

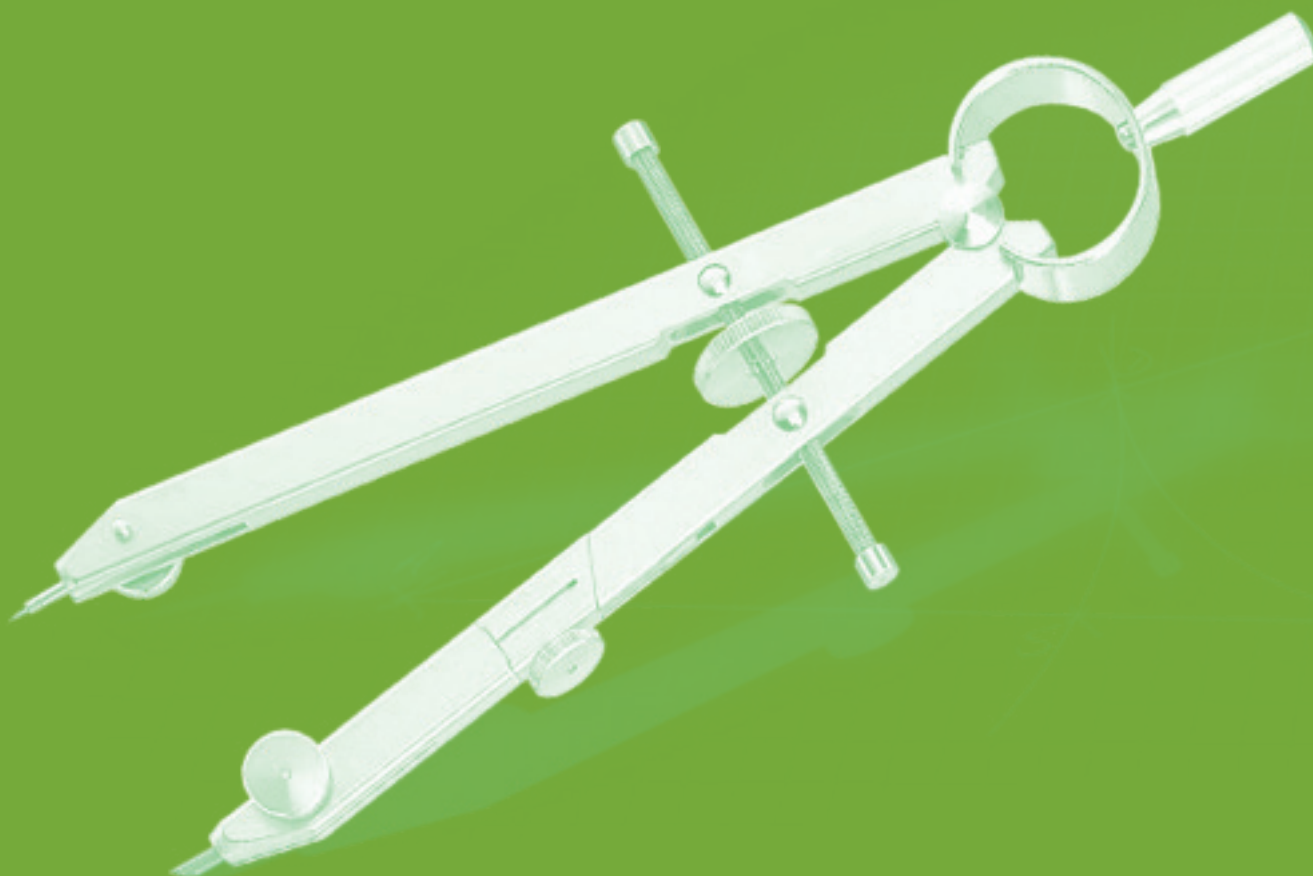
ESSENTIAL



Mathematics

Basic 8

Facilitator's Guide



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Approved**



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ESSENTIAL

Mathematics

Basic 8

Facilitator's Guide

Adwoa Nkrumah • Vida Takyi
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INTRODUCTION

"Essential Mathematics Teacher Guide" is a comprehensive and invaluable resource designed to empower junior high school teachers in their quest to inspire a love for mathematics and foster mathematical proficiency among final year students. This teacher guide is carefully written to support you in delivering engaging and effective math instruction that equips your students with the foundational skills and critical thinking abilities they need to succeed not only in their academic journey but also in their future endeavors.

Mathematics is often referred to as the universal language, a language that transcends cultural boundaries and offers a powerful lens through which we can understand and interact with the world. At the junior high school level, it becomes crucial to nurture students' mathematical curiosity and provide them with a solid foundation upon which they can build their mathematical prowess and prepare adequately for their transition to senior high school or the world of work. This guide is designed to be your compass on this journey.

Key Features of “Essential Mathematics Teacher Guide”

Comprehensive Curriculum Coverage: This guide covers the essential topics in the Common Core Programme Mathematics Curriculum for Junior High Schools in Ghana, from concepts of number to algebra, geometry, measurement and data. It provides a clear roadmap for structuring your lesson to ensure a well-rounded mathematics learning for your students.

Pedagogical and Assessment Strategies: The guide offers you the opportunity to discover innovative teaching and assessment approaches that make math come alive in your classroom. Explore ways to create a nurturing and inclusive learning environment where every student feels empowered to participate and excel. Besides, it aids you to tailor your teaching methods based on the insights gained from ongoing assessment, enabling you to provide targeted support to your students.

Differentiation: The guide creates the avenue to recognize the diverse needs of your students and gain insights into how to differentiate instruction to accommodate various learning styles and abilities. This guide offers practical tips for reaching every learner effectively.

Technology Integration: Embrace the digital age and leverage technology to enhance your math instruction. It suggests teaching and learning activities that infuses technological tools and resources and how to incorporate these to engage students and promote deeper understanding.

Real-World Applications: Show your students the real-world relevance of mathematics by incorporating practical examples and projects that resonate with learners' everyday experiences. Foster their problem-solving skills and critical thinking by connecting math to everyday life.

Our aim is to provide you with the guidance and support you need to inspire your students, instill in them a passion for mathematics, and help them reach their full mathematical potential. Together, we can open the doors to a world of mathematical discovery and achievement for your junior high school students.

Sub-strand 1: Number and numeration systems**Module 1****Numbers****Content standard**

B8.1.1.1 Demonstrate understanding and the use of place value for expressing quantities in standard form and rounding numbers and decimals to significant figures and a given number of decimal places.

Indicator

B8.1.1.1.1 Apply the understanding of place value to read and write in number quantities over 1,000,000,000.

Learning expectations: In this module, learners will learn how to:

- Read and write numbers in words.
- Skip count forwards and backwards.

Essential for learning: Learners can count forwards/backwards from 100 up to 1,000.

Resources: Number work cards.

Keywords: Number, numeration, million, billion, backwards, forwards.

Competencies: Communication and Collaboration.

Starter: Refer learners to Learner's Book page 2 for warming up activity.

Main idea 1

Reading and writing numbers in words

LB page 2

Activity 1: Write some numbers on the board for learners to read. E.g.

a. 1,000,000 one million

b. 1,000,000,000 one billion

Let them count the number of zeros in each number. One million has six zeros whilst one billion has nine zeros. Let them also count the numbers of digits in one million and one billion.

Activity 2: Put learners into convenient groups. Write some numbers on the board for learners to read and write in words. E.g.

a. 5,645,245

b. 1,000,222,561

b. Five million, six hundred and forty five thousand, two hundred and forty five.

c. One billion, two hundred and twenty two thousand, five hundred and sixty one.

Activity 3: In pairs, have learners write their own figures and write them in words.

Activity 4: Go through the worked examples with learners on pages 3 - 5 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Read and write these in words.

1. 6,258,452

2. 4,640,200

Challenging activity

Work in pairs. Write words for these figures

a. 22,654,289,162

b. 12,132,605,230

Assessment tasks ----- LB page 4

Refer learners to the Learner's Book page 4 for exercise.

Suggested homework

Write these numbers in words.

1. 7,252,001

2. 1,221,488,625

3. 11,000,101,201

4. 12,217,999,001

Main idea 2

Skip counting forwards and backwards in 10,000s, 100,000s, 500,000s **LB page 4**

Activity 1: Have learners be in their previous groups. Let them skip count forwards and backwards in 10,000 starting from 10,500 up to 100,500. Repeat with different numbers.

Activity 2: Write some numbers on the board. E.g. 16,000,230. Ask them to count in 500,000s up to 18,000,230. Let them know that in skip counting in 500,000s you keep on adding 500,000 to the previous number. Hence 16,000,230 becomes 16,500,230, 17,000,230, 17,500,230, 18,000,230, 18,500,230.

Activity 3: Refer learners to pages 4 - 5 of their Learner's Book. Go through the worked examples with them.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs and count in turns. Skip count forwards and backwards in 10,000s up to the fifth number.

1. 12,600,211

2. 1,225,600,981

Challenging activity

Work in pairs. Count in turns.

Skip counting forwards and backwards in 100,000 of the following numbers up to the fifth terms.

1. 2,428,680

2. 6,486,532,005

Assessment tasks ----- LB page 6

Refer learners to the Learner's Book page 6 for exercise.

Suggested homework

1. Write the next five numbers after 130,250,112 by skip counting in 500,000s.
2. Write the first three numbers before 12,400,160 by counting backwards in 50,000s.

Answers to Assessment tasks

Main Idea 1

(LB page 4)

1.
 - a. Fifty-two million, three hundred and seventy-four thousand, one hundred and thirty-eight.
 - b. Two billion, three hundred and seventy-one million, four hundred and fifteen thousand, six hundred and twenty-three.
 - c. Two billion, nine hundred million, four hundred and one thousand, five hundred and nine.
 - d. Five billion, four hundred and thirty-six million, twenty-five thousand, three hundred and seventy.
 - e. Nine billion, two million, six hundred thousand, two hundred and fifty-six.
2.

a. 3,070,058	b. 2,320,675,300	c. 18,945,015,612
d. 95,233,000,620	e. 10,020,080,413	

Main Idea 2

(LB page 6)

- | | | | | | | | | |
|-----------|-----------|-------------|---|-------------|---|-------------|---|-------------|
| 1. | a. | 2,749,310 | ; | 2,849,310 | ; | 2,949,310 | ; | 3,049,310 |
| | b. | 15,425,402 | ; | 15,725,402 | ; | 16,025,402 | ; | 16,325,402 |
| | c. | 28,975,289 | ; | 28,475,289 | ; | 27,975,289 | ; | 27,475,289 |
| | d. | 181,042,120 | ; | 181,542,120 | ; | 182,042,120 | ; | 182,542,120 |
| | e. | 151,201,300 | ; | 150,001,300 | ; | 148,801,300 | ; | 147,601,300 |
| 2. | | 8,550,178 | ; | 8,850,178 | ; | 9,150,178 | | |
| 3. | | 120,143,910 | ; | 119,643,910 | ; | 119,143,910 | ; | 118,643,910 |
| 4. | a. | 380,649,400 | ; | 380,449,400 | ; | 380,349,400 | | |
| | b. | 2,805,659 | ; | 3,305,659 | ; | 3,805,659 | | |

Sub-strand 1: Number and numeration systems**Module 2****Comparing and ordering whole numbers using the symbols $>$, $<$, and $=$** **Content standard**

B8.1.1.1 Demonstrate understanding and the use of place value for expressing quantities in standard form and rounding numbers and decimals to significant figures and a given number of decimal places.

Indicator

B8.1.1.1.3 Compare and order whole numbers using “ $>$, $<$ and $=$ ”.

Learning expectations: In this module, learners will learn how to:

- Compare whole numbers up to nine digits using the symbols $<$, $>$ and $=$.
- Order whole numbers up to nine digits.

Essential for learning: Learners can compare and order three-digit numbers.

$<$ $>$ $=$ cards

Resources: Symbols of $<$, $>$ and $=$ on cards.

Keywords: Compare, order.

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to the Learner's Book page 7 for warming up activities.

Main idea 1

Comparing and ordering whole numbers using the symbols $>$, $<$, and $=$ symbols **LB page 7**

Activity 1: Revise the previous lesson with learners. Write two numbers on the board and let learners tell you the bigger or smaller one. E.g. 2,685 and 42,310.

Let them discuss with a learner next to him or her. They should explain why.

Activity 2: Ask each pair to write two different numbers with six digits each and to compare them.

Activity 3: Refer learners to the Learner's Book pages 7 - 8. Let them read through the rules. Let them change their partners. Ask each learner to write a seven-digit number and to compare them using the symbols cards $<$, $>$ and $=$.

Activity 4: Go through the worked examples with learners on pages 8 - 9 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Give them the symbol cards. Let them use them to compare some numbers. E.g.

1. 2,468 and 2,463

2. 42,344,800 and 39,685,498

Challenging activity

Work in pairs.

Which is greater?

1. 6,230,821,360 or 6,312,414,200

2. 280,468,113 or 2,810,468,113

Assessment tasks ----- LB page 9

Refer learners to the Learner's Book page 9 for exercise.

Suggested homework

Use the symbols $<$, $>$, and $=$ to compare these numbers.

1. 84,685,200 and 85,432,989

2. 7,843,666 and 7,843,664

3. 5,001,385,429 and 5,100,351,000

Main idea 2

Ordering whole numbers

LB page 10

Activity 1: Revise the previous lesson with learners. Put learners into convenient groups. Write some numbers on the board. Let them arrange them in ascending and descending orders. E.g.

1. 65,425,201, 56,928,899, 65,452,102

2. 113,989,600, 131,998,700, 133,946,888

Activity 2: Go through the worked examples with learners on page 10 of the Learner's Book.

Activity 3: Have learners work in threes, each learner writes a number. They compare the three numbers and order them in ascending and descending orders.

Activity 4: Go through the worked examples on page 10 with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs, write these numbers in ascending and descending orders.

31,265,201, 13,998,878, 32,005,999

Challenging activity

Have learners work in fours.

Each person writes a six-digit number. They rewrite the numbers in ascending and descending orders.

Assessment tasks ----- LB page 11

Refer learners to the Learner's Book page 11 for exercise.

Suggested homework

Write four eight-digit numbers and order them in ascending and descending orders.

Answers to Assessment tasks

Main Idea 1

(LB page 9)

1. a. $>$ b. $<$ c. $>$ d. $=$ e. $=$
2. a. 738,173,251 is greater b. 210,946,587 is greater
c. 603,716,205 is greater d. 491,826,353 is greater
3. a. $>$ b. $=$ c. $>$ d. $=$
4. a. 83,621,984 is 100,000 more than 83,521,984
or 83,521,984 is 100,000 less 83,621,984
b. 968,974,654 is 1,500,000 more than 967,474,654
or 967,474,654 is 1,500,000 less than 968,974.654

Main Idea 2

(LB page 11)

1. Ascending order
 - a. 667,676,000; 677,000,214; 700,079,576
 - b. 12,364,900; 12,365,200; 580,330,552
 - c. 52,738,456; 660,453,005; 662,453,005
 - d. 14,305,695; 72,158,672; 97,999,100; 805,553,220

2. Descending order

a. 86,723,100; 86,601,584; 86,577,881; 86,360,019

b. 891,643,852; 890,346,528; 724,813,520; 715,803,400

3. a. The smallest number is 96,348,625

b. The smallest number is 476,200,300.

4. a. The largest number is 728,903,700

b. The largest number is 270,364,820.

Sub-strand 1: Number and numeration systems

Module 3

Integers

Content standard

B8.1.1.1 Demonstrate understanding and the use of place value for expressing quantities in standard form and rounding numbers and decimals to significant figures and a given number of decimal places.

Indicator

B8.1.1.1.4 Express integers of any size into standard form.

Learning expectations: In this module, learners will learn how to:

- Write integers in standard form.
- Express integers to a given number of significant figures.
- Express integers to a given number of decimal places.

Essential for learning: Learners can write multiples of numbers.

Resources: Work cards.

Keywords: integer, significant figure, standard form

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to page 12 of the Learner's Book for quick mental activity.

Main idea 1

Numbers in standard form

LB page 12

Activity 1: Write some numbers on the board for learners to expand.

E.g.

1. a. x^3

b. a^5

c. y^2

2. Write the following in index form

a. $a \times a \times a$

b. $x \times x \times x \times x$

c. $d \times d \times d \times d$

Activity 2: Refer learners to the Main idea 1 on page 12. Have learners read through the hints.

Activity 3: Pair learners. Write some numbers on the board for the learners to write in standard form. E.g.

1. 200

2. 4,000

c. 0.0005

1. $200 = 2 \times 10^2$

2. $4,000 = 4 \times 10^3$

Guide learners to write the non-zero digit. Thus $0.0005 = 5 \times 10^{-4}$.

Let learners know that the decimal point moves four places to the left so the power of 10 is negative.

Activity 4: Go through the worked examples with learners on pages 13 - 14 of their Learner's Book.

Activity 5: Still in pairs, guide them to convert numbers in standard form to ordinary numbers. Examples:

1. $4 \times 10^5 = 4 \times 10 \times 10 \times 10 \times 10 \times 10 = 400,000$

2. $6.08 \times 10^{-2} = 6.08 \div 100 = 0.0608$

Review exercise

Differentiated lessons

Remedial activity

Work in pairs: Write these numbers in standard form.

1. 56,000

2. 0.289

Challenging activity

Work in pairs. a. Write 70,286 in standard form.

b. Convert 2.861×10^{-3} to an ordinary number.

Assessment tasks ----- LB page 14

Refer learners to page 14 of the Learner's Book for exercise.

Suggested homework

Write in standard form. 1. 630

2. 2.689

Convert to ordinary numbers. 3. 6.008×10^{-4}

4. 9.14×10^2

Main idea 2

Expressing integers in a given number of significant figures
LB page 15

Activity 1: Revise the previous lesson with learners. Remind learners that in Basic 7, they learnt how to express integers in a given number of significant figures. Let them read the rules for determining how many significant figures are in a number on page 15 of their Learner's Book. They should give their own examples.

Significant figures are the number of digits in a value or a measurement that decide the accuracy and precision of measurement.

The accuracy of the measurement depends on the number of significant figures in a number.

Rules for determining how many significant figures are in a number:

1. All non-zero figures are significant, for example, 2,653 has four significant figures.
2. Sandwiched zeros (zeros between two significant digits) are significant. For example, 2,032 and 400.5 each have four significant figures. The zeros are counted as significant.
3. Trailing zeros (zeros at the end of a number) are significant only if the number has a decimal point. Thus in 3,900, the two trailing zeros are not significant because the number does not include a decimal point. The number 3,900 has two significant figures. However, in 3,900.0, all five digits are significant because the number has a decimal point.
4. Leading zeros (zeros that are at the beginning of a number that is smaller than 1) are not significant. For example, in 0.00789, the first three digits are leading zeros which are not significant. So, 0.00789 has three significant figures.
To correct an integer to a given number of significant figures, first find the last significant figure you want.
Then consider the next significant figure. If the figure is smaller than 5, round it down, but if it is 5 or greater than 5, round it up. Add 1 to the significant figure.

Activity 2: Put learners into convenient groups. Write some numbers on the board for learners to solve. Example:

Write 1. 7,222 to 3 significant figures

2. to 2 significant figures

1. 7,222 to 3 significant figures = 7,220

2. 7,222 to 2 significant figures = 7,200

Activity 3: Have learners work in pairs. They write their own questions and solve them.

Activity 4: Go through the worked examples with learners on pages 15 - 16 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Correct 1. 285 to 2 significant figures

2. Express 10.258 to 4 significant figures

Challenging activity

Correct 1. 2.60584 to 5 significant figures

2. Correct 7006052 to 5 significant figures

Assessment tasks ----- LB page 16

Refer learners to the Learner's Book page 16 for exercise.

Suggested homework

1. Correct 16.089 to

a. 1 significant figures

b. 3 significant figures

c. 5 significant figures

2. Correct 28005 to

a. 4 significant figures

b. 3 significant figures

Main idea 3

Expressing a number to a given number of decimal places
LB page 17

Activity 1: Revise the previous lesson with learners. Write some numbers on the board, for example 30.678. Demonstrate how to convert them to the decimal place required.

1. 2 decimal places 2. 1 decimal places 3. 4 decimal places

30.678 to 2 decimal places. We consider the third figure after the decimal point which is 8, 8 is more than 5 so we add 1 to the number before it.

\therefore 30.678 to 2 decimal places = 30.68

30.678 to 1 decimal places = 30.7

30.678 to 4 decimal places = 30.6780

Activity 2: Go through the worked examples with learners on pages 17 - 18 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

Correct 20.8651 to 1. 2 decimal places 2. 3 decimal places 3. 1 decimal places

Challenging activity

Work in pairs to solve these.

Correct 20.68005 to 1. 3 decimal places 2. 5 decimal places 3. 1 decimal places

Assessment tasks ----- LB page 18

Refer learners to the Learner's Book page 18 for exercise.

Suggested homework

1. Correct 12.6059 to a. 2 decimal places b. 1 decimal places
2. Correct 326.00689 to a. 3 decimal places b. 4 decimal places

Answers to Assessment tasks

Main Idea 1

(LB page 14)

- | | | | |
|----------------------------|--------------------------|--------------------------|--------------------------|
| 1. a. 2.6812×10^2 | b. 5.69323×10^3 | c. 4.0×10^5 | d. 3.57×10^{-1} |
| e. 7.05×10^{-4} | f. 8.0×10^0 | g. 5.43×10^{-2} | h. 4.498×10^0 |
| i. 1.357×10^{-3} | j. 6.3145×10^2 | | |
| 2. a. 8,570 | b. 366,000 | c. 0.0509 | d. 0.000914 |
| e. 0.7352 | f. 12,345,000 | g. 6,500,000 | h. 0.054 |
| i. 0.0000407 | j. 2.98 | | |

3. a. 1.0×10^2 b. 4.6×10^4 c. 8.01234×10^1 d. 5.0793×10^4
 e. 7.591356×10^3 f. 8.675×10^{-1} g. 7.008×10^2 h. 5×10^{-3}
 i. 2.653×10^5 j. 3.654×10^0
4. a. 453,500 b. 623 c. 0.007088 d. 8,200 e. 0.0000005

Main Idea 2

(LB page 16)

1. a. 4 b. 6 c. 7 d. 4 e. 1
 f. 9 g. 5 h. 3 i. 4 j. 4
2. a. 80,000(1sf) b. 84,100(3sf) c. 84,050(4sf)
3. a. 3,943,700(5sf) b. 50,006,600(6sf) c. 410,000(3sf)
 d. 7,000,000(2sf) e. 87,540(4sf) f. 20,000(1sf)
 g. 540,000(2sf) h. 743,100(4sf) i. 1,090,000(3sf) j. 20(1sf)

Main Idea 3

(LB page 18)

1. a. 5.1(1dp) b. 5.07(2dp) c. 5.068(3dp)
2. a. 426.7(1dp) b. 426.75(2dp) c. 426.750(3dp)

3.

Number	One decimal place	Two decimal places	Four decimal places
a. 40.09534	40.1	40.10	40.0953
b. 123.40756	123.4	123.41	123.4076
c. 38.964951	39.0	38.96	38.9650
d. 19.999965	20.0	20.00	20.0000
e. 0.652749	0.7	0.65	0.6527
f. 0.008432	0.0	0.01	0.0084

4. a. Any two of these possible times:
 11.245 ; 11.246 ; 11.247 ; 11.248 ; 11.249
 11.250 ; 11.251 ; 11.252 ; 11.253 ; 11.254
 b. 10 times
5. a. Total mass is 0.8986 kg = 0.9 kg (1 decimal place)
 b. Mass of the lightest boy is 0.2959 = 0.30 (2 decimal place)

Sub-strand 1: Number and numeration systems**Module 4****Word problems on place value****Content standard**

B8.1.1.2 Apply the concepts and vocabulary of sets on sets of factors of numbers to identify perfect squares, determine their square root and solve real life problems involving union and intersection of two sets.

Indicator

B8.1.1.1.6 Create and solve word or real-life problems on place values.

Learning expectation: In this module, learners will learn how to:

- create and solve word or real-life problems on place values.

Essential for learning: Learners can determine the place value of four-digit numbers.

Resources: Word problems on cards.

Keywords: Thousands, hundreds, tens, ones, digit.

Competencies: Creativity and Innovation.

Starter: Refer learners to Starter on page 19 of the Learner's Book for warming up activities.

Main idea 1

Solving word on real life problems

LB page 19

Activity 1: Put learners into convenient groups. Ask each group to construct a word problem on addition. Let them read it to the class. Make corrections where necessary and let them solve it.

Activity 2: Give out sentence cards to each group. Let them read over and solve them.

E.g. Kwaku has 25 exercise books. His sister Ama has 15 exercise books. How many exercise books do they have altogether?

Activity 3: Refer learners to pages 19 - 20 of the Learner's Book. Go through the worked example with them.

Review exercise

Put learners into mixed ability groups. Give out sentence cards for each group to solve. Make sure the sentence cards are different.

1. 31,400,000
2. 33, 500,000

Assessment Task ----- LB page 20

Refer learners to the Learner's Book pages 20 - 21 for exercise.

Suggested homework:

Have learners solve these.
A farmer has 1,600 coconut trees in one of his farms. There was a disease which affected the trees. A certain number of tress were cut down leaving only 728. How many trees were cut down?

Answers to Assessment tasks

Main Idea 1

(LB page 20)

1. 47

2. 7,200

3. 2,856

4. 525

5. 200 tubers of yam

6. 317 points

7. 91,909

8. 3.6×10^8

Sub-strand 1: Number and numeration systems**Module 5****Concept of sets 1****Content standard**

B8.1.1.2 Apply the concepts and vocabulary of sets on sets of factors of numbers to identify perfect squares, determine their square root and solve real life problems involving union and intersection of two sets.

Indicator

B8.1.1.2.1 Use the concept of sets to identify perfect squares and determine the square roots. Use the knowledge on sets and sets of factors of numbers to solve problems.

Learning expectations: In this module, learners will learn how to:

- Identify perfect squares and perfect numbers.
- Use the idea of odd numbers to find the square root of the numbers.

Essential for learning: Learners can find factors of numbers.

Resources: Work cards.

Keywords: Perfect squares, perfect numbers.

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to Starter on the page 22 for warming up activity.

Main idea 1

Perfect squares and perfect numbers

LB page 22

Activity 1: Have learners tell you what they know about perfect squares and perfect numbers. If they are unable to, explain to them. I.e. When a number is multiplied by itself, you get a perfect square.

Example: $-6 \times -6 = 36$, and $6 \times 6 = 36$

Have learners come up with three perfect squares on their own.

Activity 2: Explain perfect numbers to learners. They are numbers that equals to the sum of their factors except the number itself. Ask learners to find the factors of these numbers and determine those that are perfect numbers, for example: (2, 4, 6 and 8).

Factors of 2 are (1,2) → Sum without the number itself is 1

Factors of 4 are (1,2,4) → Sum without the number itself is 3

Factors of 6 are (1,2,3,6) → Sum without the number itself is 6

Factors of 8 are (1,2,4,8) → Sum without the number itself is 7

It is only 6 which has the sum of its factors as 6, (**so 6 is a perfect number**).

Activity 3: Put learners into convenient groups. Let them find out if these two numbers are perfect numbers: 28 and 496.

Activity 4: Go through the worked examples with learners on page 23 of their Learner's Book.

Review exercise

Have learners work in pairs to determine the perfect numbers and perfect squares of these numbers: 4,6,8,9.

Assessment tasks ----- LB page 23

Refer learners to page 23 of the Learner's Book for exercise.

Suggested homework

1. Write down the first 6 perfect squares.
2. Find the multiples of these numbers and identify the set of perfect squares 4,6,7.

Main idea 2

Square roots of numbers

LB page 23

Activity 1: Revise the previous lesson with learners. Introduce the square root sign to learners by writing it on the board, $\sqrt{\quad}$ (square root).

Tell them that the square root is the inverse of squaring a number. The square root of \sqrt{a} is written as $\sqrt{a} = \pm a$.

Activity 2: Let learners know that there are two methods of finding the square root of numbers. They are repeated subtraction and prime factorisation.

Demonstrate the two methods on the board for learners to see. E.g.

Find the square root of 16.

1. Repeated subtraction

Keep on subtracting odd numbers starting from 1 until you get to zero.

E.g. $16 - 1 = 15$

$15 - 3 = 12$

$12 - 5 = 7$

$7 - 7 = 0$

Now let's count the number or the frequency in subtraction. It is 4 so the square root of 16 is 4.

