7

Content Standard *(B7.3.3.1)*
Perform a single transformation i.e. reflection and transformation on a 2D shape using graph paper.

Learning Expectations:
After studying this sub-strand, the learner will be able to;
    i.   determine shapes in real life that have reflection;
    ii.   plot points and shapes on a coordinate plane and draw their images under reflection in given lines;
    iii.   plot points and shapes on a coordinate plane and draw their images under translation by a given vector;
    iv.   verify the concept of congruent coordinates plane using properties of both the objects and images and in real life situations.

Keywords: *(Refer to page 326 of the Learner's Book 7)*
Guide learners to find the contextual meaning of the keywords. *reflection, symmetries, coordinates, translation, congruent.*

Core Competencies
    9.   Communication and Collaboration.
    10.   Critical Thinking and Problem Solving.
    11.   Digital Literacy

Lesson Presentation
Refer to page 326 of Learner's Book 7.
Let learners read the introductory notes at page 326 of Learner's Book and discuss with them.

Determine shapes in real life that have reflectional (or fold) symmetries.
Lead and guide learners to identify and mention examples of designs or objects in everyday life that have reflectional images or symmetries. For example: Adinkra symbols. *Refer to page 328 of Learner's Book 7.*

To plot points on the graph paper, ensure that the learners adhere to the following:
    1.   Label the axes (i.e., x-axis and y-axis)

2. Use correct scale
3. Label the vertices of the shape that may be drawn.

Refer to page 337 of Learner's Book 7.

Verify the concept of congruent and similar shapes in coordinate plane.
Refer to page 331 of Learner's Book 7.
Congruent describes a shape in Mathematics that has the same shape and size as another. Similar shapes are the same in appearance.

When two figures are similar to each other then it is based on their shape and size. There are basically four rules for congruence.
Conditions for similarity of triangles are:
- AAA similarity criterion
- AA similarity criterion
- SSS similarity criterion
- SAS similarity criterion

1. AAA similarity criterion
   If in two triangles **corresponding angles** are equal, then their corresponding sides are in the same ratio and hence the two triangles are similar (AAA similarity).

2. AA similarity criterion
   If in two triangles **two angles of one triangle** are respectively equal to the two angles of the other triangle, then the two triangles are similar? (AA similarity).

3. SSS Similarity criterion
   If in two triangles **corresponding sides** are in **the same ratio**, then their corresponding angles are equal and hence the triangles are similar (SSS similarity).

4. SAS Similarity criterion
   If **one angle of a triangle is equal to one angle of another triangle** and the sides including these angles are in the same ratio then the triangles are similar (SAS similarity).

STRAND 4: HANDLING DATA

Sub-Strand 1: Data

Refer to pages 340-378 of Learner's Book 7

Content Standard *(B7.4.1.1)*
Select, justify and use appropriate methods to collect data.

Learning Expectations:
After studying this sub-strand, the learner will be able to:
  i.   select and justify a method used to collect data to answer a given question;
  ii.   design and administer a questionnaire for collecting data to answer questions and record the results;
  iii. organise and present data from a survey to a table.

Keywords: *(Refer to page 340 of Learner's Book 7)*
Guide learners to find the contextual meaning of the keywords. *data, questionnaire, frequency, observation, interview, survey, mean, medium*

Core Competencies
  1.   Critical Thinking and Problem Solving.
  2.   Communication and Collaboration.
  3.   Digital Literacy

Lead and guide learners to read and discuss the information provided at the pages stated in the Learner's Book 7.

Guide learners to prepare a frequency distribution table for a given data.
Refer to pages 347-352 of Learner's Book 7.

Pie Chart *(Refer to pages 353-354 of Learner's Book 7)*
Guide learners to use the data provided at page 355 to draw a pie chart.
Guide learners to practice further by using the information provided to draw pie chart.
Resources needed are a pair of compasses, a ruler and a protractor.

Measures of central tendency *(Refer to pages 365-370 of the Learner's Book 7)*
Lead and guide learners to calculate the mean for a given set of data. Guide learners to determine mode and median for a given data.

Sub-Strand 2: Chance or Probability

Refer to page 379-388 of Learner's Book 7

Content Standard *(B7.4.2.1)*
Identify the sample space for a probability experiment involving single events.

> **Learning Expectations:**
> After studying this sub-strand, the learner will be able to:
>   i.   demonstrate understanding of likelihood of a single outcome occurring by providing examples of events or certain forms of personal contexts;
>   ii. classify the likelihood of a single outcome occurring as impossible, possible or certain;
>   iii. calculate the probability of an event and express the probability as fraction, decimals, percentages and/or ratios.

Keywords: *(Refer to pages 379-of Learner's Book 7)*
Guide learners to find the contextual meaning of the keywords. (*impossible, possible, certain outcome, probability, chance*

Core Competencies
   1. Critical Thinking and Problem Solving.
   2. Communication and Collaboration.
   3. Personal Development and Leadership

Lead and guide learners to classify the outcome of some events as possible, impossible and certain.

Refer to pages 380-384 and let learners work in groups to do the examples and exercises.

Let them give reasons for their answers. Let learners provide other contexts in life in which an experiment or an event can be said to be impossible, possible or certain.

Calculate the probability of the event and express the probability as fraction, decimals, percentage and or ratio *(Refer to page 383 of the Learner's Book 7)*
Probability of an event E which is obtained from a set of possible outcomes S is defined as;

$$P(E) = \frac{n(E)}{n(S)}$$

Diagnostic Assessment

When a die is tossed once, find the probability of obtaining a number that is divisible by 2 without a remainder.

Solution

Let the sample space, s = {1, 2, 3, 4, 5, 6}

n(S) = 6

Let E = {number divisible by 2 without remainder}

E = {2, 4, 6}   n{E} = 3

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2} = 0.5$$

ANSWERS TO THE LEARNER'S BOOK EXERCISES

STRAND 1: NUMBER
SUB-STRAND 1: NUMBER AND NUMERATION SYSTEM

Exercise 1 *(Refer to page 5 of Learner's Book 7)*
1. Ten (10) blocks
2. a. 12 blocks, 4 flats, 6 rods and 2 cubes
    b. 84 blocks, 5 flats, 1 rods
    c. 9 blocks, 2 flats, 3 rods and 9 cubes.

Exercise 2 *(Refer to pages 6−7 of Learner's Book 7)*
1. 1.

b.	17	g.	15
c.	25	h.	47.4
d.	20	i.	15
e.	3	j.	30 ; 13
f.	25	k.	35; 4; 2:

Different corresponding figures are welcome

2.
    l. $4{,}810 = (20 \times 200) + (4 \times 100) + (8 \times 50) + (1 \times 10)$
    m. $7{,}740 = (70 \times 100) + (2 \times 200) + (6 \times 50) + (4 \times 10)$
    n. $5{,}990 = (100 \times 5) + (200 \times 4) + (100 \times 1) + (10 \times 9)$
    o. $8{,}860 = (40 \times 200) + (8 \times 100) + (1 \times 50) + (1 \times 10)$
    p. $9.530 = (45 \times 200) + (4 \times 100) + (2 \times 50) + (3 \times 10)$
    Any way that you can arrange to obtain an answer is accepted

Exercise 3 *(Refer to page 9 of Learner's Book 7)*

1. 4,076,800 of GH¢ 200.00 notes
2. 182, 8525 of GH¢200.00 notes
3. 6,527,700 of GH¢100.00 notes
4. 14,493,000 of GH¢50.00 notes
5. 44,015,250 of GH¢20.00 notes
6. $GH¢200 \times 3500 = 700{,}000.00$