Activity 3: Pair learners and ask them to find the square root of 25.

Activity 4: Demonstrate how to use the prime factorisation method. Ask learners to find the prime factors of $16 = 2 \times 2 \times 2 \times 2$. Let them pair the factors, select one and find the product. So pairing the factors we have (2×2) , (2×2) .

The product of one pair of factors is 2×2 , therefore the square root of 16 is 4.

Activity 5: Go through the worked examples with learners on pages 24 - 26 of their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve these.

1. Use repeated subtraction to find the square root of 81.
2. Use prime factors to find the square root of 64.

Assessment tasks ----- LB page 26

Refer learners to the Learner's Book page 26 for exercise.

Suggested homework

Find the square roots of these numbers. **1.** 121 **2.** 169 **3.** 225

Answers to Assessment tasks

Main Idea 1

(LB page 23)

1. {6, 28, 496}
2. [1, 4, 9, 16, 25, 36, 49, 64, 81, 100]
3. **a.** Multiples of 2: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, ...
Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, ...
Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, 45, ...
Perfect numbers: {6, 28, ...}
Perfect squares: {4, 9, 16, 25, 36, 64, 81, 100, ...}
Multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32, 36, ...
Multiples of 6: 6, 12, 18, 24, 30, 36, 42, 48, 54, ...
Multiples of 8: 8, 16, 24, 32, 40, 48, 56, 64, 72, ...
Perfect numbers: {6, 28, ...}
Perfect squares: {4, 16, 36, 64, 100, ...}
- c.** Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, ...
Multiples of 6: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, ...

Multiples of 7: 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, ...

Perfect numbers: {6, 28, ...}

Perfect squares: {25, 36, 49, 100, 144, 196, 225, ...}

d. Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, ...

Multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, ...

Multiples of 7: 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, ...

Perfect numbers: {6, 28, ...}

Perfect squares: {4, 9, 16, 36, 49, 64, 81, 100, ...}

e. Multiples of 2: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, ...

Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, ...

Multiples of 8: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, ...

Perfect numbers: {6, 28, ...}

Perfect squares: {4, 9, 16, 36, 64, 81, 100, ...}

4. Perfect numbers: {6, 28}

Perfect squares: {4, 9, 16, 25, 36, 49, 64, 81}

Main Idea 2

(LB page 26)

1. a. $64 - 1 = 63$

$$63 - 3 = 60$$

$$60 - 5 = 55$$

$$55 - 7 = 48$$

$$48 - 9 = 39$$

$$39 - 11 = 28$$

$$28 - 13 = 15$$

$$15 - 15 = 0$$

There are 8 subtractions

$$\therefore \sqrt{64} = 8$$

b. $100 - 1 = 99$

$$99 - 3 = 96$$

$$96 - 5 = 91$$

$$91 - 7 = 84$$

$$84 - 9 = 75$$

$$75 - 11 = 64$$

$$64 - 13 = 51$$

$$51 - 15 = 36$$

$$36 - 17 = 19$$

$$19 - 19 = 0$$

There are 10 subtractions

$$\therefore \sqrt{100} = 10$$

c. $144 - 1 = 143$

$$143 - 3 = 140$$

$$140 - 5 = 135$$

$$135 - 7 = 128$$

$$128 - 9 = 119$$

$$119 - 11 = 108$$

$$108 - 13 = 95$$

$$95 - 15 = 80$$

$$80 - 17 = 63$$

$$63 - 19 = 44$$

$$44 - 21 = 23$$

$$23 - 23 = 0$$

There are 12 subtractions

$$\therefore \sqrt{144} = 12$$

d. $576 = \sqrt{24}$

e. $\sqrt{169} = 13$

2. a. $17 \overline{) 289}$

$$\begin{array}{r} 17 \overline{) 289} \\ 17 \\ \hline 1 \end{array}$$

$$289 = 17 \times 17$$

$$\therefore \sqrt{289} = 17$$

b. $5 \overline{) 625}$

$$\begin{array}{r} 5 \overline{) 625} \\ 5 \\ \hline 125 \\ 5 \\ \hline 25 \\ 5 \\ \hline 5 \\ 5 \\ \hline 1 \end{array}$$

$$= 5 \times 5 \times 5 \times 5$$

$$625 = 5 \times 5 = 25$$

c. $2 \overline{) 576}$

$$\begin{array}{r} 2 \overline{) 576} \\ 2 \\ \hline 288 \\ 2 \\ \hline 144 \\ 2 \\ \hline 72 \\ 2 \\ \hline 36 \\ 2 \\ \hline 18 \\ 3 \\ \hline 9 \\ 3 \\ \hline 3 \\ 3 \\ \hline 1 \end{array}$$

$$1,764 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$576 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \quad \sqrt{1,764} = 2 \times 3 \times 7$$

$$\therefore \sqrt{576} = 2 \times 2 \times 2 \times 3 = 24 \quad \therefore \sqrt{1,764} = 42$$

d. $2 \overline{) 1,762}$

$$\begin{array}{r} 2 \overline{) 1,762} \\ 2 \\ \hline 882 \\ 3 \\ \hline 441 \\ 3 \\ \hline 147 \\ 7 \\ \hline 49 \\ 7 \\ \hline 7 \\ 7 \\ \hline 1 \end{array}$$

3. 56 seats

4. 64 chairs

Sub-strand 1: Number and numeration systems

Module 6

Concept of sets 2

Content standard

B8.1.1.2 Apply the concepts and vocabulary of sets on sets of factors of numbers to identify perfect squares, determine their square root and solve real-life problems involving union and intersection of two sets.

Indicator

B8.1.1.2.2 Use the knowledge on sets and sets of factors of numbers to solve real-life problems involving union and intersection.

Learning expectation: In this module, learners will learn how to:

- Use the concept of sets and the factors of numbers to solve problems.

Essential for learning: Learners can find factors or numbers.

Resources: Work cards.

Keywords: Set, perfect square, multiples, union of sets, intersector of sets, subset.

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to page 27 of the Learner's Book for warming up activities.

Main idea 1

Solving real-life problems involving the union and intersection of sets

LB page 27

Activity 1: Revise intersection and union of set with learners. Put them into convenient groups. Let them solve some problems on intersection of union on sets. E.g. Set A = {2,4,6,8,10,12}. Set B = {3,6,9,12,15}.

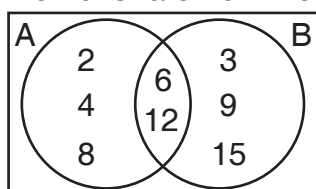
Find $A \cap B$ and $A \cup B$.

$A \cup B$ is the set of all elements belonging to either A or B or both.

Thus $A \cup B$ (2,3,4,6,8,9,10,12,15)

$(A \cap B)$ is the set of elements that belong to both A and B. Thus $(A \cap B) = \{6,12\}$.

Activity 2: Demonstrate how the two sets could be put in a Venn diagram.



From the diagram

$$A \cap B = \{6, 12\}$$

$$A \cup B = \{2, 3, 4, 6, 8, 9, 12, 15\}$$

Activity 3: Pair learners and let them find the union and intersection of these sets.

$$\text{Set } P = \{5, 10, 15, 20, 25\}$$

$$\text{Set } T = \{10, 20, 30, 40, 50\}$$

Let them exchange their work with the group next to them and check answers.

Activity 4: Go through the worked examples with learners on pages 28 - 30 of the Learner's Book.

Review exercise

Put learners into mixed ability groups to solve this. Given that P = factors of 12 and Q = factors of 16. Find **1.** $Q \cap P$ and **2.** $Q \cup P$.

Assessment tasks ----- LB page 30

Refer learners to page 30 of the Learner's Book for exercise.

Suggested homework

In a class of 20 learners, 10 play football and 5 play basketball and 2 play both games.

- 1.** Draw a Venn diagram to illustrate the given information.
- 2.** How many learners play none of the games?

Revision 1

Number and numeration systems ----- (LB page 31)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

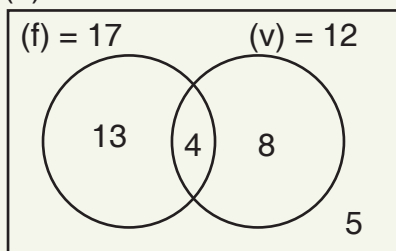
(LB page 30)

- 1.** 40 farmers
- 2.** 4 learners
- 3.** **a.** 45 learners **b.** 35 learners
- 4.** **a.** $A \cap B = \{4, 8, 12\}$; $A \cup C = \{2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14\}$
b. i. $(A \cap B) = 3$ **ii.** $(A \cap C) = 1$ **iii.** $(A \cup B) = 7$

5. a. $(u) = 30$

b. i. 25 boys

ii. 5 boys



Answers to Revision

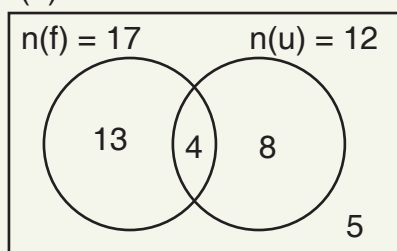
1

(LB page 31)

1. Eight billion, forty-five million, six hundred and one thousand, one hundred and thirty-two.
2. 3,405,700,006.
3. 271 ; 1,481 ; 500 ; 271 ; 1,981 ; 500 ; 271 ; 2,481 ; 500.
4. a. 800,000 (1 sf) b. 750,000 (3 sf) c. 750,060 (5 sf)
5. a. 567.9 (1dp) b. 567.890 (3dp) c. 567.8901 (4dp)
6. a. 8.7654×10^8 b. 5.54×10^{-1} c. 6.843057×10^6
7. Multiples of 2 : {2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30}.
 a. perfect squares = {4, 16} b. perfect numbers = {6, 28}
8. $36 - 1 = 35$
 $35 - 3 = 32$
 $32 - 5 = 27$
 $27 - 7 = 20$
 $20 - 9 = 11$
 $11 - 11 = 0$

There are 6 subtractions, $\sqrt{36} = 6$

9. a. $(P \cap Q) = 12$ b. $(p) = 30$ c. $(Q) = 34$ d. $(P \cup Q) = 52$
10. a. $n(u) = 30$ b. i. 25 boys ii. 5 boys



Sub-strand 2: Number operation

Module 1

Multiplication and division of numbers by power of 10

Content standard

B8.1.2.1 Apply mental mathematics strategies and number properties used to solve problems.

Indicator

B8.1.2.1.1 Multiply and divide by power of 10 including decimals and the benchmark fractions.

Learning expectations: In this module, learners will learn how to:

- Recall multiplication and division facts.
- Recall benchmark fractions converted to decimals and percentages.
- Find the product of decimal numbers and the powers of 10.

Essential for learning: Learners can recall multiplication facts up to 144 and its related division facts.

Resources: Bottle tops.

Keywords: Multiplication fact, division fact.

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to Starter on page 32 of the Learner's Book for warming up activities.

Main idea 1

Multiplication and division facts

LB page 27

Activity 1: Put learners into convenient groups. Write some numbers on the board for learners to form multiplication facts and their related division facts.

E.g. 12, 6 and 72 = $12 \times 6 = 72$
 $72 \div 6 = 12$
 $72 \div 12 = 6$

Ask learners to compare their work with the group next to them.

Activity 2: Now have learners work in pairs, one learner writes a multiplication sentence and the other writes two division facts for it.

Activity 3: Go through the worked examples with learners on pages 32 - 33 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Write multiplication and division facts for the following fact family.

1. 6, 5 and 30 2. 64, 8 and 8

Challenging activity

Work in pairs.

Write two division facts for the following multiplication sentences below.

1. 150, 10 and 15 2. 60, 7 and 420

Assessment tasks ----- LB page 33

Refer learners to the Learner's Book page 33 for exercise.

Suggested homework

Write multiplication and division facts for the following numbers.

1. 12, 13 and 156 2. 140, 20 and 7

Write two division sentences for the following.

3. $15 \times 6 = 90$ 4. $49 \times 5 = 245$

Main idea 2

Converting between fractions, decimals and percentages
LB page 33

Activity 1: Have learners read through the notes on main idea 2 on page 33.

Activity 2: Put learners into convenient groups. Ask learners to convert some fractions to decimals, e.g. $\frac{4}{10}$. They should divide the numerator by the denominator. $\therefore \frac{4}{10} = 10 \overline{) 0.4} = 0.4$.

Now let them work in pairs to change more fractions to decimals.

Activity 3: Guide learners to convert decimals to fractions with a denominator of 1, then multiply both the numerator and the denominator by the powers of 10.

Example: $\frac{1}{5} = \frac{.05 \times 100}{1 \times 100} = \frac{5}{100}$ or move the decimal point from left to right and divide the numerator by the power of 10. So $.05 \rightarrow$ move 2 decimals places equals $\frac{5}{100}$.

Activity 4: Converting fractions into percentages. In pairs ask learners to convert fractions to percentages. Guide them to multiply the fraction by 100; for example change $\frac{4}{5}$ to percentages = $\frac{4}{5} \times 100 = 80\%$.

Give more exercises for learners to solve. E.g.

1. $\frac{2}{5}$

2. $\frac{14}{20}$

3. $\frac{7}{15}$

Converting percentage to decimal

Let learners identify how to convert a percentage to a decimal. We divide the percentage by 100.

E.g. $18\% = \frac{18}{100} = 0.18$

Activity 5: Go through the worked examples with learners on pages 34 - 35 in their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve these.

Convert the following to decimals and percentages.

1. $\frac{7}{20}$

2. $\frac{3}{5}$

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

Assessment tasks ----- LB page 35

Refer learners to Learner's Book page 35 - 36 for exercise.

Suggested homework:

Write these fractions as decimals and percentages.

1. $\frac{16}{50}$

2. $\frac{1}{5}$

3. $\frac{13}{20}$

Main idea 3

Multiplying and dividing decimals by powers of 10 **LB page 36**

Activity 1: Revise the previous lesson with learners. Put learners into convenient groups. Demonstrate how to multiply a decimal by a power of 10 on the board e.g. 0.232×10^3 .

Let them know that in this instance, the power of 10 is 3. So you move the decimal point three places to the right: $0.232 \times 10^3 = 232$.

Let them solve some questions in their previous groups. Examples:

1. 0.024×10^2

2. 1.256×10^4

Activity 2: Demonstrate how to divide by powers of 10 to learners. Write a number, e.g. $0.5 \div 10^2$. Here the power of 10 is 2, so we move two decimal places to the left.

$\therefore 0.5 \div 10^2 = 0.005$

Activity 3: Pair learners to work out these.

1. 0.42×10^{-3} 2. $\frac{3.02}{10^{-1}}$

Activity 4: Go through the worked examples with learners on pages 36 - 37 in the Learner's Book.

Review exercise

Put learners into mixed ability groups to solve these.

1. 0.009×10^2 2. 0.24×10^{-3}

Assessment tasks ----- LB page 37

Refer learners to the Learner's Book page 37 for exercise.

Suggested homework:

Calculate the following.

1. 0.024×10^4 2. 2.68×10^3 3. $\frac{6.004}{10^4}$ 4. $\frac{0.241}{10^{-3}}$

Answers to Assessment tasks

Main idea 1

(LB page 33)

1. a. $7 \times 3 = 21$ and $3 \times 7 = 21$ b. $9 \times 9 = 81$ c. $11 \times 8 = 88$ and $8 \times 11 = 88$
 $21 \div 7 = 3$ and $21 \div 3 = 7$ $81 \div 9 = 9$ $88 \div 11 = 8$ and $88 \div 8 = 11$
d. $12 \times 3 = 36$ and $3 \times 12 = 36$ e. $9 \times 8 = 72$ and $8 \times 9 = 72$
 $36 \div 12 = 3$ and $36 \div 3 = 12$ $72 \div 9 = 8$ and $72 \div 8 = 9$
2. a. $48 \div 8 = 6$ and $48 \div 6 = 8$ b. $63 \div 9 = 7$ and $63 \div 7 = 9$
c. $65 \div 13 = 5$ and $65 \div 5 = 13$ d. $108 \div 12 = 9$ and $108 \div 9 = 12$

Main Idea 2

(LB page 35)

1. a. $\frac{3}{4} = 0.75 = 75\%$ b. $\frac{2}{5} = 0.4 = 40\%$
c. $\frac{14}{20} = 0.7 = 70\%$ d. $\frac{28}{40} = 0.7 = 70\%$
2. a. $3\% = \frac{3}{100} = 0.03$ b. $80\% = \frac{4}{5} = 0.8$
c. $39\% = \frac{39}{100} = 0.39$ d. $67\% = \frac{67}{100} = 0.67$

3. a. $500\% = \frac{500}{100} = 5$ b. $62 \frac{1}{2}\% = \frac{125}{200} = \frac{5}{8}$ c. $48\% = \frac{48}{100} = \frac{12}{25}$
4. a. $0.6 = \frac{3}{5} = 60\%$ b. $0.25 = \frac{1}{4} = 25\%$ c. $0.55 = \frac{11}{20} = 55\%$
- d. $0.125 = \frac{1}{8} = 12 \frac{1}{2}\%$ e. $0.64 = \frac{16}{25} = 64\%$

5.

Fractions	Decimal	Percentage
$\frac{1}{10}$	0.1	10%
$\frac{9}{20}$	0.45	45%
$\frac{19}{20}$	0.95	95%
$\frac{4}{5}$	0.8	80%
$\frac{3}{4}$	0.75	75%
$\frac{1}{2}$	0.5	50%

Main Idea 3

(LB page 37)

1. a. 53 b. 86 c. 268.9
d. 0.0068 e. 37.9 f. 6.7
2. a. 20.7 b. 4,370 c. 80.6 d. 65 e. 26
3. a. 0.069 b. 0.0408 c. 0.00437
d. 0.0000027 e. 0.00036 f. 0.000077
4. a. 0.306 b. 0.008 c. 0.0068 d. 0.000051
e. 4.5 f. 39 g. 6,200 h. 85
5. a. 40.007 b. 0.000242 c. 0.07063 d. 48.709

Sub-strand 2: Number operation

Module 2

Mental mathematics strategies

Content standard

B8.1.2.1.1 Apply mental mathematics strategies and number properties used to solve problems.

Indicator

B8.1.2.1.2 Apply mental mathematics strategies and number properties to do calculation.

Learning expectation: In this module, learners will learn how to:

- Use doubling and halving strategies to find the product of two numbers.

Essential for learning: Learners can find multiples of numbers.

Resources: Bottle caps.

Keywords: halving, doubling, product

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to page 38 of the Learner's Book for warming up activity.

Main idea 1

Halving and doubling strategies

LB page 36

Activity 1: Write a multiplication question on the board e.g. 27×20 . Guide them to use the doubling and halving strategy to solve it.

$27 \times 20 \rightarrow$ double 27 is 54 and half 20 is 10, so the question now becomes $54 \times 10 = 540$.

Repeat this activity with different numbers.

Activity 2: Pair learners and let them solve these in their jotters.

1. 32×40

2. $6\frac{1}{2} \times 8$

Activity 3: Go through the worked examples with learners on page 39 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. 25×14

2. 17×20

Challenging activity

Work in pairs to solve these.

1. 17.5×40

2. 21×22

Assessment tasks ----- LB page 39

Refer learners to page 39 of the Learner's Book for exercise.

Suggested homework

Use halving and doubling strategies to solve these.

1. 15×12

2. 37×20

3. 12.5×20

4. 44×22

Answers to Assessment tasks

Main Idea 1

(LB page 39)

1. a. $35 \times 12 = 70 \times 6 = 420$

b. $300 \times 18 = 5,400$

c. $500 \times 21 = 10,500$

2. a. $100 \times 14 = 1,400$

b. $10 \times 64 = 640$

c. $8 \times 100 = 800$

d. $2 \times 6 = 12$

3. a. $5 \times 8 = 40$

b. $7 \times 18 = 126$

c. $17 \times 32 = 544$

d. $15 \times 4.5 = 67.5$

Sub-strand 2: Number operation

Module 3

Addition and subtraction of whole numbers and decimal numbers

Content standard

B8.1.2.2 Apply the understanding of the addition, subtraction, multiplication and division of (i) whole numbers within 10,000, and (ii) decimals up to $\frac{1}{1000}$, to solve problems and round answers to given decimal places.

Indicator

B8.1.2.2.1 Add and subtract more than four-digit numbers.

Learning expectations: In this module, learners will learn how to:

- Add and subtract whole numbers.
- Add and subtract decimal numbers.

Essential for learning: Learners can do addition with six-digit numbers.

Resources: Multi-base block.

Keywords: addition, subtraction, partitioning

Competencies: Critical Thinking and Problem solving.

Starter: Refer learners to page 40 of the Learner's Book for mental exercise.

Main idea 1

Using partitioning strategy to add and subtract whole numbers
LB page 36

Activity 1: Put learners into convenient groups. Give them numbers to expand. Examples:

1. $800,251 \rightarrow 800,000 + 200 + 50 + 1$
2. $64,299 \rightarrow 64,000 + 200 + 90 + 9$

Activity 2: Demonstrate how to add using partitioning on the board.

46,124 and 36,613

$$\begin{array}{r} 40,000 + 6,000 + 100 + 20 + 4 \\ + \quad 30,000 + 6,000 + 600 + 10 + 3 \\ \hline 70,000 + 12,000 + 700 + 30 + 7 \\ = \quad 80,000 + 2,000 + 700 + 30 + 7 \end{array}$$

Activity 3: In their groups, ask learners to add some numbers, for example 54,836 and 34,236.

Activity 4: Demonstrate how to do subtraction using partitioning with learners. E.g.

3,442,163 – 2,222,031

$$\begin{array}{r} 3,442,163 \rightarrow 3,000,000 + 400,000 + 42,000 + 100 + 60 + 3 \\ - \quad 2,222,031 \rightarrow 2,000,000 + 200,000 + 22,000 + 000 + 30 + 1 \\ \hline 1,000,000 + 200,000 + 20,000 + 100 + 30 + 2 \end{array}$$

Activity 5: Go through the worked examples with learners on pages 40 - 41 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. $1,642 + 3,321$

2. $2,466 - 1,133$

Challenging activities

Work in pairs.

1. $2.981 + 6.422$

Assessment tasks ----- LB page 41

Refer learners to pages 41 - 42 of Learner's Book for exercise.

Suggested homework:

Solve 1. $5849 - 2628$

2. $7842 + 3685$

Activity 1: Have learners read through the hints on the topic on page 42. Let them know that the decimal point separates the whole number parts and the fractional parts. The diagram is showing 347.26.

Activity 2: Go through the steps and the worked examples on pages 43 - 44 with learners. Demonstrate how to add and subtract decimal on the board with addition and subtraction questions.

Examples:

1. Subtract 25.691 from 45.068.
2. Add 130.265 and 235.685.

Activity 3: Put learners into convenient groups. Let them solve these questions. You may write your own.

1. $63.285 + 13.456$
2. Subtract 35.456 from 68.089

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

$$13.621 + 14.365$$

Challenging activity

Have learners work in pairs to solve this.

1. $7,954.466 - 2,580.486$

Assessment tasks ----- **LB page 44**

Refer learners to page 44 of the Learner's Book for exercise.

Suggested homework

Solve these.

1. Add 24.660 and 11.284.
2. Add 1,246.325 and 680.116.
3. Subtract 685.521 from 852.892.
4. Subtract 6,245.409 from 8,642.989.

Answers to Assessment tasks

Main Idea 1

(LB page 41)

1. a. $56,833 = 50,000 + 6,000 + 800 + 30 + 3$

$$+ 44,105 = 40,000 + 4,000 + 100 + 00 + 5$$

$$\underline{100,938} = \underline{100,000 + 0000 + 900 + 30 + 8}$$

b. $686,405 = 600,000 + 80,000 + 6,000 + 400 + 00 + 5$

$$+ 283,605 = 200,000 + 80,000 + 3,000 + 600 + 00 + 5$$

$$\underline{970,010} = \underline{900,000 + 70,000 + 0,000 + 000 + 10 + 0}$$

c. 11,123,376

d. 10,178,592

2. a. $74,934 = 70,000 + 4,000 + 900 + 30 + 4$

$$- 13,521 = 10,000 + 3,000 + 500 + 20 + 1$$

$$\underline{61,413} = \underline{60,000 + 1,000 + 400 + 10 + 3}$$

b. $465,872 = 400,000 + 60,000 + 5,000 + 800 + 70 + 2$

$$- 132,621 = 100,000 + 30,000 + 2,000 + 600 + 20 + 1$$

$$\underline{333,251} = \underline{300,000 + 30,000 + 3,000 + 200 + 50 + 1}$$

c. 1,351,111

d. 1,635,132

3. a. $717,781 = 700,000 + 10,000 + 7,000 + 700 + 80 + 1$

$$+ 284,116 = 200,000 + 80,000 + 4,000 + 100 + 10 + 6$$

$$\underline{1,001,897} = \underline{1,000,000 + 00,000 + 1,000 + 800 + 90 + 7}$$

b. $314,522 = 300,000 + 10,000 + 4,000 + 500 + 20 + 2$

$$+ 458,461 = 400,000 + 50,000 + 8,000 + 400 + 60 + 1$$

$$\underline{772,983} = \underline{700,000 + 70,000 + 2,000 + 900 + 80 + 3}$$

c. $686,410 = 600,000 + 80,000 + 6,000 + 400 + 10 + 0$

$$+ 283,660 = 200,000 + 80,000 + 3,000 + 600 + 60 + 0$$

$$\underline{970,070} = \underline{900,000 + 70,000 + 0,000 + 000 + 70 + 0}$$

d. $749,421 = 700,000 + 40,000 + 9,000 + 400 + 20 + 1$

$$- 133,214 = 100,000 + 30,000 + 3,000 + 200 + 10 + 4$$

$$\underline{616,207} = \underline{600,000 + 10,000 + 6,000 + 200 + 00 + 7}$$

Main Idea 2

(LB page 44)

$$\begin{array}{rcl}
 \text{1. a. } 2,057.392 & = & 2,000 + 000 + 50 + 7 + \frac{3}{10} + \frac{9}{100} + \frac{2}{1000} \\
 + 723.221 & = & \quad \quad 700 + 20 + 3 + \frac{2}{10} + \frac{2}{100} + \frac{1}{1000} \\
 \hline
 2,780.613 & = & 2,000 + 700 + 80 + 0 + \frac{6}{10} + \frac{1}{100} + \frac{3}{1000}
 \end{array}$$

$$\begin{array}{rcl}
 \text{b. } 6,957.2 & = & 6,000 + 900 + 50 + 7 + \frac{2}{10} \\
 + 3,042.425 & = & 3,000 + 000 + 40 + 2 + \frac{4}{10} + \frac{2}{100} + \frac{5}{1000} \\
 \hline
 9,999.625 & = & 9,000 + 900 + 90 + 9 + \frac{6}{10} + \frac{2}{100} + \frac{5}{1000}
 \end{array}$$

$$\begin{array}{rcl}
 \text{c. } 841.12 & = & 800 + 40 + 1 + \frac{1}{10} + \frac{2}{100} \\
 + 125.921 & = & 100 + 20 + 5 + \frac{9}{10} + \frac{2}{100} + \frac{1}{1000} \\
 \hline
 967.041 & = & 900 + 60 + 7 + \frac{0}{10} + \frac{4}{100} + \frac{1}{1000}
 \end{array}$$

2. a. $235.124 + 5,834.2 = 6,069.324$

The number is 6,069.324.

b. $658.12 + 326.133 = 984.253$

The number is 984.253.

3. 3,771.250 kg

$$\begin{array}{rcl}
 \text{4. a. } 4,625.999 & = & 4,000 + 600 + 20 + 5 + \frac{9}{10} + \frac{9}{100} + \frac{9}{1000} \\
 - 104.010 & = & \quad \quad 100 + 00 + 4 + \frac{0}{10} + \frac{1}{100} + \frac{0}{1000} \\
 \hline
 4,521.989 & = & 4,000 + 500 + 20 + 1 + \frac{9}{10} + \frac{8}{100} + \frac{9}{1000}
 \end{array}$$

$$\begin{array}{rcl}
 \text{b. } 1,592.08 & = & 1,000 + 500 + 90 + 2 + \frac{0}{10} + \frac{8}{100} \\
 - 121.75 & = & \quad \quad 100 + 20 + 1 + \frac{7}{10} + \frac{5}{100} \\
 \hline
 1,470.33 & = & 1,000 + 400 + 70 + 0 + \frac{3}{10} + \frac{3}{100}
 \end{array}$$

$$\begin{array}{rcl}
 \text{c. } 6,954.477 & = & 6,000 + 900 + 50 + 4 + \frac{4}{10} + \frac{7}{100} + \frac{7}{1000} \\
 - 590.386 & = & \quad \quad 500 + 90 + 0 + \frac{3}{10} + \frac{8}{100} + \frac{6}{1000} \\
 \hline
 6,364.091 & = & 6,000 + 300 + 60 + 4 + \frac{0}{10} + \frac{9}{100} + \frac{1}{1000}
 \end{array}$$

5. a. 8,531.917

b. 222.253

6. a. $299.08 - 187.75 = 111.33$ The number is 111.33.

b. $4,000 - 149.919 = 3,850.081$ The number is 3,850.081.

c. $634.930 - 421.9 = 213.03$ The number is 213.03.