   $GH¢100 \times 300 \quad = \quad 30{,}000.00$

   $GH¢50 \times 160 \quad = \quad \underline{\quad 8{,}000.00}$

   $\qquad\qquad\qquad GH¢738{,}000.00$

7. $GH¢200 \times 4500 = 900,000.00$
    $GH¢100 \times 600 \quad = \quad 60,000.00$
    $GH¢50 \times 80 \qquad = \qquad 4,000.00$
    $GH¢20 \times 50 \qquad = \qquad \underline{1,000.00}$
    $\qquad\qquad\qquad\quad \underline{GH¢965,000.00}$

8. $GH¢200 \times 5000 = 1,000,000.00$
    $GH¢100 \times 6010 = \quad 601,000.00$
    $GH¢20 \times 4200 \quad = \quad \underline{84,000.00}$
    $\qquad\qquad\qquad \underline{GH¢1,685,000.00}$

9. $GH¢100 \times 19000 = \quad 1,900,000.00$
    $GH¢200 \times 175 \qquad = \qquad \underline{35,000.00}$
    $\qquad\qquad\qquad \underline{GH¢1,935,000.00}$

10. $GH¢450 \times 3000 = \quad 1,350,000$
    $GH¢100 \times 4200 = \quad 420,000$
    $GH¢20 \times 500 \qquad = \qquad \underline{10,000}$
    $\qquad\qquad\qquad \underline{GH¢1,780,000.00}$

11. $GH¢20 \times 5 = 100$
    $GH¢10 \times 5 = \quad 50$
    $GH¢5 \times 4 \quad = \quad 20$
    $GH¢2 \times 10 = \quad 20$
    $GH¢1 \times 10 = \quad \underline{10}$
    $\qquad\qquad\quad \underline{GH¢200.00}$

Exercise 4 *(Refer to page 12 of Learner's Book)*

1. 5050, 5100, 5150; 5300, 5350
2. 7525, 7550, 7575, 7600; 7675, 7700
3. 1,500, 500, 1,500, 750, 1,501, 000, 1,501, 250, 1,501, 500; 1,502, 000, 1502, 250
4. 5, 250, 450, 5,250, 425, 5,250, 400, 5,250, 375; 5, 250, 300, 5, 250, 300, 5,250,275
5. 3,750, 500, 3,750, 250, 3,750, 000; 3,749, 500, 3,749,250, 3,749, 000
6. 7, 000 050, 7, 000, 000, 6,999,950, 6,999,900; 6999,800, 6,999, 750
7. 9,000 000, 9, 000, 250, 9,000, 500, 9000, 750, 9,001,000;
8. 5,500 000, 5,500, 050, 5,500, 100, 5,500, 150, ...

9. 1,250, 000, 1,249, 975, 1,249, 950, 1,249,925, ...
10. 7,500, 750, 7, 500, 700, 7,500, 650, 7,500, 600, ...

Exercise 5 *(Refer to page 14 of Learner's Book)*

1.	57, 100, 000	6.	60, 850, 000
2.	83, 700, 000	7.	94, 100, 000
3.	1,350,900, 000	8.	1, 109, 600, 00
4.	12, 623, 000, 000	9.	998, 865, 000
5.	1, 106, 250,000	10.	1, 886, 670,000

Exercise 6 *(Refer to page 18 of Learner's Book)*

	A		B
1.	Is less than	1.	>
2.	Is greater than	2.	>
3.	Is greater than	3.	<
4.	Is equal to	4.	<
5.	Is less than	5.	=

Exercise 7 *(Refer to pages 19 - 20 of Learner's Book 7)*

1. a. 2, 444, 600
    b. Two million, four hundred and forty-four thousand, six hundred.

2. a. 2, 113, 500
    b. Two million, one hundred and thirteen thousand, five hundred.

3. a. 518, 600
    b. five million, seven hundred and seventeen thousand, five hundred

4. a. 5, 717, 500
    b. Five million, seven hundred and seventeen thousand, three hundred.

5. a. 815, 300
    b. Eight hundred and fifteen thousand, three hundred.

Exercise 8 *(Refer to pages 23 - 24 of Learner's Book 7)*

1. a. 1,405,210
    b. 1,392,663,420.

2. a. 37,411,500
    b. 1,392,663,420

3. a. 41,216,000
    b. 2,144,563,000

4. a. 419,730,000
    b. 1,116,210,000

5. a. 112,700,000
    b. 1,491,300,000

Exercise 9 *(Refer to page 26-27 of Learner's Book 7)*

1.

i.

	Round up	Round down
a. Thousand	3,815,000	3,815,000
b. Ten thousand	3,800,000	3,800,000
c. Hundred thousand	3,800,000	3,800,000

ii.

	Round up	Round down
a. Thousand	8,329,000	8,329,000
b. Ten thousand	8,330,000	8,329,000
c. Hundred thousand	8,300,000	8,300,000

iii.

	Round up	Round down
a. Thousand	28,362,000	28,361,000
b. Ten thousand	28,360,000	28,360,000
c. Hundred thousand	28,400,000	28,000,000

iv.

	Round up	Round down
a. Thousand	61,884,000	61,884,000
b. Ten thousand	61,880,000	61,880,000
c. Hundred thousand	61,900,000	61,880,000

v.

	Round up	Round down
a. Thousand	128,369,000	128,368,000
b. Ten thousand	128,370,000	128,360,000
c. Hundred thousand	128,400,000	128,300,000

vi.

	Round up	Round down
a. Thousand	365,781,000	365,781,000
b. Ten thousand	365,800,000	365,780,000
c. Hundred thousand	366,000,000	360,000,000

vii.

	Round up	Round down
a. Thousand	1,693,714,000	1,693,714,000
b. Ten thousand	1,693,714,000	1,693,700,000
c. Hundred thousand	1,693,800,000	1,693,700,000

viii.

	Round up	Round down
a. Thousand	2,219,362,000	2,219,362,000
b. Ten thousand	2,219,360,000	2,219,360,000
c. Hundred thousand	2,219,400,000	2,219,360,000

Exercise 10 *(Refer to pages 30 - 31 of Learner's Book 7)*

1.

	a.	b.	c.
i.	251, 470, 000	251, 500, 000	251, 000, 000
ii.	403, 680, 000	403, 700, 000	404, 000, 000
iii.	482, 030, 000	482, 000, 000	482, 000, 000
iv.	561, 370, 000	561, 400, 000	561, 000, 000
v.	819, 840, 000	819, 800, 000	820, 000, 000

2.

i.	216, 400, 000	216, 400, 000	216, 000, 000
ii.	215, 100, 000	215, 000, 000	220, 000, 000
iii.	607, 500, 000	607, 000, 000	610, 000, 000

iv. 346, 200, 000   346, 000, 000   350, 000, 000
v.   739, 100, 000   739, 000, 000   740, 000, 000

Exercise 11 *(Refer to page 35 of Learner's Book 7)*

1.

	Tenth	Hundredth	Thousandth	Ten Thousand	Hundred Thou-sand
a.	60.1	60.10	60.098	60.0985	60.098547
b.	2.0	2. 01	2.014	2.0137	2.01371
c.	14.0	13.98	13.978	13.9783	13.97833
d.	0.0	0.02	0.025	0.0249	0.02489
e.	41.1	41.10	41.097	41.0966	41.09658
f.	113.6	113.61	113.610	113. 6098	113. 60976
g.	0.1	0.05	0.050	0.0504	0.05038
h.	5.3	5.31	5.313	5.3126	5.31260
i.	0.1	0.10	0.100	0.0998	0.07979
j.	0.0	0.00	0.000	0.0000	0.00001
k	0.0	0.00	0.005	0.0046	0.00458
l	8.0	8.02	8.020	8.0200	8.02005

2.