Sub-strand 2: Number operations

Module 4

Multiplication and division of whole numbers

Content standard

B8.1.2.2 Apply the understanding of the addition, subtraction, multiplication and division of **i.** whole numbers within 10,000, and **ii.** decimals up to $\frac{1}{1000}$, to solve problems and round answers to given decimal places.

Indicator

B8.1.2.2.1 Multiply or divide multi-digit numbers by 2- and 3-digit numbers.

Learning expectations: In this module, learners will learn how to:

- Multiply and divide using the area model.
- Multiply whole numbers using the lattice method and the distributive property.
- Investigate the divisibility test for numbers.

Essential for learning: Learners can do addition and subtraction of decimals.

Resources: Multi-based blocks.

Keywords: lattice, divisibility test, distributive property

Competencies: Critical thinking and problem solving.

Starter: Refer learners to the Learner's Book page 45 for warming up activity.

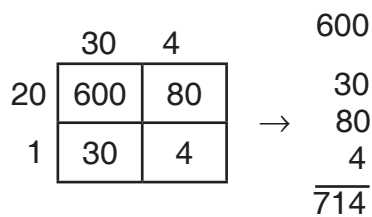
Main idea 1

Multiply and divide using the area model **LB page 45**

Activity 1: Put learners into convenient groups, Let them read through how to use the area model to do multiplication. Read through the steps with learners on pages 45 - 46 of their Learner's Book.

Using area model

Activity 2: Demonstrate how to use the model on the board. Expand the numbers and draw the grid. Multiply and add 34×21 . Model 34×21 :



So $34 \times 21 = 714$

Activity 3: Have learners work in pairs to solve this: 41×25 .

Activity 4: Demonstrate how to do the division on the board. Write a division question on the board for learners to solve in pairs.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Use the area model to solve these

1. 242×25

2. $125 \div 4$

Challenging activity

Solve these in pairs.

1. 158×86

Find the quotient using area model $685 \div 5$.

Assessment tasks ----- LB page 48

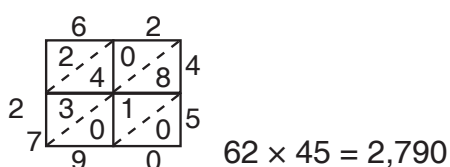
Main idea 2

Multiply and divide using the lattice method

LB page 49

Activity 1: Refer learners to page 49 of the Learner's Book. Take them through the method of using lattice for multiplication. Work some examples on the board.

Activity 2: Write 62×45 on the board. Demonstrate multiplication using the lattice method.



Activity 3: Go through the worked examples with learners on pages 50 - 52 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Use the lattice method to multiply 62 by 8.

Challenging activity

Work in pairs to solve these.

1. 48×32

2. Divide 128 by 8.

Assessment tasks ----- LB page 52

Refer learners to page 52 of the Learner's Book for exercise.

Suggested homework

Use lattice method to solve these

1. 35×26

2. $790 \div 5$

3. 126×45

Answers to Assessment tasks

Main Idea 1

(LB page 48)

1. a. 252×125

	200	50	2
100	20,000	5,000	200
20	4,000	1,000	40
5	1,000	250	10

$$25,000 + 6,250 + 250 = 31,500$$

$$\therefore 252 \times 125 = 31,500$$

b. 316×24

	300	10	6
20	6,000	200	120
4	1,200	40	24

$$7,200 + 240 + 144 = 7,584$$

$$\therefore 316 \times 24 = 7,584$$

c. 564,250

d. 9,512

e. 79,131

f. 27,213

2. a. 354

b. 218

c. 1,467

d. 6,781

$$\begin{array}{r} \times 120 \\ 354 \\ \hline 000 \end{array}$$

$$\begin{array}{r} \times 13 \\ 218 \\ \hline 654 \end{array}$$

$$\begin{array}{r} \times 251 \\ 1467 \\ \hline 1,467 \end{array}$$

$$\begin{array}{r} \times 348 \\ 6781 \\ \hline 54,248 \end{array}$$

$$\begin{array}{r} 7,080 \\ 35,400 \\ \hline 42,480 \end{array}$$

$$\begin{array}{r} 2,180 \\ 2,834 \\ \hline \end{array}$$

$$\begin{array}{r} 73,350 \\ 293,400 \\ \hline 368,217 \end{array}$$

$$\begin{array}{r} 271,240 \\ 2,034,300 \\ \hline 2,359,788 \end{array}$$

3. a. $216 \div 4$

50 + 4		
4	216	16
	- 200	- 16
	16	0

$216 \div 4 = 50 + 4 = 54$

b. $169 \div 13$

10 + 3		
13	169	39
	- 130	- 39
	39	0

$169 \div 13 = 10 + 3 = 13$

c. $482 \div 2$

200 + 40 + 1		
2	482	82
	- 400	- 80
	39	0

$482 \div 2 = 200 + 40 + 1 = 241$

d. 56

e. 75

Main Idea 2

(LB page 52)

1. a. $754 \times 321 = 242,034$

7		
2	2	1
	1	5
4	1	4
	1	0
2	0	7
	0	5
	0	3

b. $744 \times 833 = 619,752$

7		
6	5	3
	6	2
1	2	1
	1	2
9	2	1
	1	2
	7	5

c. $421 \times 195 = 82,095$

4		
8	0	4
	0	2
2	3	6
	1	8
	0	9

d. $337,260$

7		
3	2	8
	1	2
3	4	2
	1	8
7	1	4
	0	6
	2	6

e. 195,520

9		
1	1	8
	0	8
9	0	0
	0	0
5	7	2
	3	2
	5	3

f. 132,550

2		
1	0	8
	2	8
3	1	6
	5	6
2	0	4
	1	4
	5	5

2. a. $425 \times 12 = 425 \times (10 + 2)$

$= 425 \times 10 + 425 \times 2$

$= 4,250 + 850$

$= 5,100$

b. $280 \times 19 = 280 \times (20 - 1)$

$= 280 \times 20 - 280 \times 1$

$= 5,600 - 280$

$= 5,320$

c. $98 \times 250 = (100 - 2) \times 250$

$= 25,000 \times 100 - 250 \times 2$

$= 25,000 - 500$

$= 24,500$

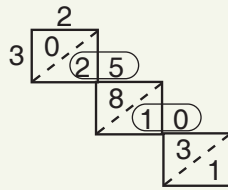
d. $572 \times 110 = 572 \times (100 + 10)$

$= 572 \times 100 + 572 \times 10$

$= 57,200 + 5,720$

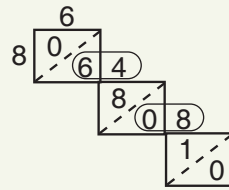
$= 62,920$

3. a. $3 \overline{)250}$



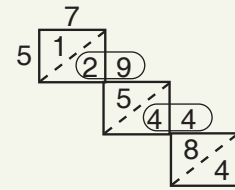
$\therefore 250 \div 3 = 83 \text{ r } 1$

b. $8 \overline{)648}$



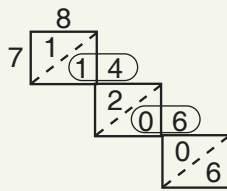
$\therefore 648 \div 8 = 81$

c. $5 \overline{)794}$



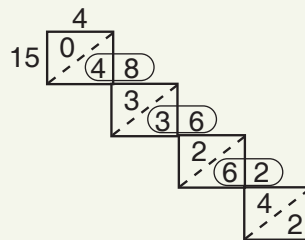
$\therefore 794 \div 5 = 158 \text{ r } 4$

d. $7 \overline{)846}$



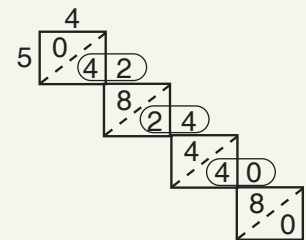
$\therefore 846 \div 7 = 120 \text{ r } 6$

e. $15 \overline{)4,862}$



$\therefore 4,862 \div 15 = 324 \text{ r } 2$

f. $5 \overline{)4,240}$



$\therefore 4,240 \div 5 = 848$

4. a.

	50 + 10 + 4		
9	576	126	36
	- 450	- 90	- 36
	126	36	0

$\therefore 576 \div 9 = 50 + 10 + 4 = 64$

b.

	600 + 50 + 4		
4	2,619	219	19
	- 2,400	- 200	- 16
	219	19	3

$\therefore 2,619 \div 4 = 600 + 50 + 4 = 654 \text{ r } 3$

c.

	300 + 100 + 3		
13	5,243	1,343	43
	- 3,900	- 1,300	- 39
	1,343	43	4

$\therefore 5,243 \div 13 = 300 + 100 + 3 = 403 \text{ r } 4$

Sub-strand 2: Number operations

Module 5

Word problems involving decimals

Content standard

B8.1.2.2 Apply the understanding of the addition, subtraction, multiplication and division of **i.** whole numbers within 10,000, and **ii.** decimals up to $\frac{1}{1000}$, to solve problems and round answers to given decimal places.

Indicator

B8.1.2.2.3 Create and solve story problems involving decimals on the four basic operations.

Learning expectation: In this module, learners will learn how to:

- Create and solve word problems including word problems about data.

Essential for learning: Learners can do addition and subtraction of decimals.

Resources: Word problem cards.

Keywords: Sum, difference, product, quotient.

Competencies: Communication and Collaboration, Creativity and Innovation.

Starter: Ask learners to refer to the Learner's Book page 53 for warming up activity.

Main idea 1

Creating and solving word problems involving decimals using the four operations **LB page 53**

Activity 1: Go through the linear translation on pages 53 - 54 with learners. Write a question on the board and have learners identify the type of operation used.

E.g. The price of a crate of Cola tonic is GH¢45.00 and the price of malt is GH¢120.45. Find the total cost of the two soft drinks. Have learners identify the type of operation. In this case, it is (**addition**). Let them solve it.

Activity 2: Put learners into convenient groups. Give each group work cards with different questions on them. Let them solve them in their various groups.

Activity 3: Let each group do a presentation on the questions they solved to the class.

Activity 4: Go through the worked examples with learners on pages 54 - 55 of their Learner's Book.

Activity 5: Put learners into convenient groups. Let them work out, $366 \div 6$ in their groups.

	50	10	1
6	366	66	6
	300	60	0
	66	6	0

Add the parts of the top i.e. $50 + 10 + 1 = 61$ to get the answer.

Activity 6: Go through the worked examples with learners on pages 54 - 55 of their Learner's Book.

Review exercise

Differentiated learners

Remedial activity

Work in pairs.

The class teacher of J.S.S.2 gave 360 exercise books to be shared among 12 learners. How many will each learner get?

Challenging activity

Work in pairs to solve this.

Nana Adwoa has 2,658 layers in her poultry farm at Besease. She also has 6,399 cockerels at Akwasiho. How many birds does she have altogether?

Assessment tasks ----- LB page 55

Refer learners to the Learner's Book pages 55 - 56 for exercise.

Suggested homework

Solve these.

1. If the weight of a bag of rice is 60.30kg, what will be the weight of 60 bags of rice with similar weight?
2. A piece of wood with length 120.80 metres is to be cut equally into pieces of 8 metres. How many pieces of wood could be got from it?

Answers to Assessment tasks

Main Idea 1

(LB page 55)

1. Each piece is 4.617 m long.
2. Total mass is 12,132.5 kg.
3. 52.74 litres of water left.
4. Total cost of the three textbooks is GH¢271.35.
5. GH¢8,832.77 credit balance.

Main Idea 1

(LB page 56)

1. GH¢209,867.00
2. Madam Esi
3. GH¢1,704,593.00
4. GH¢190,133.00
5. GH¢33,785.00
6. GH¢68,224.00

Sub-strand 2: Number operations

Module 6

Indices

Content standard

B8.1.2.3 Demonstrate understanding and the use of the laws of indices in solving problems (including real life problems) involving powers of natural numbers.

Indicator

B8.1.2.3.1 Identify and explain the laws of indices. E.g.1 State the laws of indices.

Learning expectations: In this module, learners will learn how to:

- State and explain the laws of indices.
- Use the laws of indices to solve problems.

Essential for Learning: Learners can find factors and multiples of numbers.

Resources: Work card.

Keywords: index, exponent, base, power

Competencies: Critical thinking and problem-solving, communication and collaboration, Creativity and Innovation.

Starter: Refer to the Learner's Book page 57 for warming up activity.

Main idea 1

Laws of indices

LB page 57

Activity 1: Refer learners to the four laws of indices in their Learner's Book pages 57 - 58.

Laws of indices

There are fundamental rules or laws of indices you need to understand before you work with indices.

Law 1: To multiply two variables or numbers with the same base, add the powers or exponents: $a^p \times a^q = a^{p+q}$

Example: $3^4 \times 3^5 = 3^{4+5} = 3^9$

Law 2: To divide two variables or numbers with the same base, subtract the power of the denominator from the power of the numerator: $\frac{a^p}{a^q} = a^{p-q}$

Example: $\frac{8^7}{8^5} = 8^{7-5} = 8^2$

Law 3: When a variable with an index is again raised with another index, then both the indices are multiplied together.

$$(a^p)^q = a^{p \times q} = a^{pq}$$

Example: $(5^3)^2 = 5^{3 \times 2} = 5^6$

Law 4: When you multiply two variables with different bases but the same indices, multiply the bases and raise the product to the same index: $a^p \times b^p = (ab)^p$

Example: $3^2 \times 5^2 = (3 \times 5)^2$. Go through this with them.

Activity 2: Put learners into convenient groups and give each group at least one question on two laws to solve. Each group is to present their work to the whole class. Examples:

1. $x^2 \times x^2$ 2. $(4^3)^2$ 3. $\frac{6^7}{6^3}$ 4. $2^2 \times 4^2$

Activity 3: Go through the worked examples with learners on page 59 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Have learners work in pairs to solve these.

1. $3^2 \times 81^2$ 2. $\frac{4^8}{4^2}$

Challenging activity

Solve in pairs.

1. $3^6 \times 3^5$ 2. $\frac{10^{12}}{10^6}$

Assessment tasks ----- LB page 59

Refer learners to the Learner's Book page 59 for exercise.

Suggested homework

Simplify the following.

1. $9^{\frac{1}{2}}$ 2. $5^2 \times 5^{10}$ 3. $6x^2y \times 2x^2y^3$ 4. $\frac{10^{12}}{10^6}$

Answers to Assessment tasks

Main Idea 1

(LB page 59)

1. $2^{15} \times 2^{-12} = 2^3 = 8$

2. $3 \times \frac{1}{36} = \frac{1}{12}$

3. a. $4^{\frac{7}{6}}$

b. $(\frac{1}{8})^{\frac{5}{4}}$

c. 1

4. a. m^9

b. p^6

c. $2^{16} n^{12}$

d. $5x^6y^4$

5. a. $5y^4$

b. $21w^4x^3$

6. a. 2

b. $2^6 = 64$

c. 12

d. 6

e. 7^5

Sub-strand 2: Number operations

Module 7

Equations that include indices

Content standard

B8.1.2.3 Demonstrate understanding and the use of the laws of indices in solving problems (including real life problems) involving powers of natural numbers.

Indicator

B8.1.2.3.2 Apply the laws of indices to simplify and evaluate numbers involving powers of numbers (PEDMAS).

Learning expectations: In this module, learners will learn how to:

- Solve exponential equations.
- Solve real-life problems that include powers of natural numbers.

Essential for learning: Learners can simplify indices.

Resources: Work cards.

Keywords: index, exponent, equation

Competencies: Critical thinking and problem-solving, communication and collaboration, Creativity and Innovation.

Starter: Refer learners to the Learner's Book page 60 for warming up activity.

Main idea 1

Exponential equations

LB page 60

Activity 1: Put learners into convenient groups and write a question and guide them to solve it.

E.g. $16^x = 64$.

$16^x = (4^2)^x = 4^3$ (The bases are the same so we equate the exponents.)

$$= 4^x = 3$$

$$\therefore x = \frac{3}{4}$$

Activity 2: Have learners work these in their groups. You may give different questions.

1. $4^{2x} = 64$

2. $5^x = 25$

Activity 3: Go through the worked examples with learners on pages 60 - 61 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Solve these.

1. $16^x = 64$

2. $3^x = 27$

Challenging activity

Work in pairs.

1. $\left(\frac{1}{2}\right)^x = 16$

2. $7^x = 343$

Assessment tasks ----- LB page 61

Refer learners to the Learner's Book page 61 for exercise.

Suggested homework

1. $4^{2x} + 2 = 66$

2. $9^{x+2} = 27^x$

3. $16^x = 64$

4. $\frac{1^x}{3} = 51$

Main idea 2

Solving real-life problems involving powers of natural numbers
LB page 62

Activity 1: Explain to learners how and when exponents are used in real-life situations. Write a question on the board for learners to solve in groups.

E.g. The human body has about 12 billion cells. Write this number in exponential form.

$12 \text{ billion} = 12,000,000,000 = 1.2 \times 10^{11}$

Guide learners to solve it. Let them discuss their answers.

Activity 2: In pairs, give learners similar question to solve. Example:

The distance between the earth and the moon is about 150 billion km. Express this in powers of 10.

$150 \text{ billion} = 150,000,000,000$

$150 \text{ billion} = 1.5 \times 10^{11}$

Activity 3: Go through the worked examples with learners on pages 62 - 63 of their Learner's Book.

Review exercise

Put learners into mixed ability group to solve this:

160 billion litres of water flows through River Pra each day. Write this in powers of 10.

Assessment tasks ----- LB page 64

Refer learners to page 64 of the Learner's Book for exercise.

Suggested homework

1. An aeroplane travels 500 million km to its destination. Write this in powers of 10.
2. A Cool drink factory produces 2 billion, 200 million drinks in a month. Write this in powers of 10.

Revision 2

Number operations ----- (LB page 65)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 61)

- | | | | |
|--------------------------|-----------------------|-----------------------|-------------|
| 1. a. $x = -2$ | b. $x = -4$ | c. $x = 4$ | d. $x = 3$ |
| 2. a. $x = 4$ | b. $x = 2$ | c. $x = -\frac{1}{3}$ | d. $x = 2$ |
| 3. a. $x = 2$ | b. $x = -\frac{1}{2}$ | c. $x = \frac{1}{2}$ | d. $x = -1$ |
| 4. a. $\{-\frac{3}{2}\}$ | b. $\{0\}$ | c. $\{-1\}$ | d. $\{10\}$ |

Main Idea 2

(LB page 64)

- | | | |
|-----------------------------|--|---------------------------------|
| 1. 3.75×10^9 kg | 2. $2^8 = 256$ cells | 3. 1.5×10^8 km |
| 4. 1.5×10^7 metres | 5. 2.75×10^{13} red blood cells | 6. 1.47×10^{12} litres |

Answers to Revision

2

(LB page 65)

1. a. Hospital A recorded 6,627 malaria cases.
b. Hospital C
c. The three hospitals recorded 20,370 cases.

2. a. $682 \times 423 = 288,486$

	6	8	2	
2	2	3	0	4
8	1	1	0	2
8	1	2	0	3
	4	8	6	

- b. $258 \times 583 = 150,414$

	2	5	8	
1	1	2	4	5
5	1	4	6	8
0	0	1	2	3
	4	1	4	

- | | |
|------------------------------------|----------------------------------|
| 3. GH¢35.45 \times 8 = GH¢283.60 | 4. The excess weight is 2.83 kg. |
| 5. 32 napkins | 6. 7.2×10^2 |
| 7. a. $x = 0$ | b. $x = 1$ |
| 8. GH¢5,037.22 | c. $x = \frac{1}{2}$ |
| | d. $\frac{3}{4}$ |

Sub-strand 3: Fractions, decimals and percentages

Module 8

Operations on fractions

Content standard

B8.1.3.1 Apply the understanding of operation on fractions to solve problems involving fractions of given quantities and round the results to given decimal and significant places.

Indicator

B8.1.3.1.1 Review fractions and solve problems involving basic operations on fractions.

Learning expectations: In this module, learners will learn to:

- Review the concept of fractions.
- Review the basic operations on fractions.

Essential for learning: Learners can do addition and subtraction of like fraction.

Resources: strips of paper, crayons

Competencies: Critical thinking and problem-solving.

Starter: Refer learners to page 66 of the Learner's Book for warming up activities.

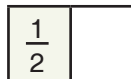
Main idea 1

Reviewing the concept of fractions

LB page 66

Activity 1: Have learners explain to you what a fraction is. Let them give examples. They should draw the fraction they mention and colour it.

Example: one half: $\frac{1}{2}$



Activity 2: Give each learner a sheet of paper and crayons. Let them fold it into two equal parts, and shade 1 part and name it as $\frac{1}{2}$. Again let them refold it. They should tell you their observation.

$$\frac{1}{2} = \frac{2}{4} = \frac{4}{8} \quad \frac{3}{6} \text{ They are equivalent fractions.}$$

Activity 3: Ask learners to observe the three fractions, and tell you what is happening to the numerators and the denominators. Explain when the numerators and the denominators of fractions are multiplied by the same number you get equivalent fractions.

Activity 4: Guide learners to reduce fractions to their lowest term, e.g. $\frac{4}{12} = \frac{1}{3}$. (You divide the numerator and the denominator by the same number.)

Mixed fractions and improper fractions

Activity 5: Write examples of mixed fractions and improper fractions on the board. Let them tell you why they are named so. E.g. $10\frac{1}{2}$ is a mixed fraction. It has a whole number and a fraction. Let them give their own examples.

$\frac{21}{2}$ is an improper fraction. Let learners explain to you why the numerator is bigger than the denominator. An improper fraction could be changed to a mixed fraction and vice versa.

Activity 6: Have learners work in pairs to solve these: Change to mixed fractions.

a. $\frac{13}{6}$ b. $\frac{22}{7}$ Let them give their own examples.

Have learners work in mixed ability groups to solve these:

1. Change to improper fractions.

a. $20\frac{1}{5}$ b. $\frac{29}{11}$

2. Reduce the following to their lowest terms.

a. $\frac{4}{12}$ d. $\frac{100}{12}$

Assessment tasks ----- LB page 69

Refer learners to page 69 of the Learner's Book for exercise.

Suggested homework

1. Write two equivalent fractions for each of these:

a. $\frac{2}{3}$ b. $\frac{8}{9}$ c. $\frac{1}{5}$

2. Change the following fractions to mixed fractions:

a. $\frac{13}{2}$ b. $\frac{29}{5}$ c. $\frac{19}{2}$

Main idea 2

Review the basic operations on fractions

LB page 69

Activity 1: Review the previous lesson with learners. Let learners explain what they understand when we say basic operations (they are addition, subtraction, multiplication and division).

Write some addition and subtraction questions on the board for learners to solve in pairs. E.g.

1. $\frac{1}{3} + \frac{1}{5}$ 2. $\frac{3}{4} - \frac{1}{3}$

Let learners exchange their work to the learner next to them to check their answers.

Activity 2: Write some multiplication and division questions on the board for learners to solve. E.g.

1. $\frac{2}{3} \times \frac{5}{8}$ 2. $\frac{1}{12} \times \frac{10}{11}$ 3. $\frac{5}{6} \div \frac{1}{3}$

Activity 3: Go through the worked examples with learners on pages 70 - 71 of their Learner's Book.

Review exercise

Pair learners to solve these:

Multiply: a. $1\frac{1}{2} \times \frac{1}{3}$ b. $\frac{9}{10} \div \frac{1}{3}$ c. $\frac{9}{10} - \frac{1}{3}$

Assessment tasks ----- LB page 71

Refer learners to Learner's Book pages 71 - 72 for exercise.


Suggested homework

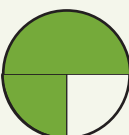
Solve

1. $2\frac{1}{3} + \frac{4}{5}$ 2. $16\frac{1}{5} - 10\frac{1}{3}$ 3. $\frac{5}{8} \times \frac{1}{7}$ 4. $\frac{13}{15} \div \frac{5}{8}$


Answers to Assessment tasks

Main Idea 1

1. a. $\frac{5}{8}$ 

b. $\frac{3}{4}$ 

c. $\frac{5}{6}$ 

(LB page 69)
d. $\frac{3}{6}$ 

2. a. $\frac{5}{10} = \frac{1}{2}$

b. $\frac{2}{4} = \frac{1}{2}$

c. $\frac{4}{6} = \frac{2}{3}$

3. a. $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{15}{20} = \frac{12}{16} = \frac{18}{24} = \text{etc}$

b. $\frac{1}{16} = \frac{2}{32} = \frac{3}{48} = \frac{4}{64} = \frac{15}{80} = \text{etc}$

(Any three of the equivalent fractions)

(Any three of the equivalent fractions)

4. a. $\frac{7}{9} = \frac{35}{45} = \frac{28}{36} = \frac{21}{27}$

b. $\frac{5}{9} = \frac{10}{15} = \frac{22}{33}$

5. a. $\frac{9}{12} = \frac{3}{4}$

b. $\frac{14}{21} = \frac{2}{3}$

c. $\frac{24}{46} = \frac{12}{23}$

d. $\frac{66}{99} = \frac{2}{3}$

6. a. $1\frac{2}{5}$

b. $1\frac{7}{11}$

c. $1\frac{9}{61}$

d. $1\frac{1}{99}$

7. a. $\frac{51}{8}$

b. $\frac{35}{4}$

c. $\frac{49}{5}$

d. $\frac{56}{5}$

Main Idea 2

(LB page 71)

1. a. $\frac{2}{3}$

b. $1\frac{8}{15}$

c. $11\frac{1}{6}$

2. $1\frac{17}{24}$

3. $\frac{31}{14} = 2\frac{3}{14}$

4. a. $3\frac{1}{2}$

b. $\frac{11}{24}$

c. $\frac{6}{7}$

5. $\frac{7}{16}$

6. $\frac{5}{21}$

7. a. $\frac{2}{3}$

b. $8\frac{1}{8}$

c. $\frac{4}{27}$

8. $\frac{3}{2} = 1\frac{1}{2}$

9. $1\frac{5}{7}$

10. a. $\frac{27}{250}$

b. $\frac{8}{9}$

c. $\frac{2}{3}$

11. 7

12. $\frac{1}{2}$

Sub-strand 3: Fraction, decimals and percentages**Module 2****The order of operations on whole numbers and fractions****Content standard**

B.8.1.2.3 Demonstrate understanding and the use of the laws of indices in solving problems (including real life problems) involving powers of natural numbers.

Indicator

B.8.1.2.3.4 Solve real life problems involving powers of natural numbers.

Learning expectations: In this module, learners will learn how to:

- Use the order of operations to solve problems.
- Use the order of operations to solve fractions.
- Use basic operations to solve word problems that include fractions.

Essential for learning: Learners can add and subtract numbers within one million.

Resources: Multi-base blocks.

Keywords: exponent, add, subtract, multiply, divide, parantheses

Competencies: Critical thinking and problem-solving, communication and collaboration, creativity and innovation.

Starter: Refer learners for starter on page 73 for warming up activity.

Main idea 1

Use order of operations to solve problems

LB page 73

Activity 1: Explain the meaning of BODMAS/ PEMDAS to learners. Refer them to pages 73 - 74 of the Learner's Book.

Write a question on the board. Demonstrate how to solve it using BODMAS. Explain as you work along.

$$24 \div 4 + 6(10 - 5)$$

$$= 24 \div 4 + 6(5)$$

$$= 6 + 30 = 36$$

$$\text{So } 24 \div 4 + 6(10 - 5) = 36$$

Activity 2: Have learners work in pairs to set their own questions and solve them.

Ask learners to compare their work with the group next to them.