		Tenth	hundredth	Thousandth	Ten Thousand	Hundred Thousand
a	Round up	9.7	9.67	9.673	9.6732	9.67318
	Round down	9.6	9.67	9.670	9.6730	9.67318
b	Round up	11.4	11.33	11.329	11.3290	11.32897
	Round down	11.3	11.31	11.328	11.3289	11.32897
c	Round up	5.1	5.15	5.150	5.1497	5.14973
	Round down	5.1	5.15	5.150	5.1497	5.14973
d	Round up	112.2	112.20	112.196	112.1960	112.19635
	Round down	112.1	112.20	112.196	112.1960	112.19630
e	Round up	131.6	131.64	131.639	131.6389	131.63895
	Round down	131.6	131.60	131.630	131.6389	131.63894

f	Round up	17.6	17.60	17.597	17.5968	17.59678
	Round down	17.6	17.60	17.596	17.5967	17.59678
g	Round up	0.6	0.64	0.640	0.6399	0.63989
	Round down	0.6	0.60	0.640	0.6399	0.63989
h	Round up	23.7	23.73	23.730	23.7300	23.72998
	Round down	23.7	23.73	23.730	23.7300	23.72998
i	Round up	105.6	105.64	105.639	105.6387	105.63874
	Round down	105.6	105.64	105.639	105.6387	105.63874
j	Round up	73.2	73.16	73.160	73.1600	73.16000
	Round down	73.2	73.16	73.160	73.1600	73.16000

3.

	Round up	Round down
Nearest Tenth	102.6	102.6
Nearest Hundredth	102.59	102.59
Nearest Thousandth	102.590	102.590
Nearest Ten thousand	102.5900	102.5900
Nearest Hundred thousand	102.58998	102.58998

Exercise 12 *(Refer to page 37 of Learner's Book 7)*

1. The Zero between seven and three is significant. 3 significant figures.
2. Zero between the decimal point and five in sigificant. 3 S.f.
3. And the two zeros are Sf: 4S.f.
4. The zeros between 2 and 1 and between the point and 3 are significant. 5 S.f.
5. The Zeros are not S.f.: 1S.f.
6. .The Zeros are not S.f.: 1S.f.
7. The zero is SF: 4S.f
8. The zero between the point and trailing zero is not significant
9. The leading and trailing zeros are not significant. 3 S.f.
10. The zeros between two and four are significant but the trailing zero is not. 5 S.f.

Exercise 13 *(Refer to page 38 of Learner's Book 7)*

	2s.f	3s.f	4s.f	5s.f	6s.f
1.	1.1	1.10	1.096	1.0963	1.09635
2.	0.00 88	0.00 880	0.008800	0.0087997	0.00879965
3.	130.0	131.0	131.1	131.08	131.079
4.	57.0	57.0	57.04	57.040	57.0397
5.	3.6	3.61	3.608	3.6080	3.60799
6.	0.57	0.570	0.5701	0.57010	0.570097

Exercise 14 *(Refer to page 41 of Learner's Book 7)*

1.

	1dp	2dp	3d.p	4d p	5 d p	6 d p
a.	5.2	5.20	5.197	5.1974	5.19744	5.197438
b	0.2	0.24	0.240	0.2398	0.23980	0.239796
c	113.1	113.14	113.140	113.1396	113.13958	113.139576
d	17.3	17.30	17.298	17.2979	17.29795	17.297946
e	31.1	31.13	31.130	31.1300	31.12996	31.129959
f	0.6	0.57	0.569	0.5690	0.56899	0.568985

2. 1.535grams or 1.541
3. 7.675metres or 7.681metres
4. 1.69metres or 1.72metres
5. 25.85minutes or 25.92minutes

STRAND 1: NUMBER
SUB-STRAND 2: NUMBER OPERATIONS

Exercise 1 *(Refer to page 44 of Learner's Book 7)*

1.
1. 54
2. 96
3. 6
4. 8
5. 9
6. 9
7. 11
8. 8×12
9. 7×12
10. 9
11. 12 skip counts (12 steps of 9)
12. 48

Exercise 2 *(Refer to page 47 of Learner's Book 7)*

1. i). 0.35;35%   ii). 0.36;36%   iii). 0.06;6%   iv). 0.44;44%
   v). o.6; 60%   vi). 0.21%   vii). 0.6;60%   viii). 0.25;25%
   ix). 0.34;34%   x). 0.95;95%

2. a. $\dfrac{1}{5}$ b. $\dfrac{2}{3}$ c. $\dfrac{7}{10}$ d. $\dfrac{1}{8}$ e. $\dfrac{3}{20}$

3. a. $\dfrac{9}{20}$ b. $\dfrac{1}{25}$ c. $\dfrac{4}{5}$ d. $\dfrac{1}{8}$ e. $\dfrac{8}{25}$

Exercise 3 *(Refer to page 51 of Learner's Book 7)*

1. 3.7
2. 31.2
3. 1.29
4. 0.5
5. 710
6. 1816.2
7. 31
8. 37118.2
9. 5390
10. 0.06
11. 0.0822
12. 0.372
13. 0.635
14. 0.0904
15. 1.0361
16. 0.0187
17. 0.00137
18. 0.11347
19. 0.0000423
20. 0.00045603

71

Exercise 4 *(Refer to page 53 of Learner's Book 7)*

1.	140	5.	160	9.	2,000
2.	4000	6.	1600	10.	400
3.	200	7.	2,500	11.	320
4.	3000	8.	300	12.	3200

Exercise 5 *(Refer to page 54 of Learner's Book 7)*

1.	208	6.	3,560
2.	387	7.	6,083
3.	210	8.	(8) 105,792
4.	285	9.	(9) 234,354
5.	896	10.	8,064

Exercise 6 *(Refer to page 55-56 of Learner's Book 7)*

1.	*GH¢*30.00	6.	350
2.	35 balloon	7.	0.8*kg*
3.	240	8.	130
4.	36 balloons	9.	125
5.	70 stamps	10.	538

Exercise 7 *(Refer to page 56 of Learner's Book 7)*

1.	1.5kg	7.	160minutes
2.	*GH¢*300,000.00	8.	75
3.	*GH¢*1,120.00 a week	9.	*GH¢*42.00
4.	28eggs left	10.	42 boys
5.	25m^2		
6.	$\frac{7}{10}$		

Exercise 8 *(Refer to page 60 of Learner's Book 7)*

1.	792	5.	644	9.	35.64
2.	5,061	6.	1,366	10.	36.764
3.	2,247	7.	164.509		
4.	2,386	8.	355.668		

Exercise 9 *(Refer to pages 65 of Learner's Book 7)*

A.	1. 2,508	2. 4, 656	3. 3,451	4. 374
	5. 498	6. 286	7. 5,838	8. 258
	9. 674	10. 2,175	11. 11430	12. 75779
	13. 35688	14. 379848	15. 31104	

B.	1. 918	2. 27,405	3. 120,978	4. 17,952	5. 317,856
	6. 33384	7. 271884	8. 6180	9. 22825	10. 53400

C.	1. 2,016	2. 4,042	3. 15, 768	4. 44,308	5. 6, 786
	6. 6090	7. 8536	8. 1362	9. 11648	10.13976

Exercise 10 *(Refer to page 68 of Learner's Book 7)*

1.