Activity 3: Go through the worked examples with learners on page 74 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve this.

a. $24 \div 8 + 2(10 - 7)$

Challenging activity

Solve this in pairs

a. $81 \div 3 + (4 - 1)^2$

Assessment tasks ----- LB page 75

Refer learners to the Learner's Book page 75 for exercise.

Suggested homework

Solve these:

1. $(6 + 8) - 4 \times (3 + 5)$

2. $63 \div 9 + (2 \times 4)^2$

3. $24 \div 6 + 2 \times 5 - 8$

Main idea 2

Simplify fractions using the correct order of operations
LB page 73

Activity 1: Go through the guidelines for the order of operations with learners. Demonstrate the working example on the board.

Guidelines for the correct order of operations on fractions:

- First, simplify parentheses in the expression.
- Simplify exponents in the expression.
- Multiply and divide before adding and subtracting.
- Multiply and divide from left to right in the expression.
- Add and subtract from left to right in the expression.

$$\left(\frac{1}{3} + \frac{2}{5}\right) \div \frac{4}{5}$$

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

$$\frac{11}{15} \times \frac{5}{4} = \frac{11}{12}$$

Activity 2: Put learners into convenient groups to solve this: $\frac{12-(8 \times 2)}{6 \times (2 + 8)}$.

Activity 3: Go through the worked examples with learners on pages 75 - 76 of their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve these:

a. $2\left(\frac{1}{2}\right)^2 + 6\left(\frac{1}{3}\right)^2$

b. $\frac{3^2 \times 2^2}{(2^2 - 4^2) + 4 \times 2}$

Assessment Task ----- LB page 76

Refer learners to page 76 of the Learner's Book for exercise.

Suggested homework

Solve these:

1. $\frac{2}{3} + 6\left(\frac{2}{3} + \frac{1}{4}\right) - \frac{1}{5}$

2. $\frac{3^2 \times 2^2}{(2^2 - 4^2) + 4 \times 2}$

Main idea 3

Solve word problems involving fractions

LB page 78

Activity 1: Put learners into convenient groups. Give each group different exercises to solve.

E.g. A box contains 60 different balls; 15 are red and 25 are blue.

1. Express the red balls as a fraction of the total number of balls.
2. Express the red balls as a fraction of the blue balls.

Give learners time to discuss how they will solve it. Let them do a presentation to the class.

Activity 2: Go through the worked examples with learners on page 77 of their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve this:

1. Teacher Kwesi spent $\frac{17}{20}$ of his salary on food and clothing. What fraction of his salary is left?

Assessment tasks ----- LB page 78

Refer learners to the Learner's Book page 78 for exercise.

Suggested homework

Solve these word problems.

1. In a certain school, $\frac{5}{8}$ learner's are girls. If the total number of learners is 64. Find:
 - a. The fraction for boys.
 - b. The total number of girls.
 - c. The total number of boys.

Revision 3

Fractions, decimals and percentages ----- (LB page 79)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 75)

- | | | | | |
|-------|-------|-------|--------|--------|
| 1. 25 | 2. 12 | 3. 24 | 4. 4 | 5. 23 |
| 6. 4 | 7. 15 | 8. 21 | 9. 160 | 10. 98 |

Main Idea 2

(LB page 76)

- | | | | | |
|------------------|---------------------|------------------|---------------------|----------------------|
| 1. 3 | 2. $-2\frac{3}{11}$ | 3. $\frac{3}{7}$ | 4. $-1\frac{4}{21}$ | 5. -8 |
| 6. $\frac{7}{9}$ | 7. $\frac{13}{16}$ | 8. $\frac{2}{9}$ | 9. $\frac{41}{48}$ | 10. $-1\frac{1}{24}$ |

Main Idea 3

(LB page 78)

- | | | | |
|---------------------------|-------------------------|--------------------|------------------------|
| 1. $\frac{3}{8}$ | 2. 80 learners | 3. GH¢6,440.00 | 4. $\frac{2}{5}$ |
| 5. $\frac{1}{3}$ km | 6. $3\frac{1}{4}$ hours | 7. $\frac{19}{24}$ | 8. $1\frac{14}{15}$ km |
| 9. $18\frac{7}{8}$ litres | 10. $7\frac{5}{6}$ kg | 11. 22 pieces | 12. 420 kg |

(LB page 79)

1. Check the learners' answers.
2. a. $4\frac{1}{3}$ b. $16\frac{1}{3}$ c. $15\frac{3}{7}$ d. $23\frac{7}{9}$
3. a. $11\frac{3}{5}$ b. $\frac{1}{2}$ c. $5\frac{5}{24}$ d. $7\frac{1}{2}$
4. Yaaba spent $\frac{1}{5}$ of her pocket money on food.
5. 8 cm long.
6. a. $6\frac{1}{35}$ b. $3\frac{1}{2}$ c. $15\frac{1}{2}$
7. 9 parts
8. a. Area of the rectangle is 14 cm^2 .
b. Perimeter of the rectangle is $15\frac{1}{15} \text{ cm}$.
9. $99\frac{1}{2} \text{ cm}$
10. The width of the rectangle is $1\frac{2}{5} \text{ cm}$.

Sub-strand 4: Number: ratios and proportion

Module 1

Ratio and proportion

Content standard

B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use these to solve real-world mathematical problems.

Indicator

B8.1.4.1.1 Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Learning expectations: In this module, learners will learn how to:

- Convert one unit of measure to another using ratio reasoning.
- Manipulate and use units appropriately to solve problems.

Essential for learning: Learners can reduce a fraction to its lowest term.

Resources: Conversion charts.

Keywords: ratio, rate, unit rate, convert

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Refer learners to the Learner's Book Starter on page 80 for warming up activity.

Main idea 1

Use ratio reasoning to convert measurement units **LB page 80**

Activity 1: Explain what a conversion factor is to learners. It is a number used to change one set of units to another by multiplying or dividing quantities.

Let them know that the main metric unit of length is the metre (m). So the metre is the base unit for lengths. Others are kilometres (km), centimetres (cm) and millimetres (mm).

Activity 2:

1,000 metre (m)	=	1 kilometre (km)
100 centimetre (cm)	=	1 metre (m)
1,000 millimetre (mm)	=	1 metre (m)

Guide learners to use ratio reasoning for the conversions table above. Example, 1 m = 100 cm.

$$1. \frac{1 \text{ m}}{100 \text{ cm}} = \frac{100}{100} = 1 \quad 2. 1,000 \text{ m} = 1 \text{ km} = \frac{1,000}{1 \text{ km}} = \frac{1,000}{1,000} = 1$$

Activity 3: Write some questions on the board, demonstrate to the learners how to solve them.

The ratio $\frac{1 \text{ km}}{1,000}$ or $\frac{1,000}{1 \text{ km}}$

Have learners work in pairs to solve some questions. For example: Express 3 km in metres.

**Conversion chart
(centimetres to metres)**

1 cm = 0.01 m
10 cm = 0.1 m
50 cm = 0.5 m
100 cm = 1 m
200 cm = 2 m
500 cm = 5 m
1,000 cm = 10 m

**Conversion chart
(metres to kilometres)**

1 m = 0.001 km
10 m = 0.01 km
50 m = 0.05 km
100 m = 0.1 km
200 m = 0.2 km
500 m = 0.5 km
1,000 m = 1 km

Activity 4: Go through the worked examples with learners on pages 82 - 83 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work on pairs.

1. Express 20 cm in mm.

Challenging activity

Work in pairs.

Convert:

1. 245 mm to cm.

2. 8 km to m.

Assessment tasks ----- LB page 83

Refer learners to page 83 of the Learner's Book for exercise.

Suggested homework:

1. Convert 250 m to km.

2. Convert 850 mm to m.

3. How many minutes are there in 3 days?

Answers to Assessment tasks

Main Idea 1

(LB page 83)

1. **a.** 6,000 cm **b.** 0.048 km **c.** 49,000,000 mm
 d. 0.00033 km **e.** 680 mm
2. 24.5 centimetres
3. 1.86 metres
4. 1 : 1
5. 620 centimetres
6. 180 centimetres
7. **a.** 5.5 litres **b.** 2,500 milligrams
8. 2,880 minutes

Sub-strand 4: Number: ratios and proportion

Module 2

Unit rate

Content standard

B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use it these to solve real-world mathematical problems.

Indicator

B8.1.4.1.2 Solve unit rate problems including those involving unit pricing and constant speed; and speed translation.

Learning expectation: In this module, learners will learn how to:

- Solve problems using unit rate.

Essential for learning: Learners can reduce a fraction to its lowest form.

Keywords: rate, unit rate, ratio

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Refer learners to page 84 of the Learner's Book page for warming up activities.

Main idea 1

Solve unit rate problems

LB page 84

Activity 1: Revise the previous lesson with learners. Explain the term “rate” to learners. It is a ratio in which two terms are measured in different units.

Let them know that all rates are ratios but not all ratios are rates.

Give an example: 10 learners shared 30 toffees. The rate is 10 learners for 30 toffees. The ratios are two unlike units, “learners and toffees”.

Activity 2: Refer learners to the Learner's Book page 84. Go through the main idea with them. Take time to explain paragraph by paragraph and give examples.

Activity 3: Put learners into mixed ability groups. Write some questions on the board for learners to solve.

E.g. A man travels 50 kilometres in 5 hours, find the unit rate.

We have 50 km = 5 hours

So $\frac{50}{5} = 10$. The unit rate for 50 km per 5 hrs = 10 km/hr.

Activity 4: Call some group leaders to explain on the board. Go through the worked examples with learners on page 85 of their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve these.

1. Find the unit rate of a car which travels 100 km in 5 hours.
2. If 50 exercise books cost ₵100.00
Find **a.** the rate **b.** the unit rate

Assessment tasks ----- LB page 86

Refer learners to the Learner's Book page 86 for exercises.

Suggested homework

Solve these:

1. What is the unit rate of speed of a motor bike that travels 400 km in 4 hours?
2. What is the unit rate of speed of a bus that travels 600 km in 6 hours?

Answers to Assessment tasks

Main Idea 1

(LB page 86)

1. **a.** 8 pencils for GH₵14.00 ; GH₵1.75 per pencil.
b. GH₵120.00 for 13 chocolate bars ; GH₵9.23 per chocolate bar.
c. 9 litres for 145 km ; 16.11 km per litre.
2. 50 km per hour.
3. 125 km per hour
4. GH₵250.00 per month
5. GH₵65.97 per week.
6. Car B
7. Mr. Musa walks faster.
8. 160 revolutions

Sub-strand 4: Number: ratios and proportion

Module 3

Distance-time graph

Content standard

B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use this to solve real-world mathematical problems.

Indicator

B8.1.4.1.3 Apply the knowledge of speed to draw and interpret travel graphs or distance-time graphs.

Learning expectations: In this module, learners will learn how to:

- Draw a distance–time graph.
- Interpret a travel graph.

Essential for learning: Learners can plot coordinate points on graph sheets.

Resources: Graph sheets.

Keywords: distance, time, speed, travel graph, average speed, constant speed

Competencies: Critical Thinking and Problem solving, Creativity and Innovation, Personal Development and Leadership.

Starter: Refer learners to the Learner's Book page 87 for warming up activities.

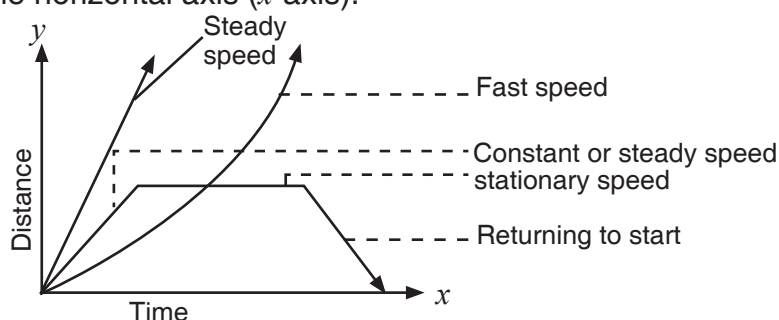
Main idea 1

Distance-time graph

LB page 87

Activity 1: Guide learners to know what a distance-time graph is. It is a simple line graph that denotes distances and time findings on the graph. It tells how far an object or a body has travelled in a given time.

Let learners know that the distance is plotted on the vertical axis (y -axis) and the time is plotted on the horizontal axis (x -axis).



Activity 2: Go through how to calculate average speed on page 88 of the Learner's Book with learners.

Give examples for learners to work on in their groups.

Activity 3: Go through worked examples 1, 2 and 3 with learners on pages 88 - 90 of their Learner's Book.

Review exercise

Have learners work in mixed ability groups to solve this.

1. Adwoa left home at 6 a.m. to travel to Nkawkaw. She took 1 hour 30 mins to drive to Bunso (Linda Dor) for breakfast. She stopped for 20 mins. She continued her journey and got to Nkawkaw at 9: 30 a.m. Draw a graph to calculate the average speed of Adwoa's journey.

Assessment tasks ----- LB page 91

Refer learners to the Learner's Book pages 91 - 92 for exercise.

Suggested homework

Copy the work into your homework book and solve it.

At 10 a.m. a motor cyclist left his home at Besease and cycled at a constant speed to visit a friend at Akwasiho 10 km away.

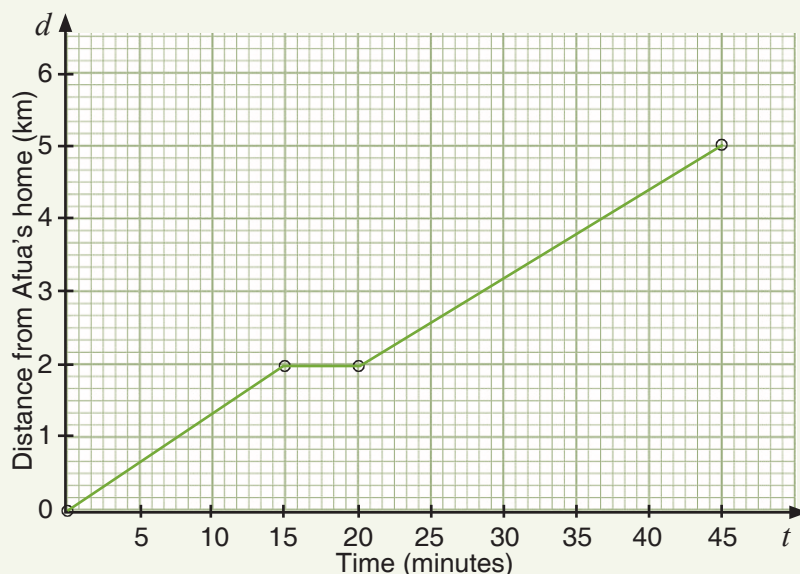
He arrived at Adensua at 11 a.m. and spent 30 mins with his friend. Riding at a constant speed, he got home in Besease at 12: 20 a.m. Draw a travel graph to represent his journey.

Answers to Assessment tasks

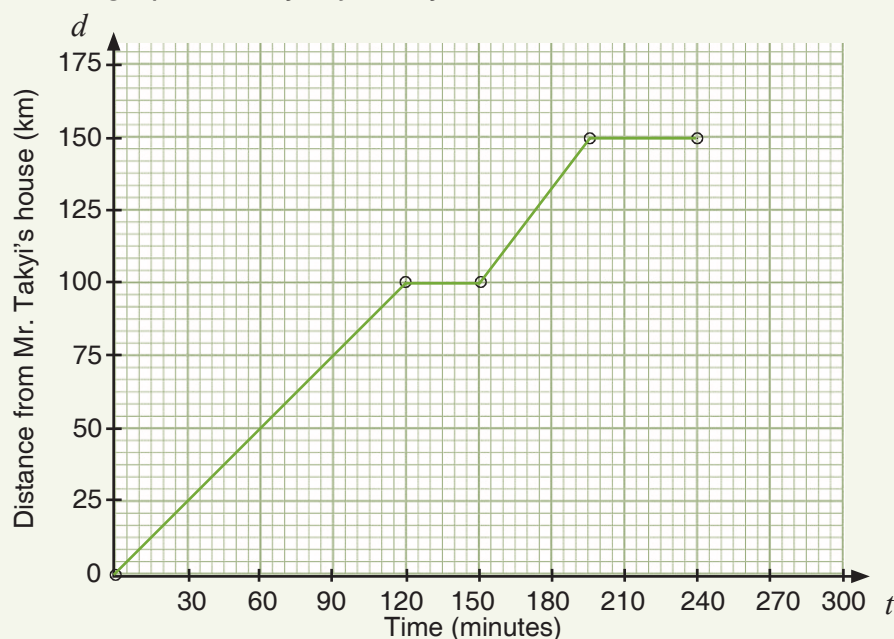
Main Idea 1

(LB page 91)

1. Travel graph of Afua's journey.

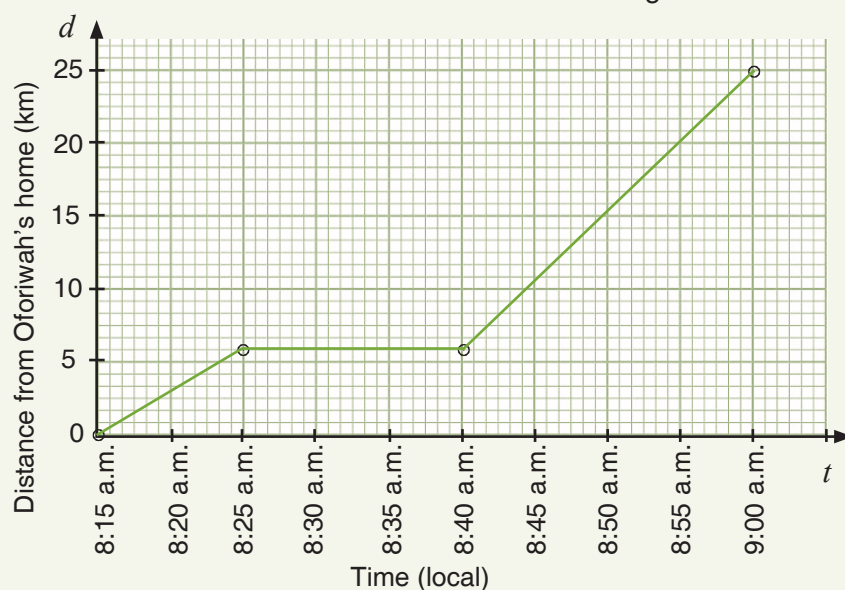


2. Travel graph of Takyi's journey.



3. a. Oforiwah's journey.

b. $33\frac{1}{3}$ km/h



4. a. She travelled 60 km.

b. 5 hours

c. Average speed = 12 km/h

d. 2 stops

e. $1\frac{1}{2}$ hours or 1 hour 30 minutes

f. $17\frac{1}{7}$ km/h or 17.14 km/h

g. The last part, EF

5. a. Mawusi started at 2:00 p.m.

b. 2:30 p.m.

c. 75 minutes

d. 30 minutes

e. 60 km/h

f. 140 km

g. $46\frac{2}{3}$ km/h or 46.67 km/h

Sub-strand 4: Number: ratios and proportion**Module 4****Proportional relationship between quantities****Content standard**

B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use this to solve real-world mathematical problems.

Indicator

B8:1.4.1.4 Recognise and represent proportional relationships between quantities by deciding whether two quantities are in a proportional relationship. (e.g. by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.)

Learning expectations: In this module, learners will learn how to:

- Use tables to find proportional and non-proportional relationship.
- Use graphs to find proportional and non-proportional relationship.

Essential for learning: Learners can draw distance graphs.

Resources: Graph sheets.

Keyword: proportional relationship.

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Refer learners to the Learner's Book page 93 for mental activity.

Main idea 1

Proportional and non-proportional relationship

LB page 93

Activity 1: Explain proportional and non-proportional relationships to learners. Let them understand that proportional relationships are relationships between two variables where their ratios are equivalent.

Non-proportional relationships are relationships between two variables where their ratios are not equivalent.

Activity 2: Let's find the relationships between these variables.

When x is 1 and y is 2, when x is 2 and y is 4, when x is 3 and y is 6. Then, the relationship is shown in the table below.

x	y
1	2
2	4
3	6

The ratio between y and x =

$$\frac{y}{x} = \frac{2}{1} = \frac{4}{2} = \frac{6}{3} = 2$$

$$\therefore \frac{y}{x} = 2$$

This is proportional relationship because the ratio between y and x is the same.

a. Have learners work in pairs to find out whether this is proportional or non-proportional relationship. You may write your own examples.

E.g. When a is 1, b is 2, when a is 2, b is 6, when a is 3, b is 9.

Let learners find the ratio $\frac{b}{a}$ and determine if the ratio is proportional or non-proportional. Let them give reasons.

$$\frac{2}{1} \neq \frac{6}{2} \neq \frac{9}{3} \text{ so this is non-proportional relationship.}$$

Activity 3: Go through the worked examples with learners on pages 94 - 95 of their Learner's Book.

Review exercise: Put learners into mixed ability groups to solve this.

Determine whether the linear relationship represented by the table: is a proportional relationship or non-proportional relationship.

x	6	18	30	42	48	60
y	1	3	5	7	8	10

Assessment tasks ----- **LB page 96**

Refer learners to page 96 of the Learner's Book for exercise.

Suggested homework

The table below shows the number of eggs laid at a poultry farm over a week. Do the numbers in the table represent proportional relationship? Give reasons.

Days	1	2	3	4	5	6	7
Number of eggs	30	60	90	120	150	180	210

Main idea 2

Proportional and non-proportional relationships using graphs
LB page 97

Activity 1: Explain graphs of proportional and non-proportional relationships to learners.

A relationship is a proportional relation if its graph is a straight line that passes through the origin (0, 0).

A non-proportional relationship is one in which its graph does not pass through the origin. A relationship may be linear (straight line) but not a proportional relationship because it does not pass through the origin.

Activity 2: Put learners into convenient groups. Write some ordered pairs on the board. Ask learners to make a table for them and plot them.

E.g. (1, 15), (2, 30), (3, 45), (5, 75), (6, 120).

They should determine whether the relationship is proportional or non-proportional.

Activity 3: Go through the worked examples with learners on pages 97 - 99 of their Learner's Book.

Review exercise

Put learners into mixed ability groups to solve this.

A radio seller sold radios over five days. Draw a graph to determine whether or not the data is a proportional relationship.

Days	1	2	3	4	5	6	7
Radios sold	7	10	14	20	30	35	40

Assessment tasks ----- LB page 99

Refer learners to pages 99 - 100 of their Learner's Book for exercise.

Suggested homework

Plot the ordered pairs and connect the points. Is the relationship proportional or non-proportional?

(1, 11), (2, 14), (3, 22), (4, 29), (5, 35)

Main idea 3

Identifying constant of proportionality from tables, graphs and equations
LB page 101

Activity 1: Let learners know what constant of proportionality on graphs, tables etc means.

It is the constant value of the ratio between two proportional quantities. The equation $y = kx$ shows that as x increases, y also increases at the same rate. The k is known as “**the constant of proportionality**”.

Activity 2: Work one example on the board with learners.

E.g. Find the constant of proportionality if y varies as x when $y = 30$, $x = 3$.

$y = kx$, substitute the values for x and y and solve for k . $x = 3$, $y = 30$ so $k = \frac{y}{x} = \frac{30}{3} = 10$.

∴ The constant of proportionality is 10.

Activity 3: Go through the worked examples with learners on pages 101 - 103 of their Learner's Book.

Review exercise

Have learners work examples in mixed ability groups to determine the constant of proportionality (k). Examine the table below and determine if the relationship is proportional and find the constant of proportionality.

x	1	4	5	7	8	10
y	4	16	20	28	32	40

Assessment tasks ----- LB page 103

Refer learners to pages 103 - 104 of the Learner's Book for exercise.

Suggested homework

Study the table below, plot and determine the constant of proportionality (k) for the table below.

x	2	3	5	7	8	10
y	10	15	25	35	40	50

Revision 4

Number: ratios and proportion ----- (LB page 105)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 96)

1. **a.** All the unit rates are the same, $\frac{5}{1}$, so the table represents a proportional relationship.
- b.** All the ratios are not the same, so the table represents a non-proportional relationship.

2.

Number of hours	1	2	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6	$6\frac{1}{2}$
Pay (GH¢)	9.00	18.00	31.50	36.00	40.50	45.00	49.50	54.00	58.50

- a.** The pay is proportional to the hours worked.
- b.** The unit rates are all the same.
3. The table does not represent a proportional relationship since the unit ratios are not the same.
4. The numbers in the table represent a proportional relationships unit rates are the same.

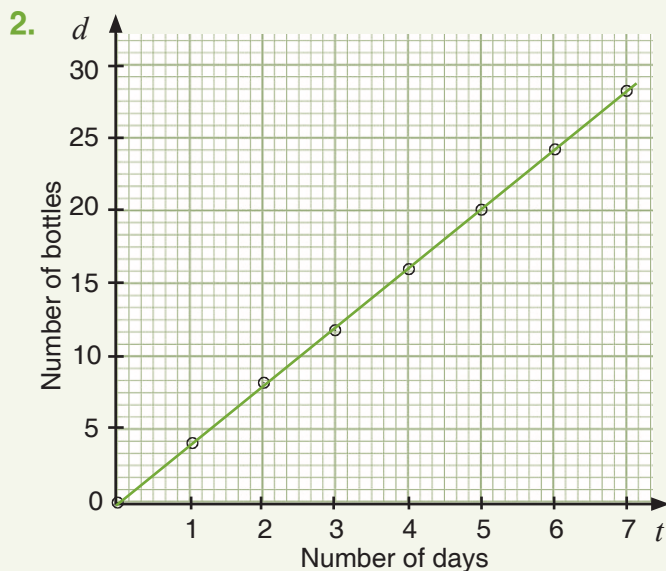
5. The numbers in the table do not represent proportional relationship.

Reason: The unit rates are not the same.

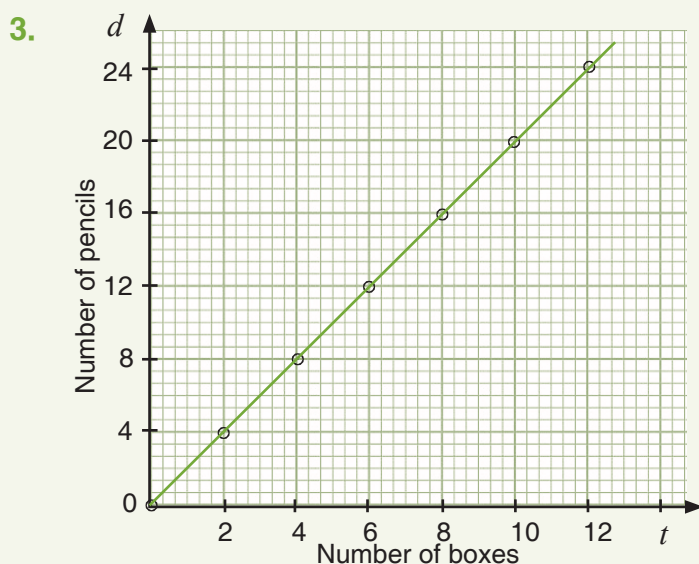
Main Idea 2

(LB page 99)

1.
 - a. GH¢2.00 per a pineapple.
 - b. 6 pineapples cost GH¢12.00
 - c. 9 pineapples
 - d. GH¢10.00
 - e. GH¢18.00
 - f. The relationship is proportional.

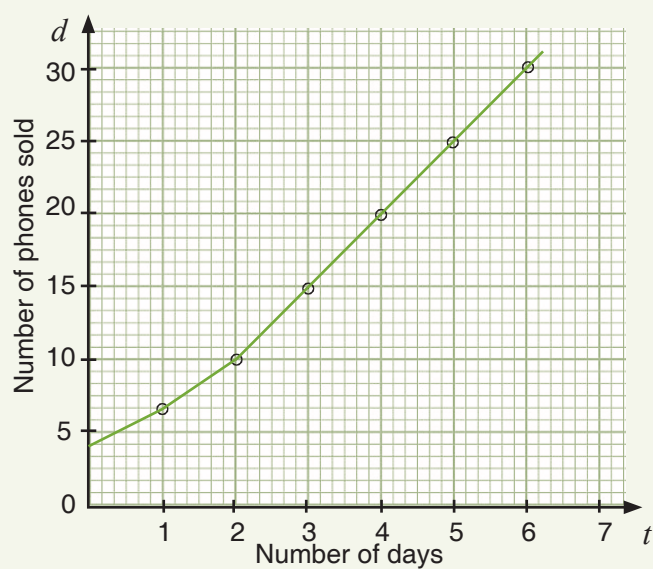


The line passes through the origin so the relationship is proportional.