Number	328	360	444	942	1586
Divisible by 2	yes	yes	yes	yes	yes
Divisible by 3	No	yes	yes	yes	No
Divisible by 4	yes	yes	yes	No	No
Divisible by 5	No	yes	No	No	No

2.

Number	224	924	1584	1992	1120
Divisible by 5	No	No	No	No	Yes
Divisible by 6	No	Yes	Yes	Yes	No
Divisible by 7	Yes	Yes	No	No	Yes
Divisible by 8	Yes	No	Yes	Yes	Yes
Divisible by 9	No	No	Yes	No	No
Divisible by 10	No	No	No	No	Yes
Divisible by 11	No	Yes	Yes	No	No

Exercise 11 *(Refer to page 69-70 of Learner's Book 7)*

1.	*GH¢100.25*	5.	*GH¢60.35*	9.	*GH¢211.95*
2.	*GH¢25.60*	6.	*GH¢12.85*	10.	*GH¢3.50*
3.	9.96*km*	7.	59.5*kg*		
4.	59.7*m*	8.	*GH¢3.25*		

Exercise 12 *(Refer to page 72 of Learner's Book 7)*

1.	*GH¢27.00*	6.	20 tin of tomatoes
2.	*GH¢105.00*	7.	*GH¢68.00*
3.	3 times	8.	*GH¢8.00*
4.	5 bottles of palm oil	9.	*GH¢37.00*
5.	*GH¢165.00*	10.	*GH¢30.00*

Exercise 13 *(Refer to page 77 of Learner's Book 7)*

1.	$3^7, 2187$	6.	$17^4, 83521$
2.	$2^8, 256$	7.	$19^4, 130321$
3.	$13^4, 28561$	8.	$23^3, 12167$
4.	$7^6, 117649$	9.	$9^4, 6561$
5.	$11^6, 1771561$	10.	$10^5, 100000$

Exercise 14 *(Refer to page 78 of Learner's Book 7)*

1. a. base is 6 and exponent 3
   b. base is 2 and exponent 12
   c. base is 11 and exponent 21
   d. base is 3 and exponent 7

2. a. 6^5 b. 7^7 c. 3^{11} d. 11^7 e. 5^6

3. a. $5 \times 5 \times 5 \times 5 \times 5 \times 5$
   b. $7 \times 7 \times 7 \times 7$
   c. $19 \times 19 \times 19 \times 19 \times 19$
   d. $17 \times 17 \times 17 \times 17 \times 17 \times 17 \times 17 \times 17 \times 17 \times 17$

Exercise 15 *(Refer to page 80 of Learner's Book 7)*

1. 2^8
2. 3^6
3. 2^7
4. 5^4
5. $2^4 \times 3^4$
6. $2^3 \times 5^3$

Exercise 16 *(Refer to pages 81 of Learner's Book 7)*

1. a. $100^{1-1} = 100^0 = 1$
   b. $125^0 = 1$
   c. $81^0 = 1$
   d. $64^0 = 1$
   e. $234^0 = 1$
2. a. $(3x)^0 = 1$
   b. $(xy7)^0 = 1$
   c. $2^{11-7} = 2^4$
   d. 1
   e. 1

Exercise 17 *(Refer to page 83 of Learner's Book 7)*

1. 64
2. 729
3. 3125
4. 1331
5. 256
6. 4.57247
7. 0.000059499
8. 0.03125
9. 0.008
10. 0.00137174

Exercise 18 *(Refer to page 85 of Learner's Book 7)*

1. $2^4 \times 3$
2. $2^2 \times 3 \times 7$
3. $3^2 \times 5$
4. $2 \times 3 \times 5^2$
5. $2^4 \times 3^2$
6. $2^3 \times 3 \times 43$
7. $2^5 \times 3 \times 5$
8. $2^2 \times 3^2 \times 41$
9. $3 \times 5 \times 421$
10. $2^2 \times 859$

Exercise 19 *(Refer to page 88 of Learner's Book 7)*

1. 3
2. 2×7
3. $2^2 \times 3$
4. 3^2
5. 2×3
6. $3 \times 5 = 15$
7. $2 \times 7 = 14$
8. $3 \times 5 = 15$
9. $2 \times 3^2 = 18$
10. $2 \times 7 = 14$

Exercise 20 *(Refer to page 91 of Learner's Book 7)*

1. a. $2^3 \times 3$
   b. 2^5
   c. $2^3 \times 3^2 \times 11$
   d. 2
   e. $2^2 \times 3^3$
   f. $2^2 \times 7$
   g. 3×5

2. 4:00pm
3. 2:30pm

STRAND 1: NUMBER
SUB-STRAND 3: FRACTIONS, DECIMALS AND PERCENTAGES

Exercise 1 *(Refer to page 99-100 of Learner's Book 7)*

1. a.

b.

c.
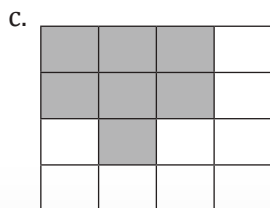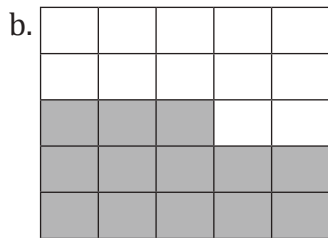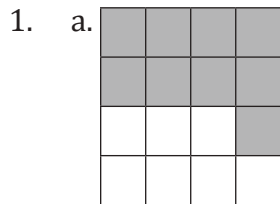
2. a. $\frac{9}{20}$ b. $\frac{7}{9}$ c. $\frac{11}{16}$

3. a. $\frac{10}{16}, \frac{15}{24}, \frac{20}{32}, \frac{25}{40}, \frac{50}{80}$

    b. $\frac{6}{14}, \frac{9}{21}, \frac{12}{28}, \frac{15}{35}, \frac{30}{70}$

    c. $\frac{8}{10}, \frac{12}{15}, \frac{16}{20}, \frac{20}{25}, \frac{24}{30}$

    d. $\frac{10}{26}, \frac{15}{36}, \frac{20}{48}, \frac{25}{60}, \frac{30}{72}$

    e. $\frac{14}{30}, \frac{21}{45}, \frac{28}{60}, \frac{35}{75}, \frac{70}{150}$

4. a. $\frac{5}{16}$ b. $\frac{3}{5}$ c. $\frac{2}{3}$ d. $\frac{7}{10}$

5. a. $\frac{51}{8}$ b. $\frac{43}{16}$ c. $\frac{32}{9}$ d. $\frac{108}{25}$

Exercise 2 *(Refer to pages 102-103 of Learner's Book 7)*

1. $A = \frac{1}{4}$ $B = \frac{9}{20}$ $C = \frac{4}{5}$ $D = 12.5\%$ $E = 22.22\%$

    $F = 80\%$ $G = 83.33\%$ $H = 0.25$ $I = 0.125$ $J = 0.222$

    $K = 0.45$ $L = 0.833$

2. $M = \frac{6}{25}$ $N = \frac{4}{5}$ $P = \frac{23}{50}$ $D = 12.5\%$ $R = 16.67\%$ $S = 46\%$

    $T = 15\%$ $U = 0.24$ $I = 0.125$ $W = 0.167$ $X = 0.8$ $Y = 0.15$

Exercise 3 *(Refer to page 107-108 of Learner's Book 7)*

1. a. $\frac{1}{2}$ b. $\frac{3}{5}$ c. $\frac{12}{25}$ d. $\frac{1}{4}$ e. $\frac{2}{3}$

2. a. $<$ b. $>$ c. $>$ d. $=$ e. $<$ f. $>$

3. a. $\frac{3}{4}$ b. $\frac{27}{30}$ c. $\frac{3}{8}$ d. $\frac{5}{6}$ e. $\frac{21}{40}$

Exercise 4 *(Refer to page 116 of Learner's Book 7)*

1. a. $\frac{3}{4}, \frac{5}{8}, \frac{1}{2}$ b. $\frac{3}{4}, \frac{2}{3}, \frac{3}{5}$ c. $\frac{3}{5}, \frac{1}{2}, \frac{3}{16}$ d. $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}$ e. $\frac{1}{3}, \frac{1}{5}, \frac{1}{6}$

   f. $\frac{2}{3}, \frac{3}{7}, \frac{8}{2}$ g. $\frac{2}{3}, \frac{1}{2}, \frac{1}{4}$ h. $\frac{7}{10}, \frac{2}{3}, \frac{1}{2}$

2. a. 0.93   b. 0.41   c. 0.15   d. 0.8   e. 0.5
   f. 0.075   g. 0.4   h. 0.12   i. 0.36   j. 0.018

3. a. 0.27, 0.48, 0.67
   b. 0.39, 0.66, 0.87
   c. 0.75, 0.88, 0.96
   d. 0.77, 0.84, 0.93
   e. 0.003, 0.005, 0.008
   f. 0.04, 0.076, 0.25
   g. 0.45, 0.7, 0.89

Exercise 5 *(Refer to page 118 of Learner's Book 7)*

1. $\frac{5}{8}, 0.75, 80\%$ 6. $\frac{3}{10}, 37\frac{1}{2}\%, 0.4$

2. $66\frac{2}{3}\%, \frac{3}{4}, 0.8$ 7. $\frac{1}{7}, 16\frac{2}{3}\%, 0.6$

3. $\frac{9}{20}, 60\%, 0.7$ 8. $50\%, 0.601, \frac{5}{8}$

4. $75\%, \frac{4}{5}, 0.9$ 9. $65\%, 0.76, \frac{31}{35}$

5. $\frac{3}{5}, 62\frac{1}{2}\%, 0.7$ 10. $0.57, 77\%, \frac{19}{21}$

Exercise 6 *(Refer to page 124 of Learner's Book 7)*

1. $11\frac{1}{4}$ 5. $3\frac{7}{12}$ 9. $21\frac{7}{24}$

2. $11\frac{1}{2}$ 6. $1\frac{1}{15}$ 10. $20\frac{3}{8}$

3. $4\frac{1}{8}$ 7. $10\frac{1}{3}$ 11. $2\frac{1}{2}$

4. $2\frac{1}{2}$ 8. $15\frac{1}{5}$ 12. $3\frac{7}{12}$

13. $1\frac{1}{15}$

14. $2\frac{2}{15}$

15. $2\frac{5}{6}$

16. $9\frac{2}{15}$

Exercise 7 *(Refer to page 129 of Learner's Book 7)*

1. $3\frac{9}{20}km$

2. $3\frac{11}{24}kg$

3. $2\frac{1}{10}litres$

4. $\frac{17}{18}hours$

5. $8\frac{5}{6}litres$

6. $3\frac{11}{40}kg$

7. $4\frac{7}{12}$

8. $1\frac{19}{24}m$

9. $3\frac{7}{10}kg$

10. $13\frac{2}{3}kg$

Exercise 8 *(Refer to pages 134-135 of Learner's Book 7)*

1. a. $5\frac{1}{3}$ b. $202\frac{1}{2}$ c. $37\frac{1}{2}$ d. $33\frac{1}{3}$ e. 675 f. $266\frac{2}{3}$

2. a. 10 b. $137\frac{1}{2}$ c. 3,600 d. $157\frac{1}{2}$

3. a. $9\frac{1}{10}$ b. $115\frac{1}{5}$ c. $2\frac{1}{10}$ d. $13\frac{639}{2000}$

4. a. $\frac{18}{25}$ b. $\frac{7}{15}$ c. $\frac{27}{40}$ d. $1\frac{19}{21}$

Exercise 9 *(Refer to pages 142-144 of Learner's Book 7)*

1. a. $450km$ b. $GH¢105.00$ c. $GH¢216.00$ d. 1 hour 59mins e. $22.5grams$
2. $GH¢63.00$
3. 54 boys
4. 480
5. $GH¢105.00$
6. $24\frac{3}{7}$
7. $GH¢1134.00$
8. 108
9. 24
10. $GH¢48.00$
11. $500litres$

12. i) $GH¢1,440.00$
    ii) $GH¢720.00$
    iii) $GH¢480.00$
    iv) $GH¢240.00$
    v) $GH¢1,200.00$
13. i) 20
    ii) 420
    iii) 40
    iv) 400
    v) 20

Exercise 10 *(Refer to pages 146-147 of Learner's Book 7)*

1. 12

2. $\dfrac{1}{18}$

3. $\dfrac{4}{7}$

4. $\dfrac{5}{24}$

5. $1\dfrac{1}{5}$

6. $\dfrac{5}{14}$

7. $1\dfrac{11}{21}$

8. $2\dfrac{6530}{7085}$

Exercise 11 *(Refer to pages 154-156 of Learner's Book 7)*

1. 25
2. 60
3. 96
4. 80
5. $7\dfrac{1}{2}$
6. 5
7. 8
8. 72
9. 27
10. 40
11. $1\dfrac{23}{42}\,litres$
12. $\dfrac{5}{8}kg$
13. $\dfrac{4}{5}kg$

14. $\dfrac{3}{16}kg$
15. $\dfrac{7}{12}$
16. $1\dfrac{7}{18}$
17. $\dfrac{7}{20}kg$
18. $\dfrac{5}{6}mil$
19. $\dfrac{33}{100}$
20. $\dfrac{4}{5}$
21. $\dfrac{1}{4}$
22. 120

23. $\dfrac{1}{6}\ and\ 20$
24. $\dfrac{1}{2}\ and\ 60$
25. $\dfrac{1}{12}\ and\ 10$
26. 50
27. $\dfrac{1}{5}$
28. 60
29. $\dfrac{7}{20},\ 21$
30. $\dfrac{9}{20},\ 27$

STRAND 1: NUMBER
SUB-STRAND 4: RATIO AND PROPORTIONS

Exercise 1 *(Refer to page 161 of Learner's Book 7)*

1. 7 : 3
2. 7 : 3
3. 4 : 11
4. 5 : 2
5. 2 : 5

6. 7 : 4
7. a. 7 : 3   b. 3 : 10
8. 42 : 55
9. a. 3 : 5   b. 5 : 3
10. a. 1 : 4   b. 7 : 3

Exercise 2 *(Refer to page 162 -163 of Learner's Book 7)*

1. 10 : 7
2. 5 : 3
3. 3 : 4
4. 15 : 8
5. 35 : 16

6. 40 : 3
7. 305 : 24
8. 9 : 2
9. 4 : 3
10. 8 : 15

Exercise 3 *(Refer to page 164-165 of Learner's Book 7)*

1. The weight of the flour is $\frac{5}{2}$ *or* $2\frac{1}{2}$ times the weight of sugar

2. The weight of meat is three times the weight of fish.

3. The boys in the class are $\frac{1}{4}$ of the girls in the class.

4. The mason earns *GH¢*20.00 more thatn the carpenter. OR The ratio of the margin wage compared to the carpenter's wage is $\frac{5}{4}$.