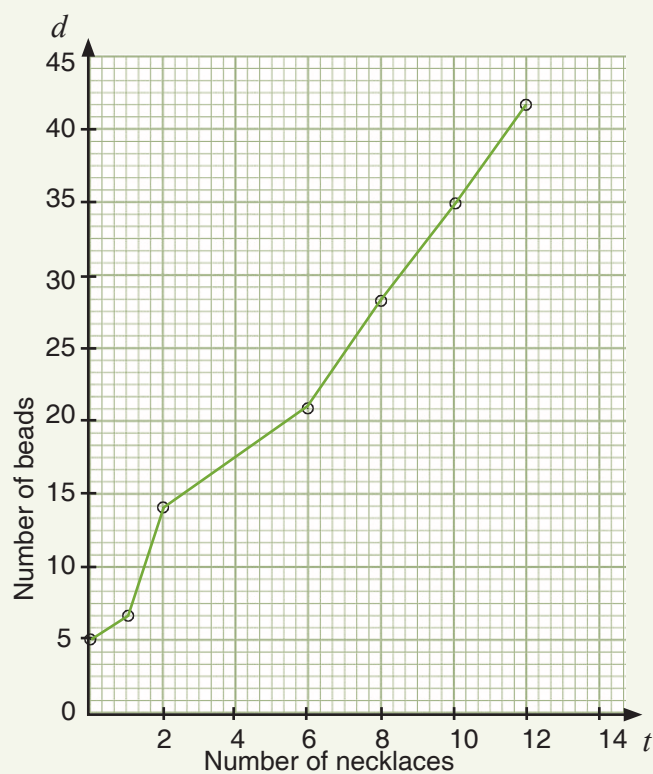
The line passes through the origin so the relationship is proportional.

4.



The line does not pass through the origin and so the relationship is non-proportional.

5.



The line does not pass through the origin and so the relationship is non-proportional.

Main Idea 3

(LB page 103)

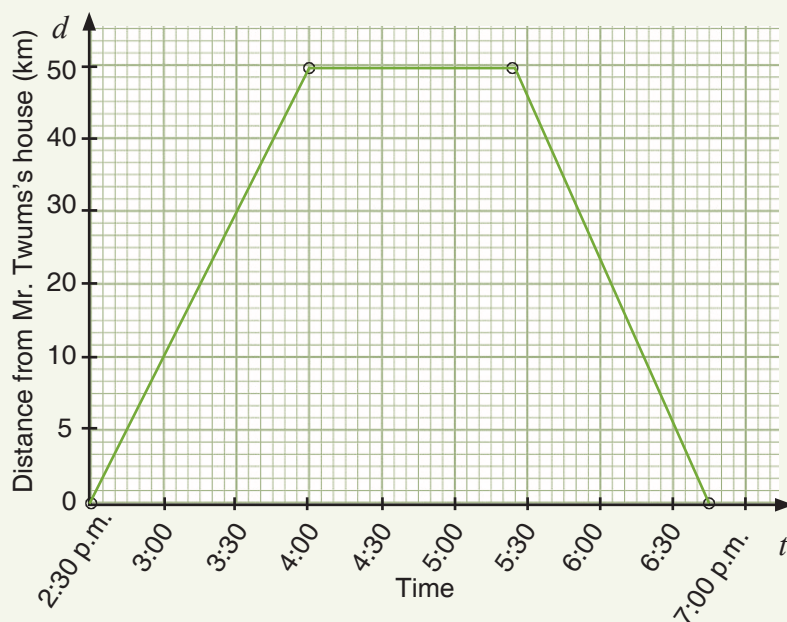
1. a. $\frac{2}{5}$ b. $\frac{6}{7}$ c. 8
2. Relationship is proportional; constant of proportionality is $\frac{1}{2}$
3. $k = 4$
4. a. $k = 5$, b. $k = 6$
5. a. $\frac{2}{3}$ b. 5 c. $\frac{1}{2}$
6. $k = 5$

Answers to Revision

4

(LB page 105)

1. $1\frac{1}{2}$ hours 2. 10 days 3. 2.5km 4. GH¢3.00 per cake of soap.
5. Travel graph of Mr. Twum's journey.



6. The constant of proportionality is 5.
7. Expressing the ratio as unit rates:
 $\frac{2}{3} \div \frac{3}{4} = \frac{8}{9}$; $\frac{8}{9} \div 1 = \frac{8}{9}$; $\frac{22}{9} \div \frac{11}{4} = \frac{8}{9}$; $\frac{8}{9}$.

All the unit rates are the same so the table represents a proportional relationship.

Sub-strand 1: Patterns and relations

Module 1

The gradient of a linear relation

Content standard

B8.2.1.1 Demonstrate the ability to draw a table of values for a linear relation, graph the relation in a number plane, determine the gradient of the line and use it to write an equation of a line in the form $y = mx + c$.

Indicator

B8: 2.1.1.1 Calculate the gradient of a line and use it to write an equation of a line in the form $y = mx + c$.

Learning expectations: In this module, learners will learn how to:

- Explain the concept of gradient using real-life examples.
- Determine the gradient of a line.

Essential for Learning: Learners can draw linear graphs.

Resources: Graph Sheets.

Keywords: Gradient, increase, decrease, slope.

Competencies: Critical thinking and problem-solving, personal development and leadership, creativity and innovation.

Starter: Have learners clap and count multiples of 100 up to 3,000.

Main idea 1

Concept of gradient

LB page 107

Activity 1: Explain to learners the concept of gradient. Let them know that the gradient of a straight line shows how steep a straight line is. It is also called a slope. Again let them know that it involves how far up one has gone as opposed to how far one has gone across.

Activity 2: Have learners know the four types of gradient.

- a. uphill b. downhill c. flat (horizontal) and d. straight up (vertical)

Refer them to pages 107 - 109 of the Learner's Book, let them read through the hints there. Stress on the summary.

Summary:

- The sign in front of a gradient represents the direction of the line.
- The numerical value represents the steepness. For example: a line with the gradient 4 and another with gradient -4 have the same steepness, but in opposite directions.

Activity 3: Explain to learners how to find the gradient of a line. Let them know that to calculate the gradient of every line the x - and the y -coordinates of a line are used. I.e. it is the ratio of

change in the y -axis to the change in the x -axis. The gradient of a line = $\frac{y^2 - y^1}{x^2 - x^1}$.

Activity 4: Put learners into convenient groups. Demonstrate by working one example on the board.

E.g. Find the gradient of a line joining this pair of points.

A = (2, 3) and B = (4, 5). The two given points are $x_1y_1 = (2, 3)$ and $x_2y_2 = (4, 5)$

Using the formula = $\frac{y^2 - y^1}{x^2 - x^1} = \frac{5 - 3}{4 - 2} = \frac{2}{2} = 1$

\therefore the gradient of the line AB = 1.

Activity 5: Have learners solve these in their groups. Find the gradient of the line.

a. P(4, 5) and K(3, 7)

b. A(2, 2), B(-3, 4)

Activity 6: Go through the worked examples with learners on pages 110 - 111 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Have learners work in pairs.

Find the gradient of line AB, A(2, 3) B(6, 4).

Challenging activity

Work in pairs. Find the gradient of the line P(3, -1), K(4, -3).

Suggested homework

1. Two points on a straight line are (8, 5) and (6, 6). Find the gradient.
2. Find the gradient with these two points T(3, -2), Z(4, 4).

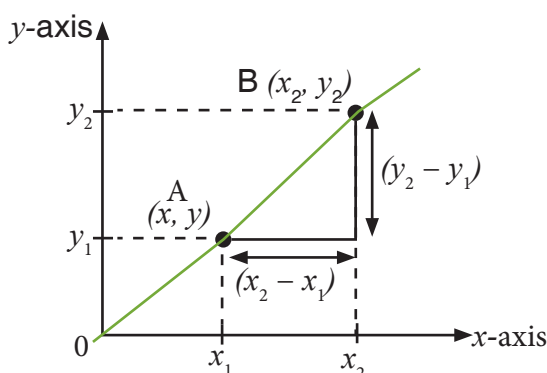
Activity 1: Refer learners to the Main idea on pages 109 - 110 of the Learner's Book. Go through the procedure to determine the gradient of a straight line.

The gradient of a line is defined as the change in the y -coordinate with respect to the change in the x -coordinate.

The gradient of a line is used to calculate the steepness of a line and determine how much it is inclined in reference to the x -axis.

Formula for calculating gradient

To calculate the gradient of any line, we use the x - and y -coordinates of a line. We work with the ratio of the change in y -axis to the change in x -axis.

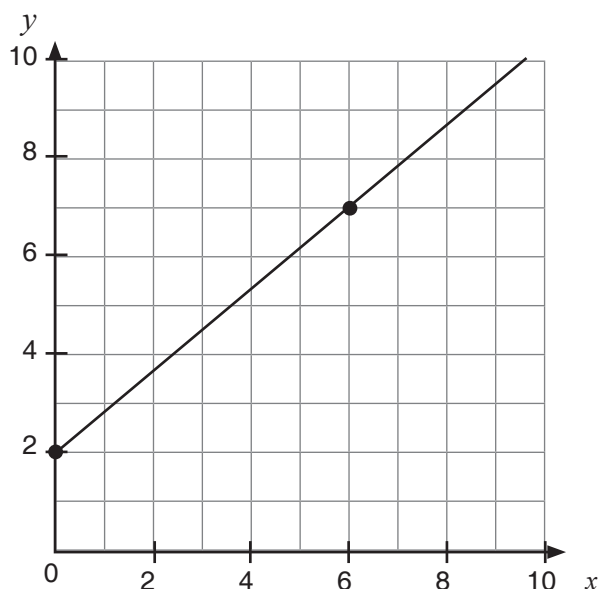


The formula for calculating the gradient of a line is given as $m = \frac{y^2 - y^1}{x^2 - x^1} = \frac{\Delta y}{\Delta x}$, where m represents the gradient of the line, and (x^1, y^1) and (x^2, y^2) are the coordinates of the points A and B respectively.

Activity 2: Go through the worked examples with learners on pages 110 - 111 of the Learner's Book.

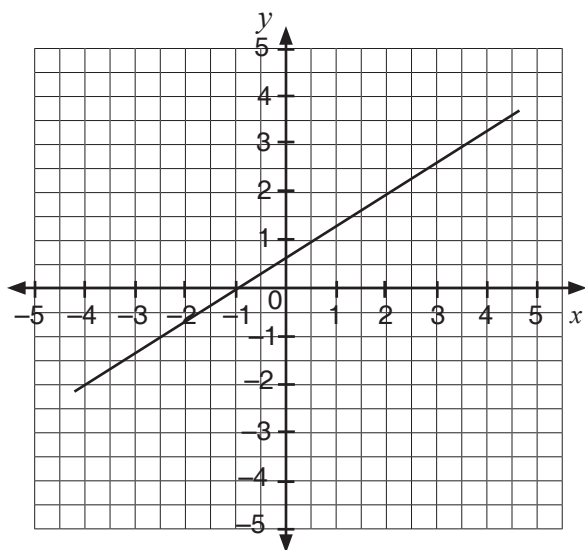
Review exercise

Put learners into mixed ability groups to find the gradient of the line.



Refer learners to page 111 of the Learner's Book for exercise.

Suggested homework: Find the gradient of the graph below.



Main idea 3

Equation of a straight line

LB page 116

Activity 1: Let learners know that, the standard form of the equation of a straight line is $ax + by + c = 0$ and its gradient is $m = \frac{a}{b}$.

Write the four methods of finding the equation of a straight line on the board.

1. Slope-intercept form.
2. Point-slope form.
3. Two-point form.
4. Intercept form.

Activity 2: Refer learners to Main idea 3 on page 116 of their Learner's Book. Go through how to use the slope-intercept form of an equation of a straight line.

The slope-intercept form of an equation of a straight line

Let learners know that the slope-intercept form is a method we can use to determine the equation of a straight line in the coordinate plane.

To find the slope-intercept form of an equation, we need the slope of the line and the y -intercept, which is the place where the line cuts the y -axis. Let's consider a straight line with a slope m and y -intercept c .

The slope-intercept form of an equation of a straight line is given as: $y = mx + c$.

$y = mx + c$

slope of the line

m

y -intercept of the line

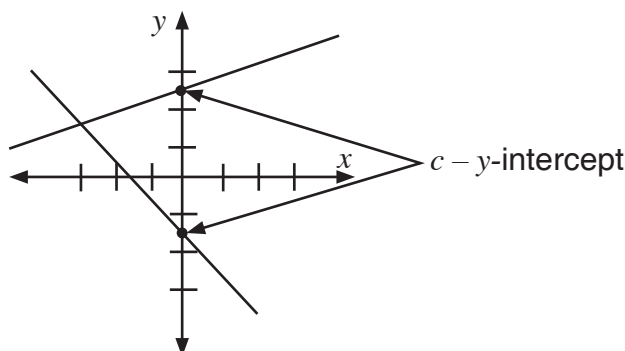
c

m and c are constants.

The slope m measures how steep the line is in respect to the horizontal. Given two points (x_1, y_1) and (x_2, y_2) on the line, the slope is calculated as:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- The y -intercept c is the point where the line crosses the y -axis.



Activity 3: Go through the worked examples with learners on page 117 in their Learner's Book.

Activity 4: Put learners into convenient groups to solve some questions.

E.g. Find the equation of the line in slope-intercept form with slope 5 and y -intercept 4. Call up some group leaders to the board to explain how they got their answer.

Solution:

Slope-intercept form of an equation is, $y = mx + c$, $m = 5$ (slope) and $c = 4$ (y -intercept)

Substituting in the equation, we have $y = 5x + 4$.

So the required equation is $y = 5x + 4$.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Find the equation of a line in slope-intercept form with slope of 3 and y -intercept 2.

Challenging activity:

Write the equation of the line in slope-intercept form with slope of 6 and y -intercept 3.

Assessment Task ----- LB page 118

Refer learners to page 118 of the Learner's Book for exercise.

Suggested homework

Write the equation of the line in slope-intercept form with:

1. a slope of 3 and y -intercept 5.
2. a slope of -2 and y -intercept 1.
3. a slope of and y -intercept -3 .

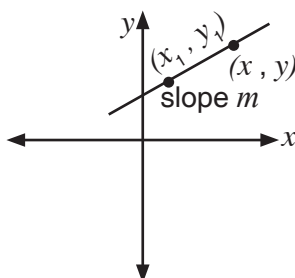
Main idea 4

The point-slope form of the equation of a straight line
LB page 119

Activity 1: Guide learners to know how to find the point-slope form of the equation. Refer learners to page 119 of the Learner's Book. Go through how to find the point-slope form with them.

How to find the point-slope form

Consider a line with a slope of m that passes through a known point (x_1, y_1) . Let (x, y) be any other point on the line whose coordinates are not known.



We know that the slope of a line is given as: $\text{Slope} = \frac{\text{change in } y\text{-coordinate}}{\text{change in } x\text{-coordinate}}$ using the points (x, y) and (x_1, y_1) . Slope, $m = \frac{y - y_1}{x - x_1}$

Multiply both sides by $(x - x_1)$: $m(x - x_1) = y - y_1$

\therefore The point-slope form of an equation is $y - y_1 = m(x - x_1)$.

Activity 2: Write an equation on the board and solve it with learners. Find the equation of a straight line passing through $(-2, 5)$, the slope m is 4, $x_1 = -2$ and $y_1 = 5$.

Formula $y - y_1 = m(x - x_1)$, substitute the values in the equation, we have $y - 5 = 4(x - (-2))$

$$y - 5 = 4x + 8$$

$$y = 4x + 8 + 5$$

$$y = 4x + 13$$

The equation in standard form $y - 4x - 13 = 0$

Activity 3: Go through the worked examples with learners on pages 121 - 123 of their Learner's Book.

Activity 4: Take learners through the (two-points form of equation of a line on page 121 of the Learner's Book)

Activity 5: Work some examples on the board with learners. E.g. Find the equation of a straight line passing through the points $(2, 1)$ and $(3, -2)$.

Let (x, y) be a point on the line. With the given points $x_1 = 2, y_1 = 1, x_2 = 3$ and $y_2 = -2$.

Substituting the values in the equation we have $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$.

$$= y - 1 = \frac{-2 - 1}{3 - 2} (x - 2)$$

$$= y - 1 = \frac{-2 - 1}{3 - 2} (x - 2)$$

$$y - 1 = \frac{-3}{1} (x - 2)$$

$$= -3(x - 2)$$

$$y - 1 = -3x + 6 = y = -3x + 7 \text{ or } y + 3x = 7$$

Activity 3: Put learners into convenient groups to solve more questions.

E.g. Find the equation of a straight line that passes through the points (1, 3) and (2, 3).

Call some group leaders to work on the board for others to observe.

Activity 4: Go through the worked examples with learners on pages 120 - 123 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Find the equation of a straight line passing through (−2, 5) and (1, −1).

Challenging activity

Work in pairs.

Write the equation of a line which passes through the points (−1, 2) and (3, −3).

Assessment Task ----- LB page 123

Refer learners to page 123 of the Learner's Book for exercise.

Suggested homework

1. Write the equation of a line using the point-slope formula with point (4, 3) and slope 4.
2. Find the equation of a straight line passing through (−1, 0) and (4, −3).

Main idea 5

Find the gradient in a linear equation

LB page 124

Activity 1: Review the previous lesson with learners. Ask learners to tell you the equation in the slope-intercept form, $y = mx + c$. They should tell you what the m and the y intercept are. m is the coefficient of x and the y intercept is c (the constant).

Activity 2: Refer learners to page 124 of the Learner's Book. Read through the Main idea 5 with them.

$$y = mx + c$$

gradient y-intercept

Activity 3: Go through the worked examples with learners on pages 124 - 125 of the Learner's Book.

Activity 4: Put learners into convenient groups. Let them solve this equation.

1. Find the gradient and the y -intercept of a straight line with the equation $2x + y = 10$.

Ask them to make y the subject of the equation first. So we have $y = -2x + 10$.

Let the group leaders solve it on the board.

Review exercise

Put learners into mixed ability groups. Let them solve this equation. Find the gradient and the y -intercept of the straight line with equation $y = 2(2x - 2)$.

Assessment Task ----- LB page 126

Refer learners to page 126 of the Learner's Book for exercise.

Suggested homework

Find the gradient of the equation.

1. $y = \frac{1}{2}x + 9$
2. $4y + 3x = 12$
3. Write the equation $3x + 2y + 6 = 0$ in the form $y = mx + c$. Find the gradient and the y -intercept.

Revision 5

Patterns and relations ----- (LB page 127)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

(LB page 111)

1. $\frac{1}{2}$

2. $-\frac{3}{5}$

3. a. 3

b. -4

c. $\frac{5}{3}$

d. 3

e. -3

f. $\frac{1}{30}$

$\frac{6}{5}$

Main Idea 2

(LB page 114)

1. 4

2.

3. a. $\frac{6}{5}$

b. -1

4. $\frac{3}{8}$

5. 3

Main Idea 3

(LB page 118)

1. a. $y = 2x + 5$

b. $y = -2x + 6$

c. $y = \frac{1}{2}x + 7$

2. a. Slope = -2 ; y -intercept = -1 ;

Equation $y = -2x - 1$

b. Slope = 1 ; y -intercept = 2 ;

Equation $y = x + 2$

3. $y = -4x + 5$

4. $y = -\frac{7}{2}x + \frac{29}{2}$

5. $y = -6x +$

6. a. $y = -\frac{1}{3}x + 9$

b. $y = -\frac{1}{2}x - \frac{15}{2}$

Main Idea 4

(LB page 123)

1. a. $y + 2x - 11 = 0$

b. $y - 3x = 0$

c. $y + x + 8 = 0$

d. $3y - 2x - 26 = 0$

2. a. $y + x - 2 = 0$

b. $5y + 6x - 30 = 0$

c. $y - 2x = 0$

3. $y = 4$

4. $x = 0$

5. $\frac{x}{6} + \frac{y}{3} = 1 \rightarrow x + 2y - 6 = 0$

Main Idea 5

(LB page 126)

1. Gradient = 4 ; y-intercept = 9

2. Gradient = - ; y-intercept = 10

3. a. $\frac{1}{3}$

b. $-\frac{1}{4}$

c. $\frac{5}{3}$

4. a. Gradient = $-\frac{2}{5}$; y-intercept = $-\frac{3}{5}$

b. Gradient = -8 ; y-intercept = 6

c. Gradient = $\frac{2}{3}$; y-intercept = -4

5. Equation $y = -\frac{3}{4}x + \frac{5}{4}$; Gradient = $-\frac{3}{4}$; y-intercept = $\frac{5}{4}$.

Answers to Revision

5

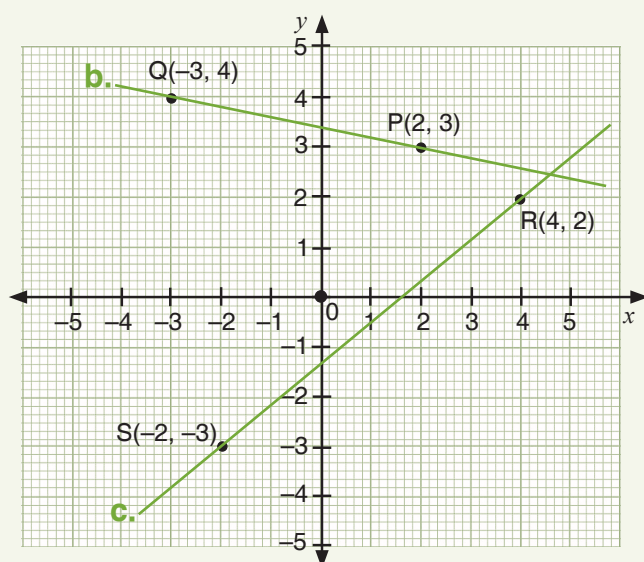
(LB page 127)

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

2. $y = \frac{2}{5}x + \frac{33}{5}$ or $5y - 2x - 33 = 0$

3. Gradient = 2 ; y-intercept = -5

4. a.

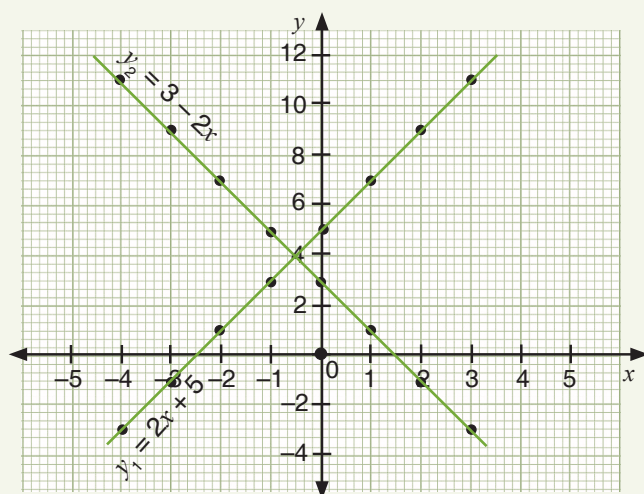


d. Coordinates of point of inter-section $(4.6, 2.5) \pm 0.1$.

5. a.

x	-4	-3	-2	-1	0	1	2	3
$y_1 = 2x + 5$	-3	<u>-1</u>	<u>1</u>	<u>3</u>	<u>5</u>	<u>7</u>	<u>9</u>	11
$y_2 = 3 - 2x$	<u>11</u>	9	<u>7</u>	5	<u>3</u>	<u>1</u>	<u>-1</u>	<u>-3</u>

b.

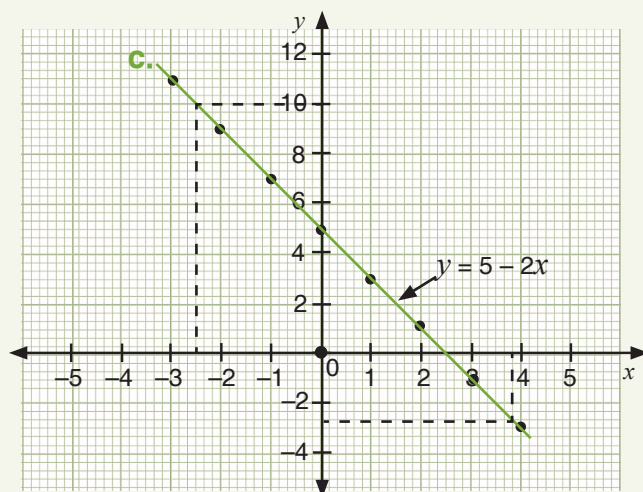


c. y_1 and y_2 intersect at point $(-\frac{1}{2}, 4)$.

6. a.

x	-3	-2	-1	0	1	2	3	4
y	<u>11</u>	9	7	<u>5</u>	3	<u>1</u>	<u>-1</u>	-3

b.



d. i. Gradient = -2

ii. When $x = -2.5$, $y = 10$

iii. When $y = -2.8$, $x = -3.9$

Sub-strand 2: Algebraic expressions

Module 1

Graph of relations

Content standard

B8. 2. 1. 1 Demonstrate the ability to draw a table of values for a linear relation, graph the relation in a number plane, determine the gradient of the line and use it to write an equation of a line of the form $y = mx + c$.

Indicator

B8: 2.1.1.1.2 Use a graph of a linear relation to determine subsequent missing elements in the ordered pairs of the relation.

Learning expectations: In this module, learners will learn how to:

- Use information from a graph to find missing values.
- Use graph of linear relations to solve real-life problems.

Essential for learning: Learners can find the gradient of a line when two coordinates are given.

Resources: Graph Sheets.

Keywords: relation, ordered pairs

Competencies: Critical thinking and problem-solving, personal development and leadership, creativity and innovation.

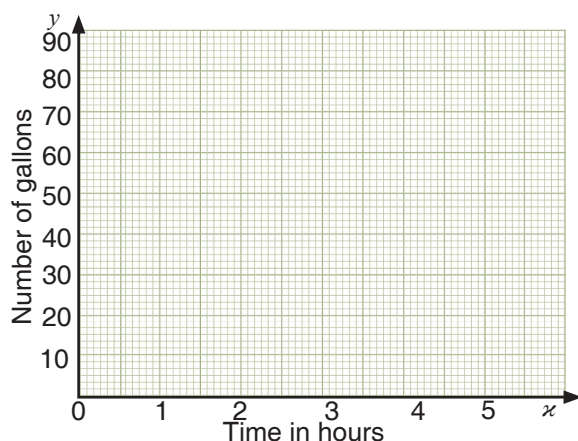
Starter: Refer learners to page 128 of the Learner's Book for warming up activity.

Main idea 1

Find missing elements in ordered pairs of relations

LB page 128

Activity 1: Put learners into convenient groups. Paste a graph question on the board. Guide learners to interpret the graph and answer questions on it. E.g.



The graph shows the relation of time and the number of gallons of water fetched.

Answer the following questions.

1. How many gallons of water was fetched at the 3rd hour?
2. At what time was 65 gallons fetched?
3. How long does he have to fetch 70 gallons of water?

Activity 2 : Refer learners to pages 129 - 131 of the Learner's Book. Go through the worked examples with them.

Review exercise

Put learners into mixed ability groups. Let them solve this graph problem.

Two positions are given as when $x = 0$, $y = 6$, and when $x = 2$, $y = -4$.

Assessment Task ----- LB page 132

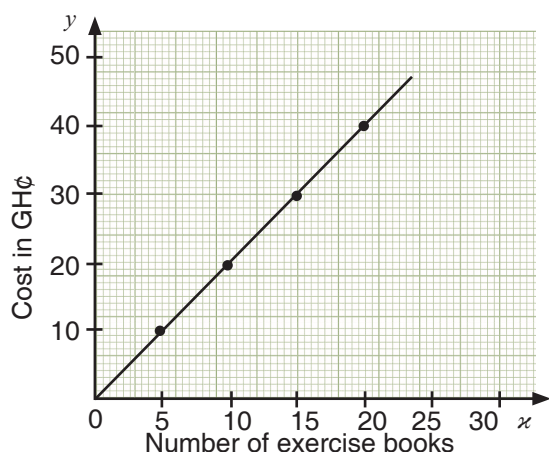
Refer learners to page 132 - 133 of the Learner's Book for exercise.

Suggested homework

The graph below shows the relation $y = 2x$ where y is the cost of pencils bought by Mr. Asante.

Use the graph to answer the following question.