5. The black thread is $\frac{1}{2}$ of the white thread. OR The white thread is twice longer than the black thread.

6. If 10 Okro plants were destroyed then 2 pepper plants were also destroyed.

7. Male footballers are twice more than female footballers. OR Male footballers are double the number of female footballers.

8. Quarter of the good eggs are the bad eggs. OR 25% of the good eggs are the bad eggs.

Exercise 4 *(Refer to page 167 of Learner's Book 7)*

1. $\frac{2}{5}$ 2. $\frac{4}{5}$ 3. $\frac{5}{8}$ 4. $\frac{5}{9}$ 5. $\frac{7}{9}$ 6. $\frac{20}{3}$ 7. $\frac{18}{5}$

Exercise 5 *(Refer to pages 170-171 of Learner's Book 7)*

1. 176
2. 72
3. 80
4. *GH¢80.00*
5. 60
6. 18mins
7. 16kg

Exercise 6 *(Refer to pages 175-177 of Learner's Book 7)*

1.

Fish weight (kg)	3	5	11	16
Cost (*GH¢*)	48	80	176	256

2.

Number of copies	5	12	40	68
Time (Seconds)	20	48	160	272

3.

Number of Words	48	60	135	210
Time (Seconds)	16	20	45	70

4.

Distance (km)	45	80	125	280
Litres of gas	3.6	6.4	10	22.4

5.

Water (litres)	18	40	110	210
Time (Mins)	0.72	1.6	4.4	8.4

Exercise 7 *(Refer to pages 182-183 of Learner's Book 7)*

1. 114 paints
2. 180m
3. (i) 6 11:12
4. Width 6; length 15
5. GH¢23,000.00

Exercise 8 *(Refer to pages 186-187 of Learner's Book 7)*

1.

5	10	20	(40)
8	(16)	32	64

2.

3	(9)	27	81
7	21	63	(189)

3.

(2)	10	50	250
5	25	125	625

4. $x = 9, y = 864$
5. $x = 44, y = 6$
6. $x = 192, y = 20$
7. $x = 25.1, y = 64.8$

Exercise 9 *(Refer to pages 190-191 of Learner's Book 7)*

1. *GH¢9107.50*
2. *GH¢12,000.00*
3. *GH¢76.00*
4. *GH¢36,000,000*
5. 160 GIRLS
6. *GH¢663.17*
7. *GH¢480.00*

STRAND 2: ALGEBRA
SUB-STRAND 1: PATTERNS AND RELATIONS

Exercise 1 *(Refer to page 195-196 of Learner's Book 7)*

1. a.

Domain	0	2	4	6	8	10
Co-domain	1	5	9	13	17	21

b.

Domain	1	2	3	4	5	6
Co-domain	5	7	9	11	13	15

c.

Domain	1	2	3	4	5	6	7	8
Co-domain	3	6	9	12	15	18	21	24

2. $a = 0$ 3. $P = 18$
    $b = 16$ $q = 23$
    $c = 6$

Exercise 2 *(Refer to pages 198-199 of Learner's Book 7)*

1. The co-domain is "3times" the domain.
2. The co-domain is the "square of" the domain.
3. The co-domain is "half of the" domain
4. The co-domain is the domain divided by 5 or '$\frac{1}{5}$ of' the domain (one-fifth)
5. The co-domain is the "square root" of the domain.

Exercise 3 *(Refer to page 200-201 of Learner's Book 7)*

1. (i)   The cost of breakfast for one worker on the field trip is GH₵3.00
    (ii)   40 workers
    (iii)   *GH₵465.00*
    (iv)   1,232 workers

2. (i)   one shoe cost *GH¢*5.00
   (ii)   a.   *GH¢*25.00
          b.   80 students
          c.   *GH¢*525.00

Exercise 4 *(Refer to pages 205-206 of Learner's Book 7)*

1.   The rule is $x \longrightarrow x + 2 (shape\ x\ triangle + 2\ sticks)$
     (i) For each shape to be added two matches sticks are used.
     (ii) Rule is 2^{x+1}
     (iii) The shape twice plus 1 will give the number of matches sticks
     (iv) 206 matches sticks

Shape number	1	2	3	4	5	6	7	8	10	50
Number of match sticks	3	5	7	9	11	13	15	17	21	105

2. (i)   Rectangle with a diagonal line. (made of 5 lines)
   (ii)   Shape number X 4 plus 1 will give the number of match sticks
   (iii) 5 match sticks make each shape
   (iv)

Shape number	1	2	3	4	5	6	21	111
	5	9	13	17	21	25	85	445

Exercise 5 *(Refer to pages 208-209 of Learner's Book 7)*

1. $x \longrightarrow 2x - 3, \quad n = 15$
2. $x \longrightarrow 2x + 1, \quad n = 27$
3. $x \longrightarrow x + 5, \quad n = 1125$
4. $x \longrightarrow 3x, \quad n = 375$
5. $x \longrightarrow x^2 + 2, \quad n = 291$

Exercise 6 *(Refer to page 211 of Learner's Book 7)*

1.   a. $x = 5$ b. $x = 5$ c. $x = 45$ d. $x = 9$ e. $x = 7$
2.

Shape number (x)	1	2	3	4	5	6	7	8	10	50
Number of match stick (*y*)	5	8	11	14	17	20	23	26	32	152

n = 152   Rule $n \longrightarrow 3x + 2$

3.

Numbers of boys (x)	5	7	9	11	13	15	81
Number of girls (y)	25	33	41	49	57	65	329

$n = 329$ Rule $n \longrightarrow 4x + 5$

Exercise 7 *(Refer to page 214 of Learner's Book 7)*

1.

x	−3	−2	−1	0	1	2	3
Y	2	3	4	5	6	7	8

2.

x	−2	−1	0	1	2	3
Y	0	−6	−8	−6	0	10

3.   i.

x	−2	0	2	4	6
Y	−9	−7	−5	−3	−1

ii.

x	−3	−1	1	3	5
y	−15	−9	−3	3	9

iii.

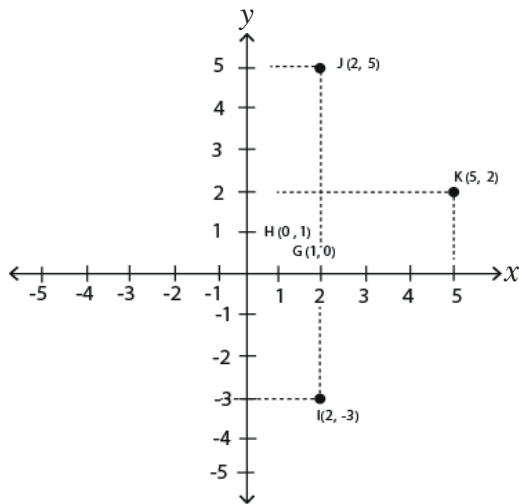| x	1	2	3	4	5
y	4	5	6	7	8

Exercise 8 *(Refer to page 216 of Learner's Book 7)*
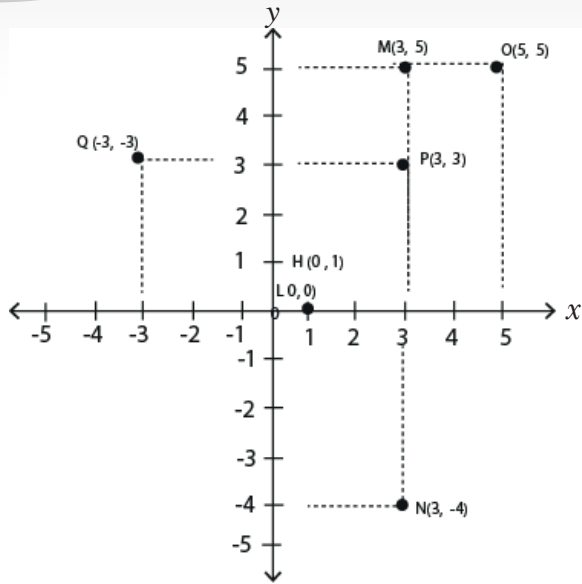
d.
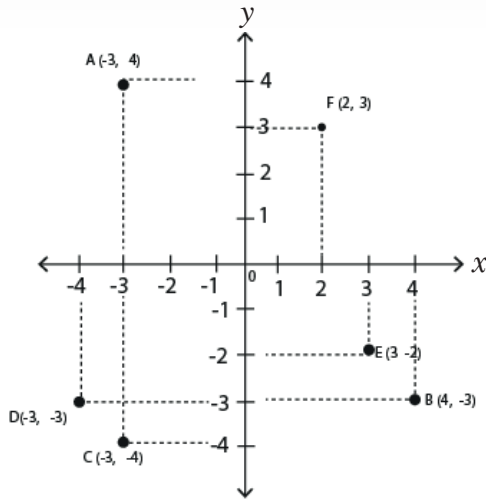
e.

f.

Exercise 9 *(Refer to page 218 of LB)*

1. Square   2. Pentagon   3. Triangle   4. (-2, -5)

STRAND 2: ALGEBRA
SUB-STRAND 2: ALGEBRAIC EXPRESSIONS

Exercise 1 *(Refer to page 213 of Learner's Book 7)*

1. $x - 25$
2. $12x$
3. $x + 15$
4. $\frac{1}{4}x$
5. $\frac{1}{5}x$
6. $17x + 26$
7. $15x - 19$
8. $\frac{1}{2}x + 11$
9. $\frac{1}{4}x - 16$
10. $\frac{1}{2}(7 - 4x)$
11. $10 - \frac{1}{5}x$
12. $\frac{1}{10}x - 4$
13. $\frac{1}{3}(6x - 9)$
14. $2x + 13 = 38$

Exercise 2 *(Refer to page 226 of Learner's Book 7)*

1. $2(x + y)$ units
2. L 10 square units
3. 31years old
4. 4.
5. $Y - x$ (cedis)

Exercise 3 *(Refer to pages 231-232 of Learner's Book 7)*

1. a $4x + 2y$
   b. 7x + 6y
   c. 3x + 2k + 2y
   d. $4x + 4k + 3y$
   e. 12x + 3k + 3y
2. a. $7x + 8y$
   b. 26x
   c. 50y
   d. $20abc$
   e. 159xy
3. a. $25x$
   b. 7x + 5n + 11y
   c. 30y
   d. $27x + 27y$
   e. 6x + 4y
4. a. $6x - 5y$
   b. -2x
   c. 6x
   d. $7y$
   e. 4a
5. a. $28x - 7y - 3$
   b. $61p + 21q$
   c. y = 11
   d. $x + 29xy - 13$
   e. $2abc - 6ab + 9bc$
6. a. $2(x + y)cm$
   b. $(2x + y + 5)cm$
   c. $(x + y + 23)cm$
   d. $4x + 4y = 4(x + y)cm$

Exercise 4 *(Refer to page 237 of Learner's Book 7)*

1. a. $42p^5$
   d. $-39ab^2$

   b. $45x^5y^7$
   e. $42x^2y^2$

   c. $-2,520abc$

2. a. $9y^2cm^2$
   d. $(6x^2 - \frac{22}{7}y^2)cm^2$

   b. $150xycm^2$
   e. $14y^2cm^2$

   c. $(12y^2 - 5x^2)cm^2$

3. a. $\dfrac{8y^2}{9x^3}$
   d. $\dfrac{r3c}{2q} = \left[\dfrac{1}{2}\dfrac{r3c}{q}\right]$

   b. $7x^2y^6$
   e. $\dfrac{1vw^2}{3u}$

   c. $\dfrac{a^2b^2c}{4}$

Exercise 5 *(Refer to pages 243-244 of Learner's Book 7)*

1. a. $35pz = \left[-70\right]$
   d. $x^2p^2 - x3$

   b. $10xy + 3p = \left[156\right]$
   e. $28x - 7y - 3\left[46\right]$

   c. $6z - x^2 + 2y^2\left[35\right]$

2. a. $\dfrac{2y^2}{x}\left[32\right]$
   d. $\dfrac{4y^2}{7x^2}\left[2\dfrac{2}{7}\right]$

   b. $\dfrac{4b}{3z}\left[-\dfrac{4}{3}\right]$
   e. $\dfrac{9yz}{4x}\left[13\dfrac{1}{2}\right]$

   c. $\dfrac{4a^2}{5c^2y}\left[3\dfrac{3}{5}\right]$

3. a. perimeter = 36 units
      Area = 25 units
   b. perimeter = 15 units
      Area = 25 units
   c. perimeter=8yunits
      Area = 4y²sq. units
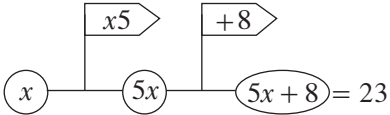   d. perimeter = 24units
      Area = 40sq. units

Exercise 6 *(Refer to page 245 of Learner's Book 7)*
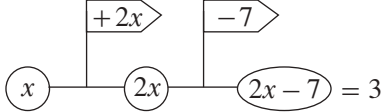
1. $\dfrac{p^2q^2x^4y^2}{q}$

2. $\dfrac{7x^2 + 2^2}{3x^2}$

3. $4\dfrac{2}{3}x^2\left(\dfrac{14x^2}{3}\right)$

4. $-x^2y - 4xy^2$
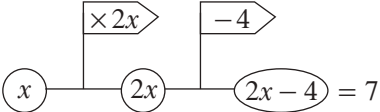
5. $7a - 7a^3 + 14a^4$

6. $xy^2 - 2x^2y + 2xy$

7. $6ab - 5a^2b$

8. $5 + y$

9. $3pq - 6q + 9p$

10. $\dfrac{7y^3}{3x^3} + 2xy - 2y^3$

CHAPTER 2: ALGEBRA
UNIT 3: VARIABLES AND EQUATIONS

Exercise 1 *(Refer to page 251 of Learner's Book 7)*

1. a.

$(5x + 8) = 23$

   b.

$(2x - 7) = 3$

   c.

$(2x - 4) = 7$

2. a. $2x - 5 = 27$ b. $2x + 10 = 85$
3. a. $x = 7$ b. $x = 1$ c. $y = 12$ d. $m = 4$ e. $n = 80$

Exercise 3 *(Refer to page 266 of Learner's Book 7)*

1. $x = 6$ 6. $x = 5$
2. $w = 3$ 7. $y = 18$
3. $r = \frac{1}{2}$ 8. $w = 10$
4. $k = 2$ 9. $x = 3$
5. $z = 4$ 10. $x = 1$

STRAND 3: GEOMETRY AND MEASUREMENT
SUB-STRAND 1: SHAPES AND SPACE

Exercise 1 *(Refer to pages 269-270 of Learner's Book 7)*

1.
b.	reflex angle	e.	obtuse angle
c.	reflex angle	f.	right angle
d.	right angle	g.	acute angle

2. Refer to page 264 of the Learner's Book 7
c. There is no right angle found in the figure.
d. The acute angles are: angles D, E, H and K respectively.
e. The obtuse angles are: angles A, N and I.
f. The reflex angles are: angles B, M and J.