1. How much will it cost to buy 15 exercise books?
2. How many exercise books can Mr. Asante buy with GH¢40.00?

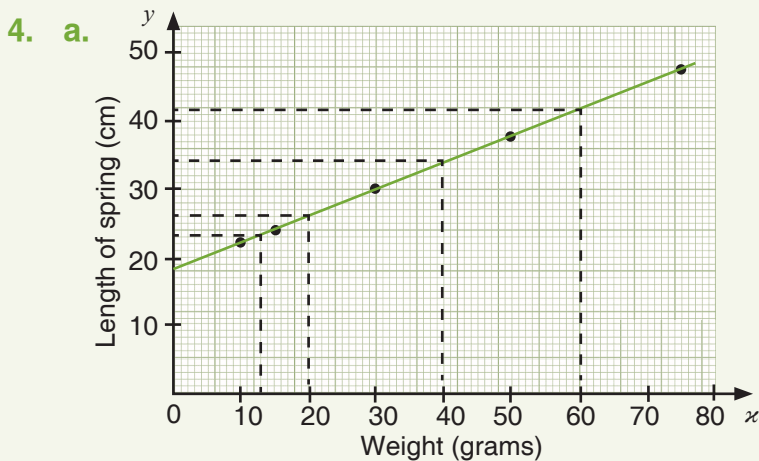
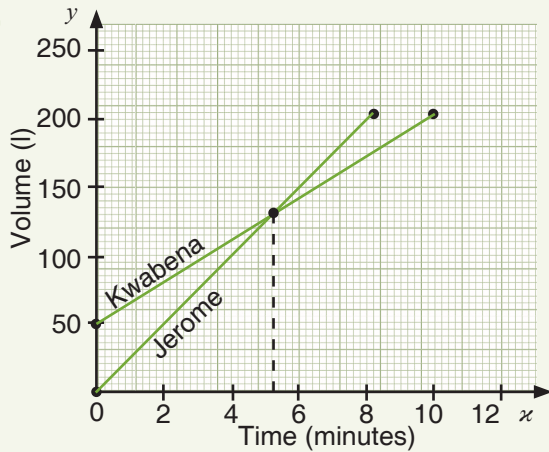


Answers to Assessment tasks

Main Idea 1

(LB page 132)

1. a. GH¢67.50 \pm 0.50 b. 4.67 kg \pm 0.1
 c. GH¢82.50 \pm 0.50 d. 3 kg
2. a. GH¢480.00 b. 70 exercise books c. 45 exercise books
3. a. b. After 5.2 min \pm 0.1



- b. i. Length for 20 g = 26 cm \pm 1 cm ii. Length for 40 g = 34 cm \pm 1 cm
- c. i. Load for 23 cm = 13 g \pm 1 g ii. Load for 42 cm = 60 g \pm 1 g
- d. Natural length of the spring is 18 cm \pm 1 cm.

Sub-strand 2: Algebraic expressions

Module 2

Binomial expressions

Content standard

B8.2.2.1. Solve problems involving algebraic expressions (including multiplication of binomial expressions) factorise given expressions and substitute values to evaluate algebraic expressions.

Indicator

B8.2.2.1.1. Use the distributive property to remove brackets and solve multiplication of binomial expression.

Learning expectations: In this module, learners will learn how to:

- Expand algebraic expressions.
- Multiply binomial expressions.
- Square binomial expressions.

Essential for Learning: Learners can simplify simple equations.

Resources: Work cards.

Keywords: distributive property, expand, binomial expression

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: I am 30 years old, describe me in three different ways.

Main idea 1

Expand algebraic expression

LB page 134

Activity 1: Write any algebraic expression on the board. Demonstrate by expanding it for learners to observe.

E.g. $2(6a + 4b) = 12a + 8b$

Activity 2: Put learners into convenient groups to solve these.

1. $2(6a - 4b)$

2. $3x(6a - 12)$

3. $4x(x - y)$

Activity 3: Go through the worked examples with learners on pages 134 - 135 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. $6(y + b)$ 2. $2x(x - 2a)$

Challenging activity

Solve these in pairs.

1. $3x(-4a + 6)$ 2. $6k(4c + 2b)$

Assessment Task ----- LB page 135

Refer learners to page 135 of the Learner's Book for exercise.

Suggested homework

1. $10x(6x - 4)$ 2. $105 - 2(45 + 4)$ 3. $n(2m + 2) - n + 5$

Main idea 2

Multiply binomial expressions

LB page 135

Activity 1: Take learners through the steps of multiplying binomials on pages 135 - 136, i.e. $(a + 3)(a + 4)$.

Activity 2: Write these on the board for learners to solve in their groups. Let them use the distributive method.

1. $(2x + 2)(4x - 1)$ 2. $(ax - b)(x + b)$

Activity 3: Go through the steps on vertical method with them on pages 136 - 137.

Multiply using the vertical method

Steps:

- Place the binomials one below the other as shown above.
- Start with the second binomial or the term on the right in the binomial that is below the first one. Multiply it by both the terms in the first binomial: $(1 \times y) + (1 \times 5) = y + 5$
- Take the first term in the bottom binomial: $(y \times y) + (y \times 5) = y^2 + 5y$
- Line up the like terms from the previous steps.
- Add the columns to obtain the result: $y^2 + 6y + 5$

The vertical method is quite similar to the vertical multiplication when multiplying whole numbers. This method applies to all polynomials. Work one example with them.

Multiply: $(y + 5)(y + 1)$

$$\begin{array}{r} y + 5 \\ \times y + 1 \\ \hline y + 5 \\ y^2 + 5y \\ \hline y^2 + 6y + 5 \end{array}$$

$$(y + 5)(y + 1) = y^2 + 6y + 5$$

Activity 4: Go through the worked examples with learners on pages 137 - 138 of their Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Use distribute property to multiply $(3x + 2)(3x - 3)$.

Assessment Task ----- LB page 138

Refer learners to page 138 of the Learner's Book for exercise.

Suggested homework

1. $(a + b)(x - y)$
2. $(xy + 1)(y - 2)$
3. $(x + 8)(y - 2)$
4. $(2 + 6y)(2y + 2)$

Challenging activity

Solve these. 1. $(5x - 2)(-x + 10)$ 2. $(2x + 2y)(4x - y)$

Main idea 3

Squares of binomials

LB page 138

Activity 1: Explain to learners what squares of binomials are. (It is the sum of the product of the two terms and the square of the last term.)

Demonstrate on the board by working one example with them. E.g. $(x + y)^2 = (x + y)(x + y)$

$$\begin{aligned} (x + y)(x + y) &= x^2 + xy + yx + y^2 \\ &= x^2 + xy + xy + y^2 \\ &= x^2 + 2xy + y^2 \end{aligned}$$

Activity 2: Have learners expand this in pairs $(m + n)^2$.

Use same method to explain $(x - y)(x - y)$ to learners.

Activity 3: Take learners through the worked examples on page 139 of the Learner's Book.

Pair them to solve these.

1. $(x + 2)^2$

2. $(3a + b)^2$

Difference of two squares

Activity 4: Explain with examples the difference of two squares. (The difference of two squares is when the sum of two numbers multiplies their difference.)

Example: $(x + y)(x - y)$

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

$$\text{So } (x + y)(x - y) = x^2 - y^2$$

Activity 5: Have learners solve these in their previous groups.

1. $(x + 6)(x - 6)$

2. $(4a + 2b)(4a - 2b)$

Activity 6: Refer learners to worked examples on pages 139 - 140 of the Learner's Book. Go through the examples with them.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve. $(2x + 2)^2$.

Challenging activity

Solve these in pairs. $(3a + b)(3a - b)$

Assessment Task ----- LB page 141

Refer learners to page 141 of the Learner's Book for exercise.

Suggested homework

Solve these.

1. $(3a + b)^2$

2. $(\frac{1}{2}x - \frac{1}{2}y)^2$

2. $(4a + 2b)(4a - 2b)$

4. $(\frac{1}{2} + q)^2$

Answers to Assessment tasks

Main Idea 1

(LB page 135)

- | | | |
|-------------------|-------------------------|----------------------------------|
| 1. a. $5x + 5y$ | b. $7x - 7y$ | c. $\frac{1}{3}s - \frac{1}{3}r$ |
| d. $3a^2 + 3ab$ | e. $7mn - 42ml$ | f. $2x^2y + 6xy^2$ |
| 2. a. $19y + 15$ | b. $8a$ | c. $-5x + 5xy$ |
| d. $mn - 2m$ | e. $-b + 18c$ | f. $8p - 11q - 5$ |
| 3. a. $-18g - 66$ | b. $10a^2 + 15am - 5ar$ | c. $12a^2 - 15a + 49b + 21$ |
| d. $38p + 10$ | e. $15r + 20u - 30z$ | f. $2b - 2c$ |

Main Idea 2

(LB page 138)

- | | | |
|------------------------------|---|-------------------------------|
| 1. a. $ax + ay + bx + by$ | b. $b^2 + 10b + 24$ | c. $x^2 - 10x + 24$ |
| d. $8x^2 - 18r^2$ | e. $6au + 15av + 6bu + 15bv$ | f. $4p^2 + 9pq - 9q^2$ |
| 2. a. $4a^2 - b^2$ | b. $8y^2 - 34y + 21$ | c. $tu - 3tv + 2su - 6sv$ |
| d. $2x^2y^2 + 5x^2y - 12x^2$ | e. $x^2 + \frac{1}{y}x - \frac{1}{3}x - \frac{1}{3y}$ | f. $12c^2 + 13c - 35$ |
| 3. a. $a^2x^2 - b^2y^2$ | b. $xy + 4x + 8y + 32$ | c. $a^2b^2 + 12ab + 20$ |
| d. $12y^2 - 23y + 10$ | e. $x^2y^2 - y^2z^2$ | f. $3x^2y^2 + 13x^2y - 10x^2$ |

Main Idea 3

(LB page 141)

- | | | |
|---|---|--|
| 1. a. $9x^2 + 24x + 16$ | b. $a^2 + 6ab + 9b^2$ | c. $16a^2 - 24ab + 9b^2$ |
| d. $25v^2 - 60vu + 36u^2$ | e. $49x^2 + 14xy + y^2$ | f. $\frac{1}{9}p^2 - \frac{2}{9}pq + \frac{1}{9}q^2$ |
| 2. a. $4a^2 - 9b^2$ | b. $x^2 - 64$ | c. $v^2 - u^2$ |
| d. $25f^2 - 4g^2$ | e. $n^2 - 36m^2$ | f. $15 - 4x - 3x^2$ |
| 3. a. $\frac{1}{16}x^2 - \frac{1}{25}y^2$ | b. $\frac{1}{16}p^2 + \frac{3}{2}pq + 9p^2$ | c. $4s^2 - 2st + \frac{1}{4}t^2$ |
| d. $m^2 + mn + n^2$ | e. $\frac{1}{4}u^2 - \frac{1}{9}v^2$ | f. $16v^2 - \frac{1}{9}w^2$ |

Sub-strand 2: Algebraic expressions

Module 3

Operations with algebraic expressions

Content standard

B8.2.2.1 Solve problems involving algebraic expressions (including multiplication of binomial expressions), factorise given expressions and substitute values to evaluate algebraic expressions.

Indicator

B8.2.2.1.2 Perform addition, subtraction, multiplication and division of algebraic expressions including fractions.

Learning expectations: In this module, learners will learn how to:

- Add and subtract algebraic expressions.
- Solve problems that include multiplying and dividing with algebraic fractions.

Essential for learning: Learners can do multiplication on binomial expressions.

Resources: Work cards.

Keyword: algebraic, expression, reciprocal

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Refer learners to page 142 of the Learner's Book for warming up activities.

Main idea 1

Addition and subtraction of algebraic fractions **LB page 142**

Activity 1: Revise the previous lesson with learners. Explain to learners that, addition and subtraction of algebraic fractions are the same as adding and subtracting rational numbers. Let them know that algebraic fractions must have the same denominator before we can add or subtract.

Activity 2: Write a fraction example on the board and guide learners to solve it.

Pair learners to solve this $\frac{35}{5} + \frac{5}{15}$.

Activity 3: Have learners work out these algebraic subtractions.

1. $\frac{4y}{3} - \frac{3y}{4}$

2. $\frac{x-2}{5} + \frac{3x}{4}$

Activity 4: Go through the worked examples on page 143 with learners.

Review exercise

Put learners into mixed ability groups to solve these.

1. $\frac{2}{a} + \frac{4}{b}$ 2. $\frac{5}{5y} - \frac{2}{2y} + \frac{5}{5y}$

Assessment tasks ----- LB page 143

Refer learners to pages 143 - 144 of the Learner's Book for exercise.

Suggested homework

Express the following as a single fraction.

1. $\frac{3}{5a} - \frac{4}{6b}$ 2. $\frac{1}{2}(y+2) + \frac{1}{2}(2y+1)$
3. $\frac{b-3}{5} - \frac{b+2}{2}$ 4. $\frac{4b+1}{b} + \frac{2a-2}{c}$

Main idea 2

Multiply and divide algebraic fractions

LB page 144

Activity 1: Write some algebraic multiplication on the board. Demonstrate by working two examples on the board. You may write your own examples. Example:

1. $\frac{2x}{4y} \times \frac{5y}{6x} = \frac{2x \times 5y}{4y \times 6x} = \frac{10xy}{24xy} = \frac{10}{24} = \frac{5}{12}$
2. $\frac{3x-9}{6} \div \frac{x-3}{4}$ (Multiply the dividend by the reciprocal of the divisor.)
 $\frac{3x-9}{6} \times \frac{4}{x-3} = \frac{3(x-3)}{6} \times \frac{4}{x-3} = 2.$

Activity 2: Put learners into convenient group to solve these.

1. $\frac{2x+12}{4} \div \frac{x+6}{4}$ 2. $\frac{3v}{4} \times \frac{v}{6}$

Activity 3: Go through the worked examples with learners on pages 145 - 146 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. $\frac{3p}{p-q} \times \frac{p+q}{p-q}$

Challenging activity

1. $\frac{8x^2}{x^2} \div \frac{x^2-4}{x^2+2x}$ 2. $6y-12 \div 12y-12$

Assessment tasks ----- LB page 146

Refer learners to page 146 of the Learner's Book for exercise.

Suggested homework

Solve these.

1. $\frac{12y+48}{8y-32}$ 2. $\frac{x^2+10x}{x(x-5)(x+10)}$ 3. Multiply $\frac{6x+6}{12x^2}$ by $\frac{6xy}{x+2}$

Answers to Assessment tasks

Main Idea 1

(LB page 143)

1. a. $\frac{7}{9}x$ b. $\frac{4}{3}y$ c. $\frac{2a+3c}{3abc}$ d. $\frac{9b-16a}{12ab}$
2. $\frac{5bc+7ac-4ab}{abc}$ 3. $\frac{7y+10}{2y}$
4. a. $\frac{6x-5}{4}$ b. $\frac{2a+2}{15}$ c. $\frac{11x+11}{6}$ d. $\frac{13a-39}{15}$
5. a. $\frac{3x+6}{4}$ b. $\frac{7a-y+3}{2a}$ c. $\frac{5}{6}$ d. $\frac{2bc-2b+c}{bc}$
6. $\frac{3r-q-9}{6q}$

Main Idea 2

(LB page 146)

1. a. $\frac{3}{8}vu$ b. $\frac{5}{(p-q)^2}$ or $\frac{5}{p^2-2pq+q^2}$ c. $\frac{5y}{6x}$
- d. $\frac{4a}{3b(a-b)}$ or $\frac{4a}{3ab-3b^2}$ e. $\frac{3}{8}$
2. a. $\frac{3}{2}$ b. $\frac{3(b-2)2}{8}$ or $\frac{3b^2-12b+2}{8}$ c. $\frac{11(3x-4y)}{5}$ or $\frac{33x-44y}{5}$
- d. $\frac{8u}{175v+125u}$ e. $\frac{1}{x-2}$
3. a. $\frac{a^3+2a^2b+ab^2+2b^3}{a^3-3a^2b+3ab^2-b^3}$ or $\frac{(a+2b)(a^2+b^2)}{(a-b)^3}$ b. $\frac{59(a+b)}{(a-b)^3}$ or $\frac{59a+59b}{a^3-3a^2b+3ab^2-b^3}$
- c. 4 d. $\frac{xy^2+y^3}{2x^2}$ e. $\frac{9}{x^3+5x^2}$

Sub-strand 2: Algebraic expressions

Module 4

Evaluation of algebraic expressions

Content standard

B8.2.2.1 Solve problems involving algebraic expressions (including multiplication of binomial expressions), factorise given expressions and substitute values to evaluate algebraic expressions.

Indicator

B8.2.2.1.3 Substitute values to evaluate algebraic expressions including fractions and use these to solve problems.

Learning expectation: In this module, learners will learn how to:

- Determine the value of an algebraic expression for given values.

Essential for learning: Learners can expand algebraic expression and can multiply binomial expressions.

Resources: Work cards.

Keywords: evaluate, substitute

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Ask learners to express 100 in five different ways.

Main idea 1

Multiply and divide algebraic fractions

LB page 147

Activity 1: Review the previous lesson with learners. Let learners know that evaluating algebraic expressions simply means replacing the variables in the expression by the given values. Then we simplify the resulting expression using the order of operations. Refer learners to page 147 Main Idea 1. Go through the explanation with learners.

Activity 2: Write some examples on the board for learners to solve in their groups.

E.g. $5x + 6$, when x is 12

Substitute $x = 12$ in the expression.

$$(5 \times 12) + 6$$
$$60 + 6 = 66$$

Activity 3: Go through the worked examples with learners on pages 148 - 149.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Solve these.

1. Find the value of x , when x is 2, $2x + 4x - 2$.
2. $4y + y - 20$, when $y = 10$.

Challenging activity

Work in pairs to solve these.

1. $b^2 - ab + 2b - a$, when $a = 2$ and $b = 4$.
2. $(2p)^2 - 2p^2 + p$, when $p = 4$.

Assessment Task ----- LB page 149

Refer learners to pages 149 - 150 for exercise.

Suggested homework

1. $3b^2 + ab$, when $a = 6$ and $b = 2$.
2. $6x + 6y^2 - 2y - 6$, when $x = 4$ and $y = 3$.
3. $\frac{4x}{y} \times 3x \times y$, when $x = 2$ and $y = 4$.

Answers to Assessment tasks

Main Idea 1

(LB page 149)

1. 5

2. $\frac{8}{9}$

3. $\frac{16}{5}$ or $3\frac{1}{5}$

4. 3

5. -2

6. $-\frac{13}{4}$ or $-3\frac{1}{4}$

7. 19

8. $-\frac{15}{2}$ or $-7\frac{1}{2}$

9. a. $-1\frac{1}{2}$

b. $-\frac{5}{64}$

c. 60

d. $-\frac{15}{8}$ or $-1\frac{7}{8}$

10. 108

Sub-strand 2: Algebraic expression

Module 5

Factorization of algebraic expressions

Content standard

B8.2.2.1 Solve problems involving algebraic expressions (including multiplication of binomial expressions), factorise given expressions and substitute values to evaluate algebraic expressions.

Indicator

B8.2.2.1.4 Factorise given expressions involving the four operations and use the experiences gained to solve problems.

Learning expectation: In this module, learners will learn how to:

- Factorise algebraic expressions and use factors to solve problems.

Essential for learning: Learners can substitute values to evaluate algebraic expressions.

Resources: Work cards.

Keywords: factorize

Competencies: Critical thinking and problem-solving, creativity and innovation, personal development and leadership.

Starter: Refer learners to Starter on Learner's Book page 151 for warming up activity.

Main idea 1

Factorising algebraic expressions

LB page 151

Activity 1: Review the previous lesson with learners. Go through the methods of factorising algebraic expressions on page 151 with learners.

Methods to use to factorise algebraic expressions

We will consider two methods: **(the common factor method)** and the **(regrouping method)**. Go through the steps with learners.

Steps to follow to use the common factor method:

Factorise algebraic expressions using the common factor method:

- Find the factors of each term.
- Find the highest common factor of the terms.
- Express the terms as a product.

For example, we can factorise $2ab + 3a$ as $2 \times a \times b + 3 \times a$. The highest common factor is a , so we keep a outside the brackets and divide the terms by the common factor and write the remaining expression inside the brackets: $2ab + 3a = a(2b + 3)$.

2. Factorise an algebraic expression using the regrouping method.

When using regrouping, we arrange the terms of the given algebraic expression in suitable groups in such a way that all the groups have a common factor.

For example, in the algebraic expression, $ax + ay + bx + by$.

regroup the terms as $(ax + bx) + (ay + by)$.

Take out the common factors:

$$x(a + b) + y(a + b)$$

$$= (a + b)(x + y)$$

Alternative method:

$$(ax + ay) + b(x + y)$$

$$= a(x + y) + b(x + y)$$

$$= (x + y)(a + b)$$

So, $(ax + bx) + (ay + by) = (x + y)(a + b)$

Activity 2: Demonstrate by working two examples on the board using the two methods.

Method 1: Common factor method

E.g. Factorise: $3ax + 6ay$

$$3ax + 6ay = 3 \times a \times x + 6 \times a \times y$$

$$= 3a(x + 2y)$$

Method 2: Re-grouping method

E.g. Factorise: $2ap + aq - bq - 2bp$

$$= a(2p + q) - b(q + 2p)$$

$$(a - b)(2p + q)$$

Activity 3: Put learners into mixed ability groups to solve some questions. E.g Using common factor, solve:

1. $54 - 81x$
2. Using grouping method solve $ab - by - ay + y^2$.

Activity 4: Go through the worked examples with learners on pages 152 - 154.

Review exercise

Put learners into mixed ability groups to solve these.

1. Use common factor method to solve $100x - 25x^2$.
2. Use grouping method to solve $4ap + aq$

Assessment Task ----- LB page 154

Refer learners to page 154 of the Learner's Book for exercise.

Suggested homework

Factorise the following.

1. $4x^2 + 2xy - 12xy - 8yz$
2. $200m + 50t$
3. $6x^2 + 8x + qz^2 - 12$

Revision 6

Algebraic expressions ----- (LB page 155)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 154)

- | | | |
|-------------------------|-------------------------|----------------------------|
| 1. a. $4a(y + 3x)$ | b. $mn(7p - 5q)$ | c. $\frac{2}{81}(v - 3w)$ |
| d. $xy(z + r)$ | e. $7(2t - 7)$ | f. $\frac{1}{8}ab(2b + 1)$ |
| 2. a. $(5s + q)(r - u)$ | b. $(x - c)(x + r)$ | c. $(5a - b)(y + 3)$ |
| d. cannot be factorised | e. Not factorable | f. $(2x + 3)(y - 4)$ |
| 3. a. $25(5v + u)$ | b. $13a(b - 4c)$ | c. Not factorable |
| d. $(2g - 5y)(f + 2b)$ | e. $(3z^2 - 4)(2x + 3)$ | f. $(2x - 1)(3y + 2)$ |

Answers to Revision

6

(LB page 155)

- | | | |
|--------------------------|------------------------------|---------------------------|
| 1. a. $15x + 25y - 40z$ | b. $-3x + 2x^2$ | c. $21 - 2x - 3x^2$ |
| d. $pq + q^2$ | e. $25a^2 - 20ab + 4b^2$ | f. $16x^2 + 40xy + 25y^2$ |
| 2. a. $8m - 23n$ | b. $2a^2 - 3ab + b^2$ | c. $-ab + 6b$ |
| d. $2y$ | | |
| 3. a. $2(9x + 16y - 6z)$ | b. $x(a + 1)$ | c. $(a + 3)(x + 1)$ |
| d. $(2b - c)(11a + 3r)$ | e. $(m + n)(x - y)$ | f. $(x + 5)(y - z)$ |
| g. $(y - m)(x - m)$ | h. $\frac{1}{8}px(2x^2 + 1)$ | |
| 4. a. $\frac{a + 3b}{6}$ | b. $\frac{5}{3}$ | c. $p - q$ |
| d. 5 | e. $\frac{x - 5}{3}$ | |
| 5. a. $(c - 4)(2b + 3)$ | b. 39 | |
| 6. 8 | 7. 89 | 8. 210 |
| 9. a. 49 | b. $3\frac{1}{2}$ | |
| 10. a. 30 | b. 36 | |

Sub-strand 3: Variables and equations

Module 1

Linear inequalities in one variables

Content standard

B8.2.3.1 Demonstrate an understanding of linear inequalities of the form $x + a \geq b$ (where a and b are integers) by modelling problems as a linear inequalities and solving the problems concretely, pictorially, and symbolically.

Indicator

B8.2.3.1.1 Translate word problems into linear inequalities in one variable and vice versa.

Learning expectation: In this module, learners will learn how to:

- Translate word problems into linear inequalities and linear inequalities into word problems.

Keywords: Inequality, variable, translate.

Competencies: Critical thinking and problem-solving, creativity and innovation.

Starter: Refer learners to Starter on page 156 of the Learner's Book for mental activity.

Main idea 1

Translate a word problem into linear inequality **LB page 156**

Activity 1: Refer learners to the phrases and symbols for the inequalities on page 156 of the Learner's Book.

Phrases	Translate to
Less than a or lower than a .	$< a$
More than a or greater than a or higher than a .	$> a$
Less than or equal to a or at most a or not greater than a .	$\leq a$
Greater than or equal to a or at least a or not less than a .	$\geq a$

Activity 2: Write some word problems on the board for learners to translate into linear inequalities. Examples:

1. I am a number and I am less than 30.
2. Seven less than the product of 2 and a number is greater than 30.

Solution

1. Let the number be y , y less than 30. That is $y < 30$.
2. Product of 2 and a number is $2x$.

Seven less than the number $2x - 7$ is greater than 30. That is $2x - 7 > 30$

Activity 3: Go through the worked examples with learners on page 157.

Review exercise

Put learners into mixed ability groups to solve these.

1. I am a number when you subtract 5 from me, I am greater than 3.
2. Seven less than twice a certain number is more than twenty-five.

Assessment tasks ----- LB page 157

Refer learners to pages 157 - 158 of the Learner's Book for exercise.

Suggested homework

Write Mathematics sentences involving linear inequalities for these word problems.

1. Six less than the product of 3 and a number is greater than -30 .
2. Think of a whole number which when multiplied by 10 and 6 is subtracted from it, the number is equal to or less than 20.
3. When q is subtracted four times from a number, the result is greater than -8 .

Main idea 2

Write a word problem from mathematical statement
LB page 158

Activity 1: Review the previous lesson with learners. Ask learners to write the inequalities symbols in their jotters. Write them on the board and let learners explain to the groups next to them.

1. $>$, greater than.
2. $<$, less than.
3. \leq , less than and equals to.
4. \geq , greater than and equals to.

Activity 2: Write a mathematical linear inequality on the board and ask learners to change it into a word problem. E.g. $4x + 6 > 10$.

The product of four and a number x plus six is greater than ten.

Call on individuals to read out loud what they wrote down.

Activity 3: Pair learners and let them write word problems of these.

1. $5t - 6 \geq 25$
2. $6x - 8 \leq 70$

Six times a certain number less by 8 is less than or equal to 70. Ask learners to read what they wrote to their partners.

Activity 4: Pair learners and let them write one linear equation and change it into a word problem.

Activity 5: Go through the worked examples with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Change these into word problems.

1. $10 + y \geq 15$ 2. $9 - x > 20$

Challenging activity

In pairs, write word problems for these inequalities.

1. $2(x + 5) \geq 25$ 2. $\frac{x}{5} \geq 15 + x$

Assessment tasks ----- LB page 159

Refer learners to the Learner's Book page 159 for exercise.

Suggested homework

Change the following inequalities into word problems.

1. $x(x + 5) \leq 15$ 2. $y \geq 10$
3. $-6y + 6 > 4y - 2$ 4. $\frac{x}{4} + \frac{1}{3} \leq 20 - 2$

Answers to Assessment tasks

Main Idea 1

(LB page 157)

- | | |
|--------------------------|------------------------|
| 1. a. $x + 15 \leq 98$ | b. $25(x + 3) \geq 40$ |
| c. $\frac{q}{5} \geq 15$ | d. $20 > 5x$ |
| d. $2(y + 6) < 27$ | f. $4x + 16 \geq 8$ |
| e. $x + 7 \leq 20$ | h. $5x - 8 \geq 0$ |
| f. $12x \leq 22$ | j. $p - 8 \geq 35$ |
2. a. $24x \geq 500$; 21 days
- b. $x + 2x + 2x + 3 \geq 63$; the minimum length of the first piece is 12 metres
- c. $x + x + 3 \leq 5$
- d. $52x \leq 5,300$; the maximum number of boxes is 101

Main Idea 2

(LB page 159)

1. Fifteen more than a number is less than eight.
2. A number subtracted from nine is greater than twenty.
3. Ten more than a number is greater than or equal fifteen
4. Five times the difference between a number and four is at most thirteen.
5. Twice the quotient of a number and five is less than sixteen.
6. A number divided by fifteen is less than the sum of twenty and the number.
7. Six less than the product of a number and nine is greater than negative thirty-three.
8. When seven is added to the product of a number and negative six, the result is at least fourteen less than four times the number.
9. The number x , is greater than or equal to fifteen.
10. The number y , is less than or equal to seven.