Exercise 2 *(Refer to pages 270 of Learner's Book 7)*
Mark and if possible correct learners' drawings.

Exercise 3 *(Refer to pages 272-273 of Learner's Book 7)*

1.
b.	is complementary angle	g.	is supplementary angle
c.	is supplementary angle	h.	is not complementary angle
d.	is supplementary angle	i.	is complementary angle
e.	is complementary angle	j.	is supplementary angle
f.	is supplementary angle	k.	is complementary angle

NB: Check learners diagrams and measurement and then mark.

2.
c.	$y = 62°$	h.	$x = 45°$
d.	$x = 75°$	i.	$x = 23°$
e.	$x = 37.5°$	j.	$y = 35°$
f.	$x = 80°$	k.	$z = 98°$
g.	$x = 33°$	l.	$a = 110°$

Exercise 4 *(Refer to pages 275-277 of Learner's Book 7)*

1.
b.	adjacent angles	e.	supplementary angles
c.	vertically opposite angles	f.	complementary angles
d.	complementary angles		

2.   a. $x = 55°$ b. $y = 99°$ c. $x = 45°$ d. $x = 25.7°$

3.   Refer to the answers in Exercise and follow the steps to answer the question

4.
e.	$x = 133°$	h.	$x = 37°$	$y = 47.7°$
f.	$q = 90°$	i.	$f = 95.3°$	
g.	$x = 105°$	j.	$h = 47.7°$	

Exercise 5 *(Refer to pages 277-279 of Learner's Book 7)*

1. $a = 100°$ $h = 80°$ $y = 80°$
      $x = 80°$ $t = 100°$

2. $x = 20°$

3. $2x = 76°,\ \ a = 76°$
      $b = 24°$ $x = 80°$

4. $t = 120°$ $p = 60°$

5. $y = 140°,$ $t = 40°,$ $x = 40°,$ $p = 140°$

6. $y = 90°,$ $x = 10°,$ $p = 50°$

7. $a = 60°$

STRAND 3: GEOMETRY AND MEASUREMENT
SUB-STRAND 2: MEASUREMENT

Exercise 1 *(Refer to page 296 of Learner's Book 7)*

1.	13mm 20cm	3.	0.012km
2.	12.4cm	4.	21,005 millimetres

Exercise 2 *(Refer to page 301 of Learner's Book 7)*

1. a $22cm$ b. $69\frac{1}{7}cm$
2. $radius = 7cm$
3. a. $25.1cm$ b. $15.7cm$

Exercise 3 *(Refer to pages 303-304 of Learner's Book 7)*

1. a. 4 square units; 7 triangles
2. a. $4\frac{1}{2}$ square units; 6 triangles

Exercise 4 *(Refer to pages 307-308 of Learner's Book 7)*

1. a. 10 squares units; 10 square units' b. 9 square unit
2. b. 15 square units

Exercise 5 *(Refer to page 309 of Learner's Book 7)*

1.	72cm^2	3.	180m^2
2.	120mm^2	4.	120km^2

Exercise 6 *(Refer to pages 310-311 of Learner's Book 7)*

1. 045°
2. 325
3. 295°
4. a. 090°
   b. 225°

Exercise 7 *(Refer to page 317 of Learner's Book 7)*

1. 280˚
2. 135°
3. 270°

4. a. 090°   b. 045°
5. 305°

Exercise 8 *(Refer to page 319 of Learner's Book 7)*

Scalar has size but no direction
Vector has magnitude and direction

Exercise 9 *(Refer to page 325 of Learner's Book 7)*

1. 5units
2. 15units
3. 5units
    Find the direction from a graph
4. 10cm

STRAND 3: GEOMETRY AND MEASUREMENT
SUB-STRAND 3: POSITION AND TRANSFORMATION

Exercise 1 *(Refer to page 335 of Learner's Book 7)*
Refer to the examples solved in the Learner's Book

Exercise 2 *(Refer to page 337 of Learner's Book 7)*

    e. $(2, -3)$
    f. $(-6, 1)$
    g. $(0, -1)$

Exercise 3 *(Refer to page 339 of Learner's Book 7)*

$\triangle PQR$ and $\triangle XYZ$ are congruent. The circles are similar

STRAND 4: HANDLING DATA
SUB-STRAND 1: DATA

Exercise 1 *(Refer to page 344 of Learner's Book 7)*
    1.   Refer to Example 2 page 343 of Learner's Book 7.

Exercise 3 *(Refer to page 361-365 of Learner's Book 7)*

    1.

        a. Frequency Table

Number of Marbles (x)	Tally	Frequency (f)
1	////	4
2	//////	8
3	///////	10
4	//////	8
5	////	5
6	////	5

        b. A bar graph should be drawn.
        c. i) 3
          ii) $4 + 8 = 12$
          iii) $5 + 5 = 10$
          iv) 5
          v) $4 + 8 = 12$

    2.   a. Frequency table

Number of Marbles (x)	Tally	Frequency (f)
5	/////	6
6	/////	6
7	///////	8
8	//////	7
9	////	4
10	////	5

      b. Draw a bar chart
      c.   i) 7
          ii) 9
          iii) 36
          iv) 877 = 15
          v) 7

Exercise 4 *(Refer to page 371 of Learner's Book 7)*

1.	7		6.	6
2.	70		7.	80
3.	140		8.	111
4.	5		9.	5
5.	11			

Exercise 5 *(Refer to page 374 of Learner's Book 7)*

1.   28kg
2.   2.2
3.   1.34
4.   80
5.   51kg

Exercise 6 *(Refer to page 377-378 of Learner's Book 7)*

1.   a. 6
        b. 48
        c. 10
        d. 121
        e. 5
        f. 50

2.   a. 14
        b. 24
        c. 3

STRAND 4: HANDLING DATA
SUB-STRAND 1: CHANCE OR PROBABILITY

Exercise 1 *(Refer to page 381 of Learner's Book 7)*

A. 1   Possible   2. Impossible   3. Possible   4. Impossible   5. Impossible

B. 1. Impossible 2. Certainly   3. Certain   5. Certain   5. Certain

    6. Possible   7. Certain   8. Possible

Exercise 2 *(Refer to page 383 of Learner's Book 7)*

1. a. possible
    b. impossible
    c. possible
    d. possible
    e. possible
    f. impossible
    g. possible
    h. possible

2. a. possible
    b. possible
    c. possible
    d. possible
    e. impossible
    f. possible
    g. impossible
    h. impossible

Exercise 2 *(Refer to page 366 of Learner's Book 7)*

The probability of rolling	Fraction	Decimals	Percentage	Ratios
Obtaining an even number	$\frac{3}{6} = \frac{1}{2}$	0.5	50%	1 : 2
Factors of 5	$\frac{4}{6} = \frac{2}{3}$	0.667	66.67%	2 : 3
A multiple of 3	$\frac{2}{6} = \frac{1}{3}$	0.33	33.33%	1 : 3
Factors of 2	$\frac{2}{6} = \frac{1}{3}$	0.33	33.33%	1 : 3
Divisiors of 12	$\frac{5}{6}$	0.83	83%	5 : 6
A 3 or greater	$\frac{2}{3}$	0.67	66.67%	2 : 3
Factors of 4				
Smaller than 4	$\frac{1}{2}$	0.5	50%	1 : 2