Sub-strand 3: Variables and equations

Module 2

Linear inequalities

Content standard

B8.2.3.1 Demonstrate an understanding of linear inequalities of the form $x + a \geq b$ (where a and b are integers) by modelling problems as a linear inequalities and solving the problems concretely, pictorially, and symbolically.

Indicator

B8.2.3.1.2 Solve simple linear inequalities.

Learning expectations: In this module, learners will learn how to:

- Solve linear inequalities in one variable.
- Find the solution set of linear equations.

Essential for learning: Learners can translate word problems into linear inequalities and vice versa.

Resources: Work cards.

Keyword: linear inequalities, balance scale, compare, order

Competencies: Critical thinking and problem-solving, creativity and innovation.

Starter: Refer learners to Starter on page 160 in the Learner's Book for warming up activity.

Main idea 1

Solve simple linear inequalities in one variable **LB page 160**

Activity 1: Review the previous lesson with learners. Read through the guidelines for solving linear inequalities on page 160 in the Learner's Book with learners.

Rules for solving linear inequalities:

1. Add or subtract the same number to or from both sides of the inequality without changing the signs of the inequality.
2. Multiply or divide both sides by the same positive number without changing the signs of the inequality.
3. The inequality's sign changes when you multiply or divide both sides by a negative number.

4. When we swap the sides around we reverse the inequality sign.

Write examples on the board and solve them with learners.

E.g. **a.** $6x - 12 \leq 36$

$$6x \leq 36 + 12$$

$$6x \leq 48$$

$$x \leq 8$$

E.g. **b.** $-2x + 4 \geq 20$

$$-2x \geq 16 \text{ (Subtract 4 from each side)}$$

$$2x \leq -16 \text{ (Multiply both sides by } -1)$$

$$x \leq -8$$

Put learners into convenient groups. Write questions for them to solve.

1. $5x \geq 30$

2. $2y + 6 \leq -8$

Activity 3: Take learners through worked examples in the Learner's Book on page 161.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. $2a \leq 12$

2. $-2x + 2 > 3$

Challenging activity

Solve these.

1. $18 - 12 \leq 3x$

2. $\frac{1}{3}x > 9$

Assessment Task ----- LB page 162

Refer learners to the Learner's Book page 162 for exercise.

Suggested homework

Find solution to the following inequalities.

1. $2y - 6 \leq 22$

2. $\frac{1}{3}x + 2 < 13$

3. $4x - 8 \leq 22$

Main idea 1

Find the solution set of linear inequalities

LB page 162

Activity 1: Review the previous lesson with learners. Let learners know that the solution set of linear inequalities is the actual number value of the variable which makes the inequality true. It can have an infinite number of solutions or none.

Ensure they know that the solution set is a set of values that satisfy a given linear inequality. Each and every member in the solution set will satisfy the inequality and no other value.

Activity 2: Put learners into convenient groups. Write an example on the board and demonstrate solving it with them. Example, $2x + 2 \leq 12$ (x is a whole number).

$$2x + 2 \leq 12$$

$$2x \leq 10 \text{ (Subtract 2 from each side)}$$

$$x \leq 5 \text{ (Divide each side by 2)}$$

The solution set is, $x = \{5, 4, 3, 2, 1, 0\}$

Activity 3: Take learners through the worked examples in the Learner's Book on pages 162 - 163.

Review exercise

Put learners into mixed ability groups. Let them find the solution set of the following.

1. $3x - 13 \geq 26$
2. $2 + 3x \leq 11$ (x is a whole number)

Assessment tasks ----- LB page 163

Refer learners to pages 163 - 164 of the Learner's Book for exercise.

Suggested homework

1. $3(x + 2) \leq 27$ (Where x is a whole number.)
2. $\frac{1}{2}x + 12 \geq x + 2$ (Where x is a natural number.)
3. $x + 4 \leq 3x - 16$
4. $12 - 6x < 36$ (x is a whole number.)

Revision 7

Variables and equations ----- (LB page 165)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 162)

1. $\{v : v \geq 4\}$
2. $\{x : x < -4\frac{1}{2}\}$
3. $\{x : x \leq 1\}$
4. $\{x : x \leq 3\}$
5. $\{x : x \geq 0\}$
6. $\{x : x > 3\}$

Main Idea 2

(LB page 163)

1. $\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$
2. $\{4, 5, 6, 7, 8, \dots\}$
3. $\{2, 4, 6, 8, \dots\}$
4. $\{x : x \geq \frac{3}{5}\}$
5. $\{x : x < 3\frac{1}{2}\}$
6. $\{1, 2, 3\}$
7. $\{5, 6, 7, 8, 9, \dots\}$
8. $\{2, 3\}$
9. $\{\dots, -11, -10, -9, -8\}$
10. $\{-3, -2, -1, 0, 1, 2\}$

(LB page 164)

1. **a.** The sum of three times a number plus 2 is less than 20.
b. $3x + 8 \geq 56$ **c.** $2(21 + x) > 50 + x$; In 8 years time.
2. **a.** Ten less than a number is at least twenty.
b. Twice the sum of a number and three is less than eighteen.
c. When a number is subtracted from eight the result is less than adding ten to the number.
3. **a.** $x \geq 4$ **b.** $x \geq \frac{23}{36}$ **c.** $x > -\frac{1}{2}$ **d.** $x > -7$
4. $\{-2, -1, 0\}$
5. $\{0, 5\}$
6. $50 + 1.5x \geq 65$
7. **a.** $\{0, 1, 2, 3, 4\}$ **b.** $\{1, 2, 3, 4\}$

Sub-strand 1: Shapes and space

Module 1

Alternate and corresponding angles

Content standard

B8.3.1.1 Demonstrate understanding and use of the relationship between parallel lines and alternate and corresponding angles and use the sum of angles in a triangle to deduce the angle sum in any polygon.

Indicator

B8.3.1.1.1 Draw and determine the values of alternate and corresponding angles.

Learning expectation: In this module, learners will learn how to:

- Determine the values of alternate and corresponding angles.

Essential for learning: Learners can identify right angles, acute angles and complementary angles.

Resources: Mathematical set.

Keywords: alternate angle, corresponding angle, transversal, parallel, exterior angle, interior angle

Competencies: Creativity and innovation.

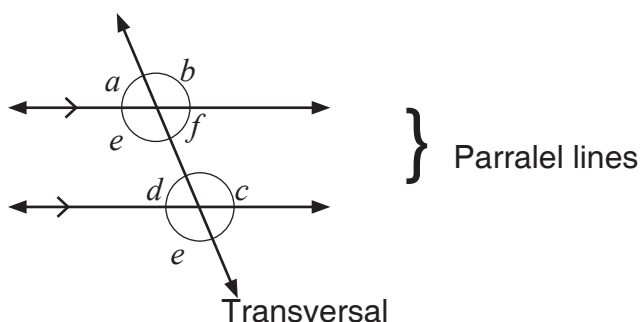
Starter: Refer learners to page 167 of the Learner's Book for warming up activities.

Main idea 1

Alternate angles

LB page 167

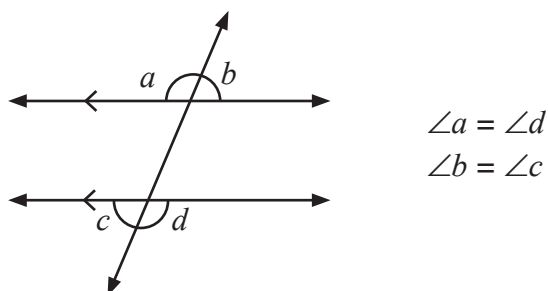
Activity 1: Let learners know the two types of angles i.e. the interior and exterior angles. Let them know that the alternate angles takes the “Z shape”. Draw one on the board. They are formed inside the two parallel lines and a transversal.



The angles e, c, f and d are formed in between the parallel lines and are pairs of alternate interior angles.

Hence $\angle e = \angle c$ and $f = \angle d$.

Activity 2: Draw alternate exterior angles on the board. Guide learners to identify the z shape and look for the alternate angles.

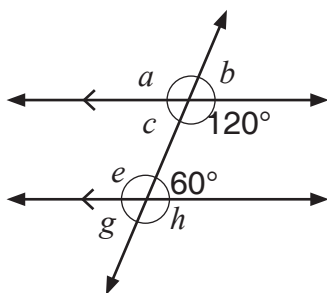


Activity 3: Pair learners. Let them draw two parallel lines. Intercept it with a transversal. They should use their own letters to identify the interior and the exterior alternate angles.

Activity 4: Go through the worked examples with learners on pages 169 - 170 of the Learner's Book.

Review exercise

Have learners work in pairs to identify the named angles.

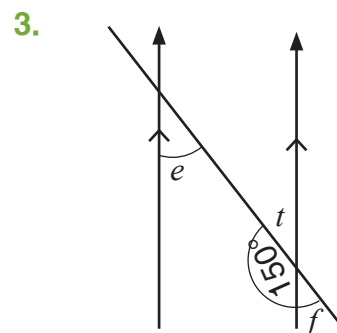
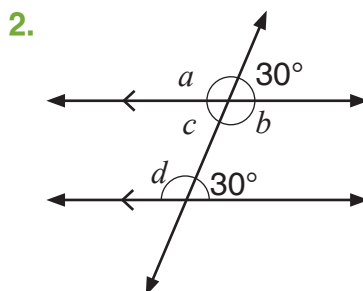
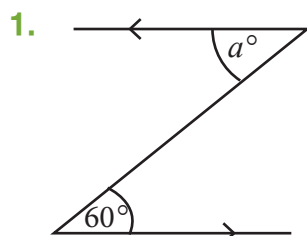


Assessment tasks ----- LB page 170

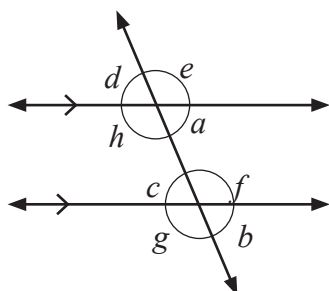
Refer learners to pages 170 - 172 of the Learner's Book for exercise.

Suggested homework

Find the values of the named angles.



Activity 1: Review the previous lesson with learners. Draw a corresponding diagram on the board and guide learners to identify the corresponding angles. Let them know that it takes the shape of a F, with two parallel lines and a transversal.

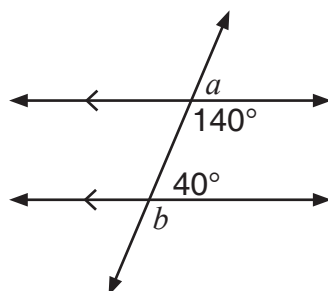


Activity 2: Guide learners to identify the “F” shape and look for the corresponding angles.

In this case, $\angle a = \angle b$, $\angle f = \angle e$, $\angle c = \angle d$ and $\angle h = \angle g$.

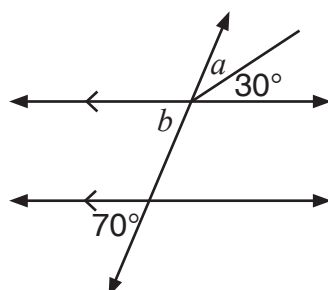
Activity 3: Pair learners and let them find the values for the named angles.

Activity 4: Take learners through the worked examples on pages 173 - 175 in the Learner's Book.



Review exercise

Have learners work with the person nearer to him/her to find the values for the named angles.



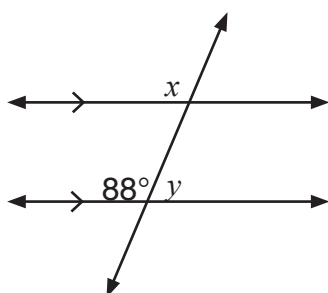
Assessment tasks ----- LB page 176

Refer learners to the Learner's Book pages 176 - 178 for exercise.

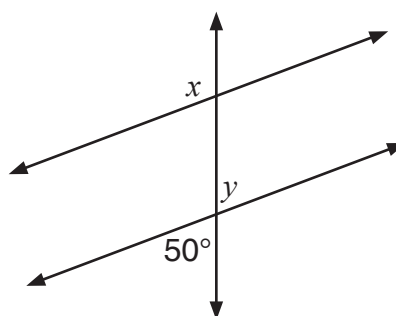
Suggested homework

Find the value of x and y in the following diagrams.

1.



2.



Answers to Assessment tasks

Main Idea 1

(LB page 170)

1. a. $w = 115^\circ$ $x = 115^\circ$ $z = 65^\circ$
b. $w = 100^\circ$ $x = 100^\circ$ $z = 80^\circ$
2. a. $y = 69^\circ$ - alternate angles
b. $y = 15^\circ$ - alternate angles
c. $y = 109^\circ$ - alternate angles
d. $y = 150^\circ$ - alternate angles
3. a. $\theta = 120^\circ$ b. $\theta = 100^\circ$ c. $\theta = 72^\circ$ d. $\theta = 62^\circ$
4. a. $x = 14$ and size of angle = 40°
b. $x = 12$ and angle = 69°
c. $x = 5.5$ and angle = 45°
d. $x = 80$ and angle 160°

Main Idea 2

(LB page 176)

1. a. $y = 68^\circ$ b. $y = 72^\circ$ c. $y = 35^\circ$
d. $y = 60^\circ$ e. $y = 46^\circ$ f. $y = 138^\circ$
2. a. 46° b. 59° c. 145° d. 57°
3. a. $x = 129^\circ$ - corresponding angle
b. $x = 128^\circ$ - alternate exterior angle to $\angle 128^\circ$
c. $x = 73^\circ$ - alternate exterior angle to $\angle 130^\circ$
d. $x = 75^\circ$ - vertically opposite angle
4. a. $a = 65^\circ$ $b = 73^\circ$ $c = 42^\circ$ $d = 115^\circ$
b. $a = 125^\circ$ $b = 55^\circ$ $c = 55^\circ$ $d = 125^\circ$
e. $e = 55^\circ$ $f = 55^\circ$ $g = 125^\circ$

5. a. $a = 55^\circ$ – alternate angles
b. $b = 72^\circ$ – corresponding angles
c. $c = 75^\circ$ – alternate angles
d. $d = 48^\circ$ – alternate angles
6. $q = 34^\circ$ – sum of angles in a triangle
 $p = 38^\circ$ – alternate angles
 $r = 73^\circ$ – sum of angles on a straight line.

Sub-strand 1: Shapes and space

Module 2

Polygons

Content standard

B8.3.1.1 Demonstrate understanding and use of the relationship between parallel lines and alternate and corresponding angles and use the sum of angles in a triangle to deduce the angle sum in any polygon.

Indicator

B8.3.1.1.2 Draw and determine the values of alternate and corresponding angles.

Learning expectations: In this module, learners will learn how to:

- Calculate the values of angles of a triangle.
- Deduce the formula for the sum of interior angles in a polygon.
- Use the formula to find the sum of interior angles in a polygon.

Essential for learning: Learners can identify and find values for alternate and corresponding angles.

Resources: Mathematical set.

Keywords: polygon, equilateral triangle, isosceles triangle, pentagon, hexagon, quadrilateral, vertex

Competencies: Creativity and innovation.

Starter: Refer learners to page 179 of the Learner's Book for warming up activity.

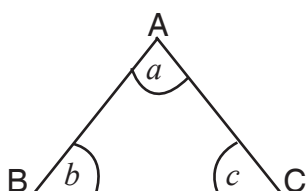
Main idea 2

Angle properties of a triangle

LB page 179

Activity 1: Draw a triangle on the board. Label the vertices and the angles. Let them do the same in their jotters. Guide them to name the angles using the capital letters.

E.g.



The angle of $a = \angle B\hat{A}C$ or $\angle C\hat{A}B$

The angle of $b = \angle C\hat{B}A$ or $\angle A\hat{B}C$

The angle of $c = \angle B\hat{C}A$ or $\angle A\hat{C}B$

Activity 2: Guide learners to identify the types of triangles and their properties. Refer them to the Learner's Book page 180.

1. Right-angle triangle.
2. Isosceles triangle.
3. Equilateral triangle.
4. Scalene triangle.

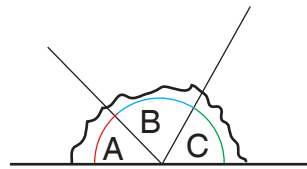
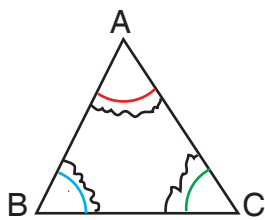
Activity 3: Put learners into convenient groups to prove the sum of the angles of a triangle is 180° . (Refer to Learner's Book page 181.)

Activity 4: Group Activity

Put learners into convenient groups. Let them follow this procedure.

1. Draw any triangle ABC.
2. Label the angles a, b, c .
3. Cut the angles.
4. Draw a straight line.
5. Arrange the angles on a straight line.
6. Let them tell you their observation.

The angles formed is a straight angle which is 180° .



Activity 5: Go through the worked examples with learners on pages 183 - 184 of the Learner's Book.

Review exercise

Put learners into mixed ability groups. They should prove that the sum of the angles of a triangle add up to 180° .

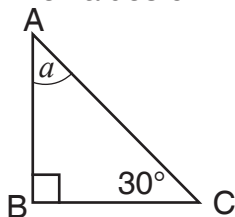
Assessment tasks ----- LB page 184

Refer learners to pages 184 - 185 of the Learner's Book for exercise.

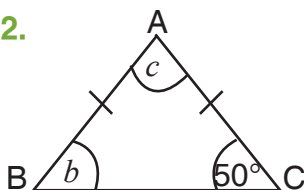
Suggested homework

Find the values of the named angles.

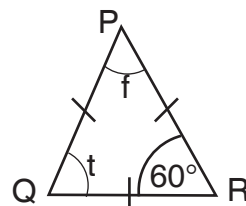
1.



2.



3.



Main idea 2

Polygons

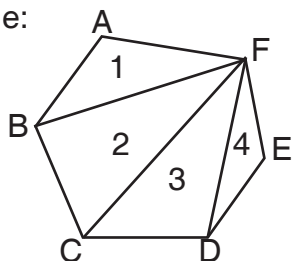
LB page 186

Activity 1: Define polygons to learners and give examples.

“A polygon is a plane figure bounded by three or more line segments. Examples: triangles, quadrilaterals, pentagons and hexagons. There are two types of polygons: regular and irregular polygons.

Activity 2: Have learners work in pairs. They draw any polygon that they like. Have them divide the polygon into triangles from one vertex to identify the number of triangles in them.

Example:



Hexagon: four triangles

Activity 3: Let them count the number of triangles they got and multiply it by 180° in order to get the sum of interior angles. With the hexagon above, there are four triangles so, $4 \times 180^\circ = 720^\circ$.

Activity 4: Have them repeat this activity with different polygons. Now let them deduce the formula for finding the sum of the angles of polygons by following these patterns.

Triangle	→	3 sides	→	1 triangle
Quadrilateral	→	4 sides	→	2 triangles
Pentagon	→	5 sides	→	3 triangles
Hexagon	→	6 sides	→	4 triangles

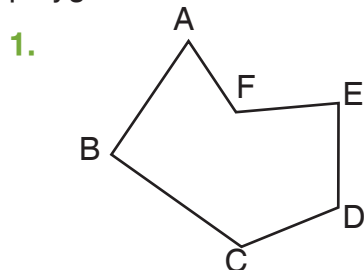
Learners should conclude that the number of triangles is the number of sides minus two.

∴ The formula for finding the sum of the interior angles of a polygon is $(n - 2) \times 180^\circ$.

Activity 5: Go through the worked examples with learners on pages 187 - 188 of the Learner's Book.

Review exercise

Put learners into mixed ability groups to calculate the number of sides and angles of the polygon below.



2. Find the number of sides of a regular polygon with 120° .

Assessment tasks ----- LB page 188

Refer learners to the Learner's Book pages 188 - 189 for exercise.

Suggested homework

Group learners for group activity for Assessment task 2 on page 189 of the Learner's Book.

Let them copy the assessment and complete the table.

Answers to Assessment tasks

Main Idea 1

(LB page 184)

- | | | |
|------------------------|--|---------------|
| 1. a. 63° | b. 40° | c. 20° |
| d. 49° | e. 68° | f. 29° |
| 2. a. $y = 68^\circ$; | the angles are 68° , 56° and 56° . | |
| b. $y = 10^\circ$; | the angles are 120° , 20° and 40° . | |
| c. $y = 15^\circ$; | the angles are 90° , 45° and 45° . | |
| d. $y = 49^\circ$; | the angles are 75° , 49° and 56° . | |
| e. $y = 18^\circ$; | the angles are 54° , 90° and 36° . | |
| 3. a. $a = 50^\circ$; | $\angle A = 50^\circ$, $\angle B = 75^\circ$ and $\angle C = 55^\circ$. | |
| b. $a = 23^\circ$; | $\angle A = 69^\circ$, $\angle B = 51^\circ$ and $\angle C = 60^\circ$. | |
| c. $a = 20^\circ$; | $\angle A = 62^\circ$, $\angle B = 62^\circ$ and $\angle C = 56^\circ$. | |
| d. $a = 38^\circ$; | $\angle P = 38^\circ$, $\angle Q = 28^\circ$ and $\angle R = 114^\circ$. | |
| e. $a = 158^\circ$; | $\angle A = 52^\circ$, $\angle B = 106^\circ$ and $\angle C = 22^\circ$. | |
| 4. $p = 53^\circ$ and | $q = 118^\circ$ | |

Main Idea 2

(LB page 188)

1. a. 135° b. 137° c. 51° d. 63° e. 99° f. 148°
2. $y = 60^\circ$
3. $x = 188^\circ$
4. $x = 76^\circ$
5. $x = 53.2^\circ$
6. a. 8 sides b. 5 sides c. 6 sides
7. a. 120° b. 128.57° c. 108° d. 90°
8. 8 sides
9. a. $1,260^\circ$ b. $1,800^\circ$
10. 105°

Name of polygon	Number of sides	Number of triangles drawn from one vertex to another inside the polygon	Sum of interior angles
Triangle	3	1	$1 \times 180^\circ = 180^\circ$
Quadrilateral	4	2	$2 \times 180^\circ = 360^\circ$
Pentagon	5	3	$3 \times 180^\circ = 540^\circ$
Hexagon	6	4	$4 \times 180^\circ = 720^\circ$
Heptagon	7	5	$5 \times 180^\circ = 900^\circ$
Octagon	8	6	$6 \times 180^\circ = 1,080^\circ$
Nonagon	9	7	$7 \times 180^\circ = 1,260^\circ$
Decagon	10	8	$8 \times 180^\circ = 1,440^\circ$
Polygon	n	$n - 2$	$(n - 2) \times 180^\circ$

Sub-strand 1: Shapes and space

Module 3

Construction and bisecting of angles

Content standard

B8.3.1.2 Demonstrate the ability to perform geometric constructions of angles (75° , 105° , 60° , 135° and 150°), and construct triangles and find locus of points under given conditions.

Indicator

B8.3.1.2.1 Construct and bisect angles of 120° , 105° , 135° and 150° .

Learning expectations: In this module, learners will learn how to:

- Construct and bisect angles of 120° and 105° .
- Construct and bisect angles of 135° and 150° .

Essential for learning: Learners can construct angles 90° and 60° .

Resources: Mathematical set.

Keywords: bisect, arc, convenient.

Competencies: Creativity and Innovation.

Starter: Ask learners to construct angle 90° .

Main idea 1

Construction of angles 120° and 105°

LB page 190

Activity 1: Have learners work in pairs.

Refer them to page 190 in the Learner's Book. Let them go through the steps of constructing an angle of 120° . Demonstrate on the board and let them construct it. To confirm, let them measure the angles with a protractor.

Activity 2: With the same partner, let them go through the steps of constructing an angle of 105° as described on page 191 of the Learner's Book.

Ask each learner to construct angle 105° in their jotters.

Review exercise

Ask each learner to construct angles of 105° and 120° in their jotters.

Activity 1: Refer learners to page 192. Go through the steps for constructing an angle of 135° with learners. Demonstrate on the board while learners observe.

Activity 2: Go through the steps one by one while learners do the construction. Let them check by measuring with a protractor.

Activity 3: Go through the same procedure for the construction of an angle of 150° . Refer them to page 193 of the Learner's Book to follow the instruction.

Review exercise

Ask each learner to construct an angle of 135° . They should give it to the next learner to verify by measuring the angle with a protractor.

Assessment Task ----- LB page 193

Refer learners to page 193 of the Learner's Book for exercise.

Suggested homework

Using a compass and ruler only, construct the following angles:

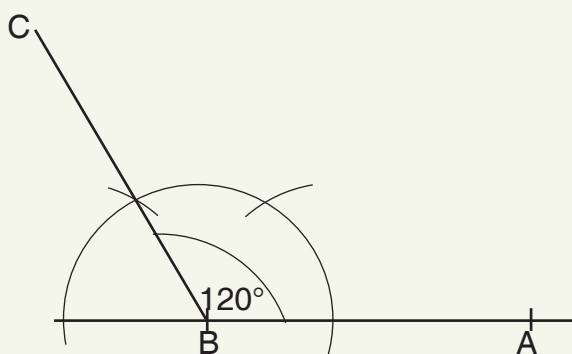
1. angle 120°
2. angle 105°
3. angle 150°
4. angle 135°

Answers to Assessment tasks

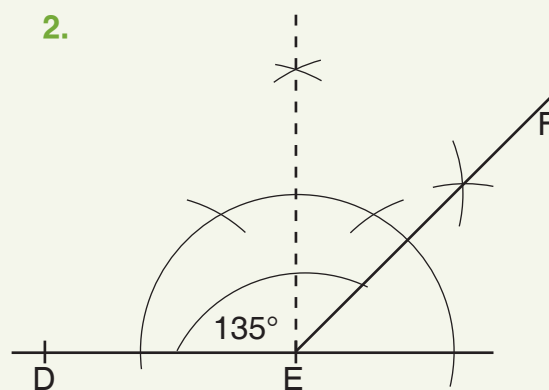
Main Idea 1

(LB page 193)

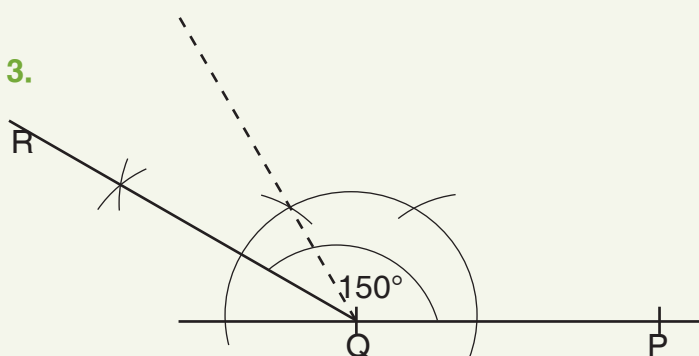
1.



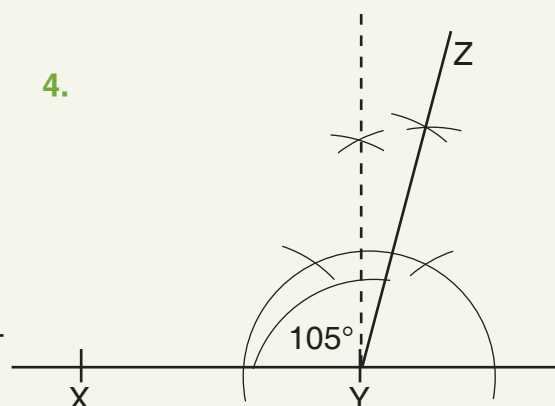
2.



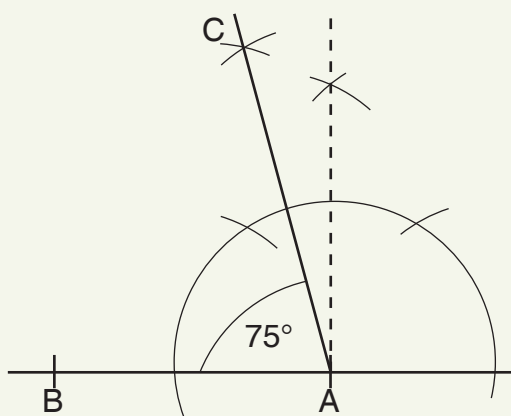
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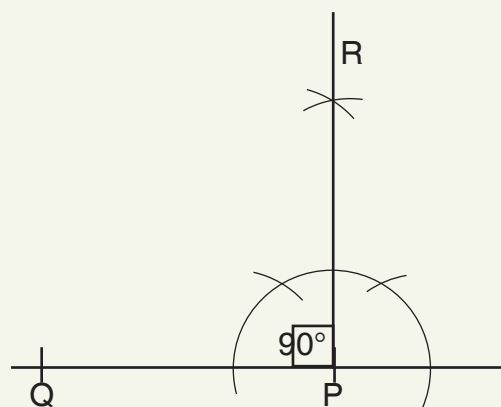
4.



5.



6.



Sub-strand 1: Shapes and space

Module 4

Construction of triangles

Content standard

B8.3.1.2 Demonstrate the ability to perform geometric constructions of angles (75° , 105° , 60° , 135° and 150°), and construct triangles and find locus of points under given conditions.

Indicator

B8.3.1.2.2 Construct scalene triangles, isosceles triangles, equilateral triangles, obtuse-angled triangles, and acute-angled triangles in different orientations under given conditions.

Learning expectation: In this module, learners will learn how to:

- Construct equilateral, isosceles and scalene triangles.
- Construct acute-angled, obtuse-angled and right-angled triangles.
- Construct each triangle:
 - a. a triangle when all the sides are given.
 - b. a triangle when two sides and one angle are given.
 - c. a triangle when a side and two angles are given.

Essential for learning: Learners can construct angles of 60° and 90° .

Resources: Mathematical set.

Keywords: equilateral triangle, isosceles triangle, scalene triangle.

Competencies: Creativity and innovation.

Starter: Ask learners to construct an angle of 60° in their jotter.

Main idea 1

Construction of equilateral, isosceles, and scalene triangles
LB page 194

Activity 1: Have learners work in pairs. Take them through the steps of constructing an equilateral triangle.

Construction of an equilateral triangle

With side 6 cm, construct an equilateral triangle. Demonstrate on the board. Follow the steps on page 194 - 195 one by one while learners do the same.

Have learners verify by measuring the angles with a protractor and the sides with a ruler.

Construction of an isosceles triangle

Activity 2: Guide learners to construct an isosceles triangle. Go through the steps with learners on page 195 of the Learner's Book. Demonstrate on the board first. Now let each learner construct one. They exchange and measure the base angles and the sides of the triangle. They will realize that the base angles are equal and the two opposite sides are also equal.

Construction of an isosceles right-angled triangle

Activity 3: Use the same procedure for learners to construct an isosceles right-angled triangle. Open at page 196 of the Learner's Book, guide learners to follow the steps. They should verify by measuring.

Construction of scalene triangle

Activity 4: Have learners open at page 197 of their Learner's Book for the construction of a scalene triangle.

Take them through the steps. Demonstrate on the board first.

E.g. Using a pair of compasses and a ruler, construct triangle PQR such that $PQ = 5$ cm, $QR = 4$ cm and $RP = 3$ cm.

Learners should verify by measuring the sides and the angles. They will realize that the sides as well as the angles are all different.

Activity 5: Go through the worked examples with learners on pages 198 - 199 of the Learner's Book.

Review exercise

Pair Learners. Each learner should construct a triangle different from one other. They exchange their work and verify by measuring.

Assessment tasks ----- LB page 200

Refer learners to page 200 of the Learner's Book for exercise.

Suggested homework

Use a compass and a ruler only.

1. Using a pair of compasses and a ruler only, construct triangle ABC with length $AB = 6$ cm, $BC = 6$ cm and $CA = 4.5$ cm. What type of triangle have you constructed?
2. Construct triangle ABC, with lengths $AB = 6$ cm, $BC = 6$ cm and $CA = 5.5$ cm. What type of triangle have you constructed?
3. Construct triangle PQR with the lengths of $PQ = 5.4$ cm, $QR = 6$ cm and $RP = 4$ cm. Measure all the three angles and write them.

Main idea 2

Construct acute-, obtuse- and right-angled triangles
LB page 200

Activity 1: Let Learners tell you what they know about an obtuse-angled triangle. (It is a triangle with one of its angles being more than 90° .)

Activity 2: Demonstrate to learners by constructing an obtuse-angles triangle on the board.

Write a question on the board and ask learners to construct it.

E.g. Construct triangle PQR with length PQ 5 cm, $\angle RPQ$ 30° , and $\angle PQR$ 45° , using a ruler and a pair of compasses only.

Activity 3:

Construction of an acute-angled triangle.

Pair learners, let learners identify the properties of an acute-angled triangle. All the angles are less than 90° .

Write a question on the board and ask learners to construct it.

E.g. Using a pair of compasses and a ruler only, construct triangle ABC, with AB = 8 cm, $\angle BAC$ 60° , and $\angle ABC$ 30° . Measure $\angle ACB$.

Have learners exchange their work with their partners and verify by measuring the angles.

Activity 4:

Construction of an right-angled triangle

Let learners tell you what a right angled-triangle is. (It is a triangle with one of its angles 90° .)

Ask learners to work in pairs but each person should construct their own.

Write a question on the board.

E.g. Using a ruler and a pair of compasses only, construct triangle ABC with AB 7.5 cm, $\angle ABC$ 90° and $\angle ACB$ 30° . Measure $\angle CAB$.

Have learners exchange their work and verify by measuring the angles on the sides.

Activity 5: Refer learners to worked examples on pages 203 - 204 in the Learner's Book. Go through the examples with them.

Review exercise

Have learners work in pairs. They should go through the solutions for the worked examples.

Assessment tasks ----- LB page 204

Refer learners to the Learner's Book page 204 for exercise.

Suggested homework

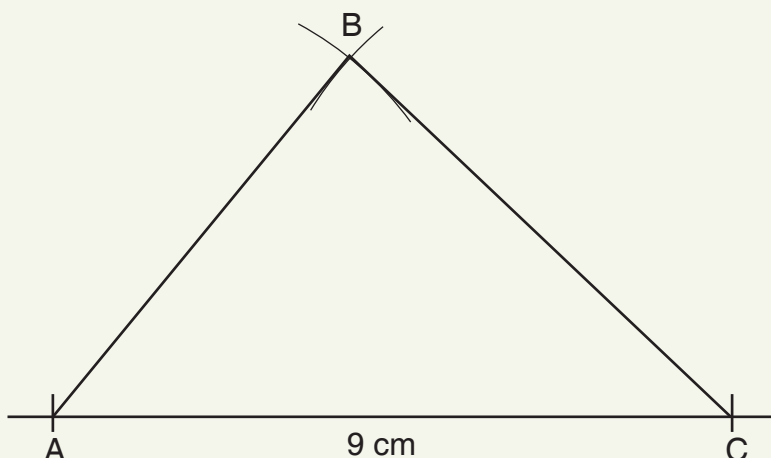
Construct triangle ABC such that triangle ABC = 105° , AB = 8 cm and BC = 7.5 cm. Measure angles CBA and CAB.

Answers to Assessment tasks

Main Idea 1

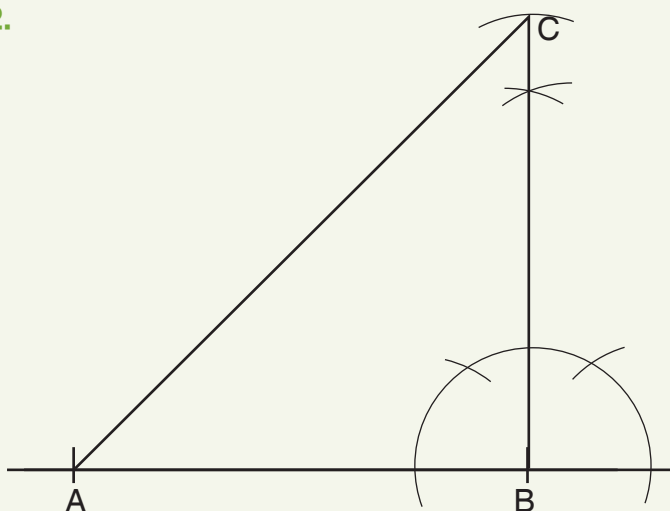
(LB page 200)

1.



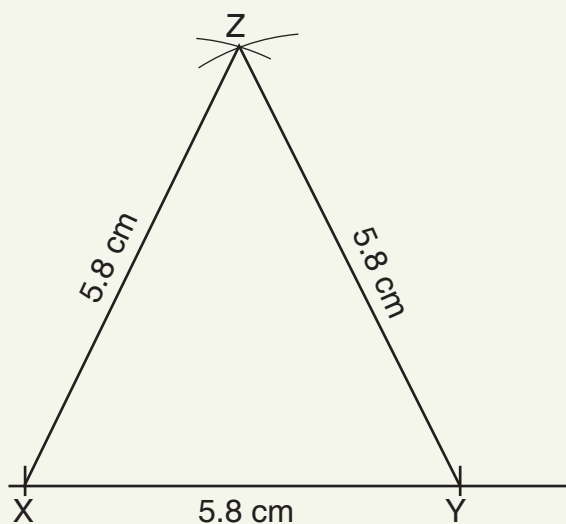
Measure: $\angle BAC = 53^\circ \pm 1^\circ$, $\angle ABC = 84^\circ \pm 1^\circ$ and $\angle ACB = 43^\circ \pm 1^\circ$

2.

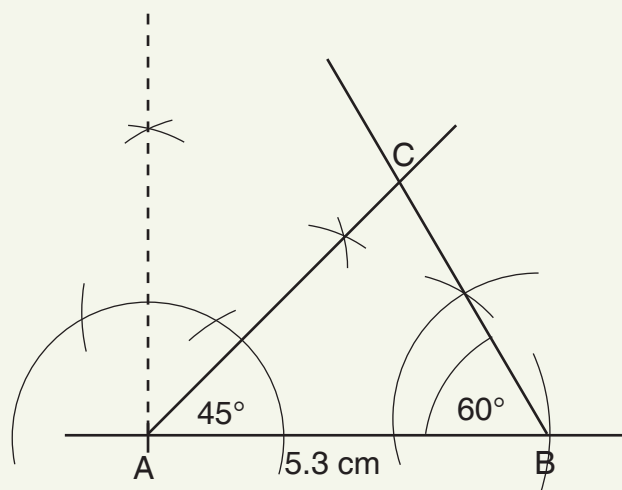


Measure: $AC = 8.5 \text{ cm}$, $\angle BAC = 45^\circ$ and $\angle ACB = 45^\circ$

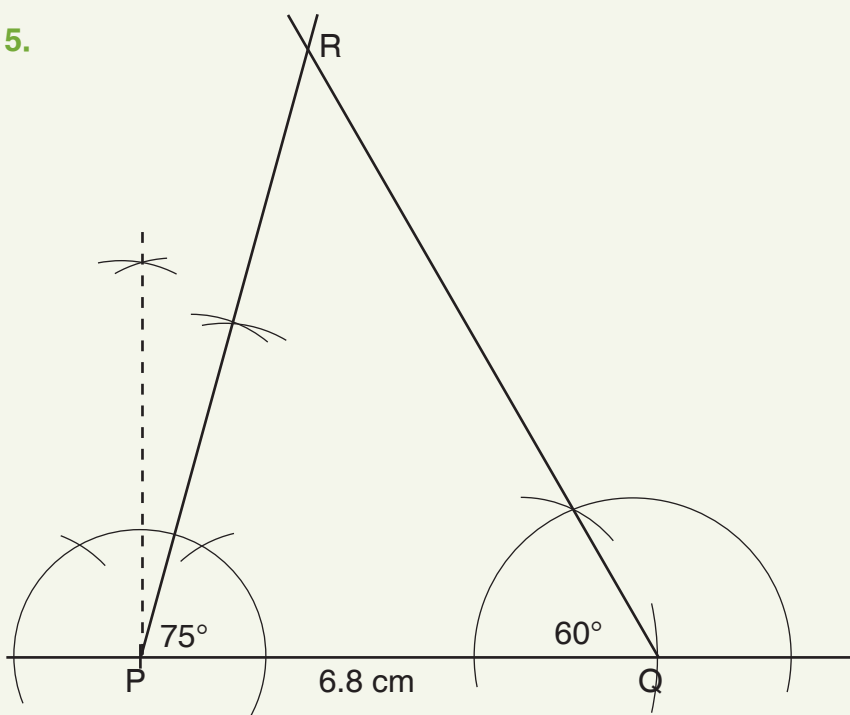
3.



4.



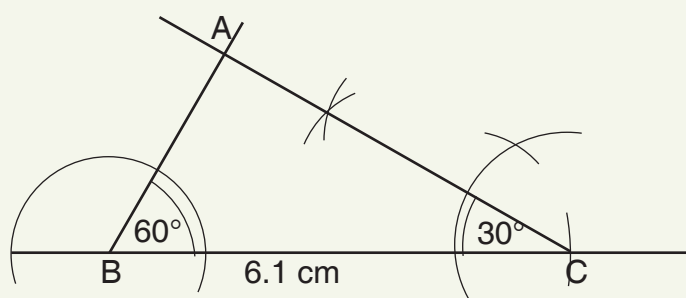
5.



Main Idea 2

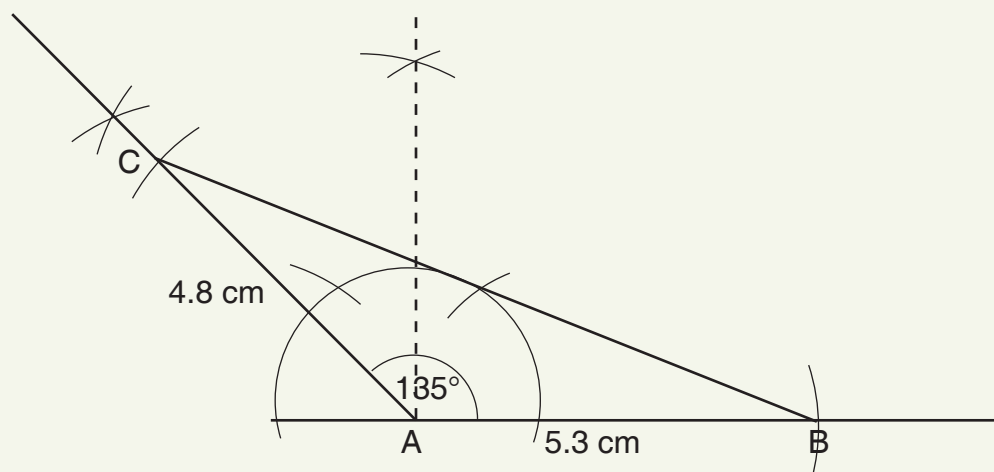
(LB page 204)

1.

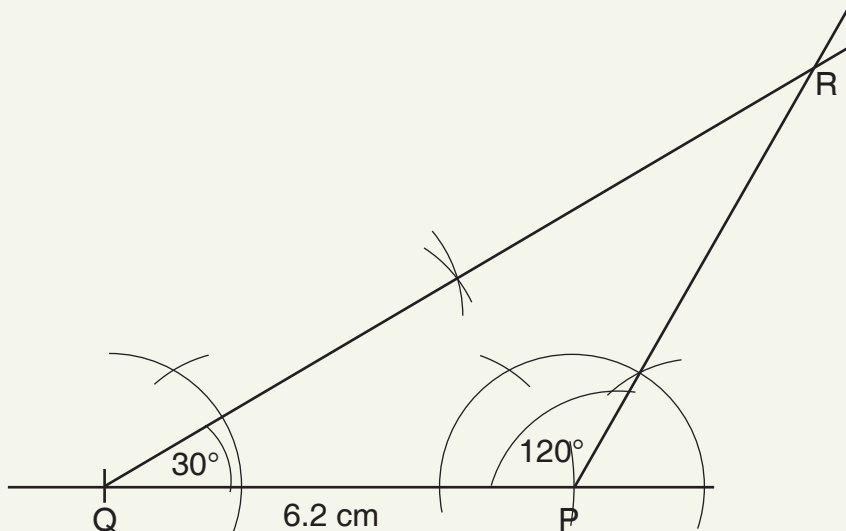


Measure: $\angle BAC = 90^\circ$, $AB = 2.9 \pm 0.1$ cm, $AC = 5.4 \pm 0.1$ cm

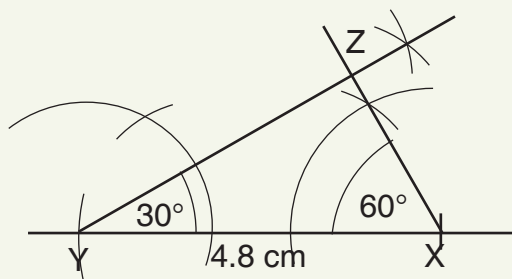
2. a.



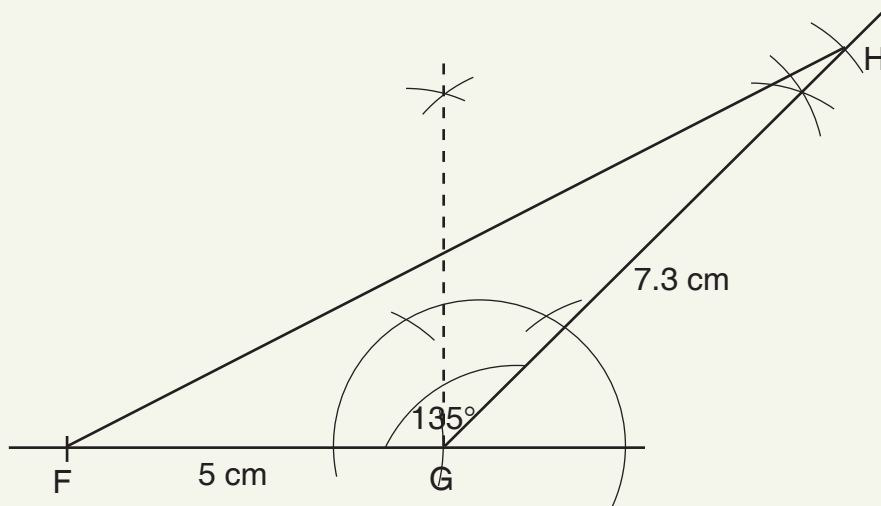
b.



c.

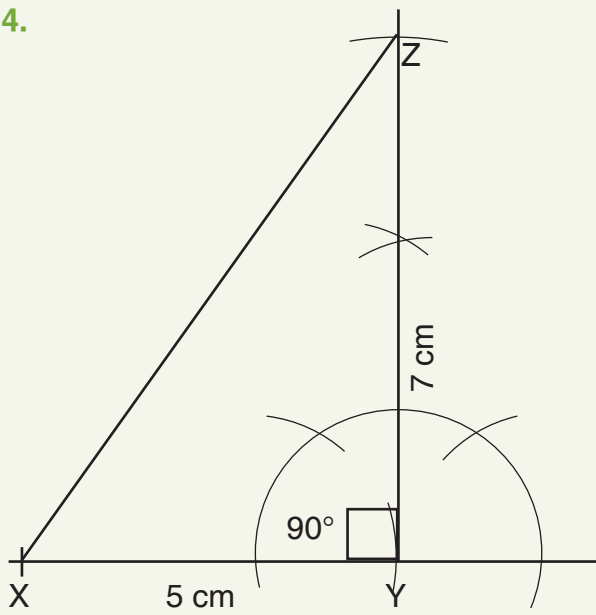


3.

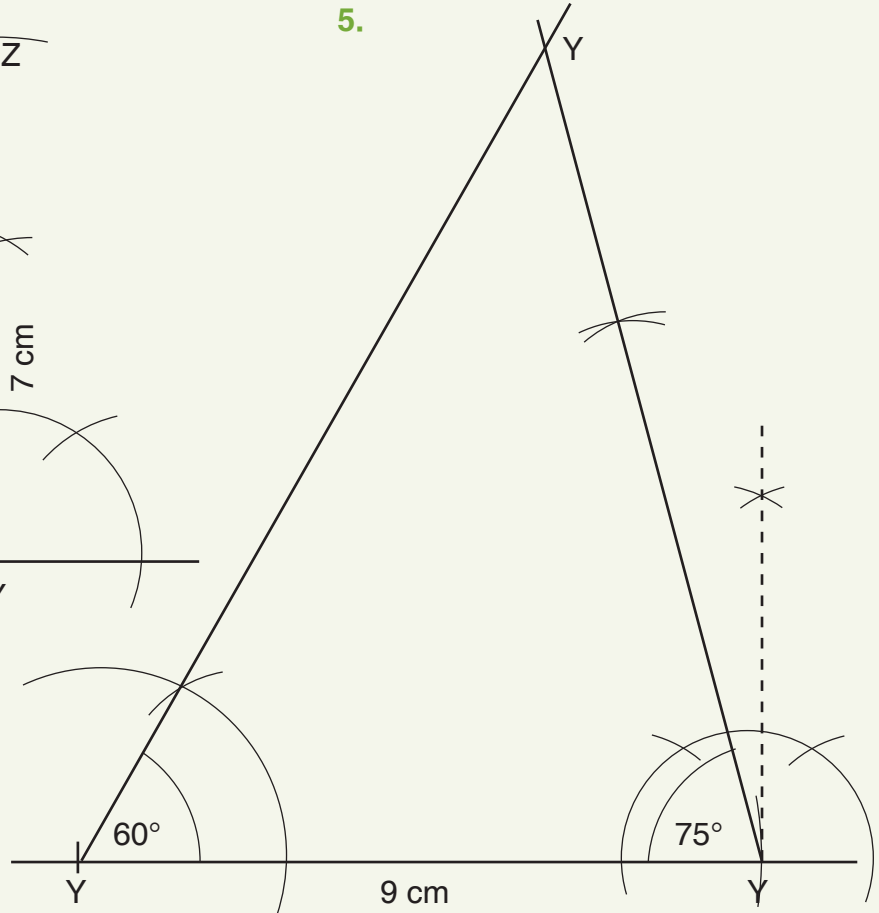


Measure : a. $\angle GHF = 17^\circ \pm 1^\circ$ b. $\angle GFH = 28^\circ \pm 1^\circ$ c. $FH = 11.4 \text{ cm} \pm 0.1 \text{ cm}$

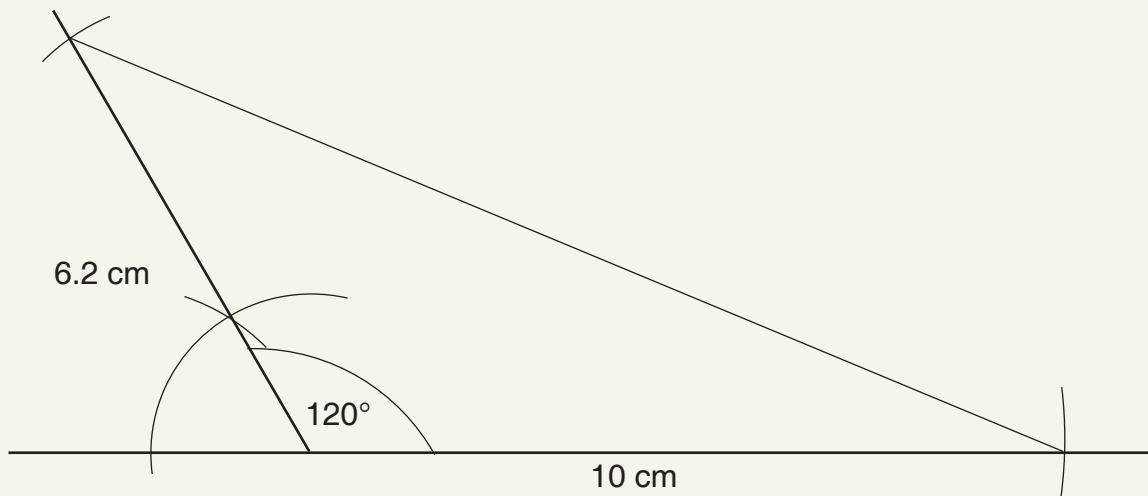
4.



5.



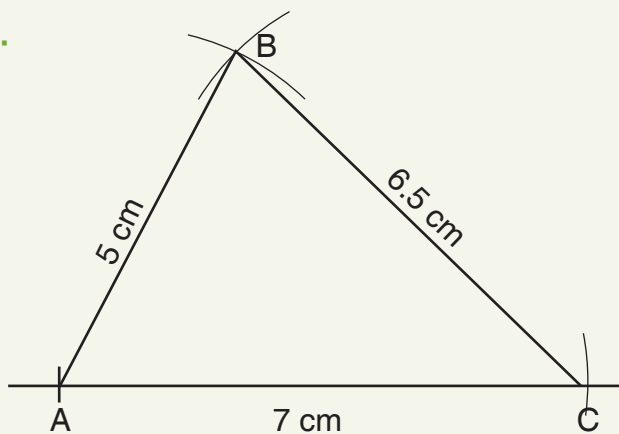
6.



Main Idea 1

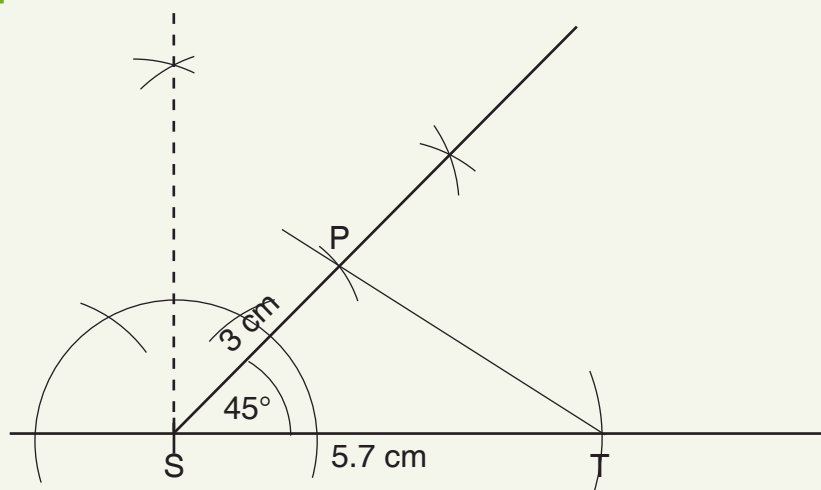
(LB page 205)

1.



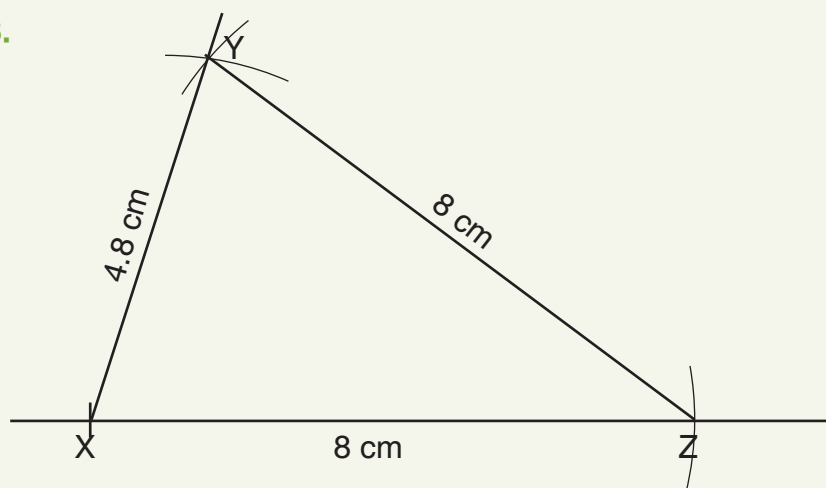
Measure: $\angle BAC = 62^\circ \pm 1^\circ$, $\angle ABC = 75^\circ \pm 1^\circ$ and $\angle ACB = 43^\circ \pm 1^\circ$

2.



Measure: $\angle SPT = 102^\circ \pm 1^\circ$, $\angle STP = 33^\circ \pm 1^\circ$ and $PT = 4.3 \text{ cm} \pm 0.1 \text{ cm}$

3.

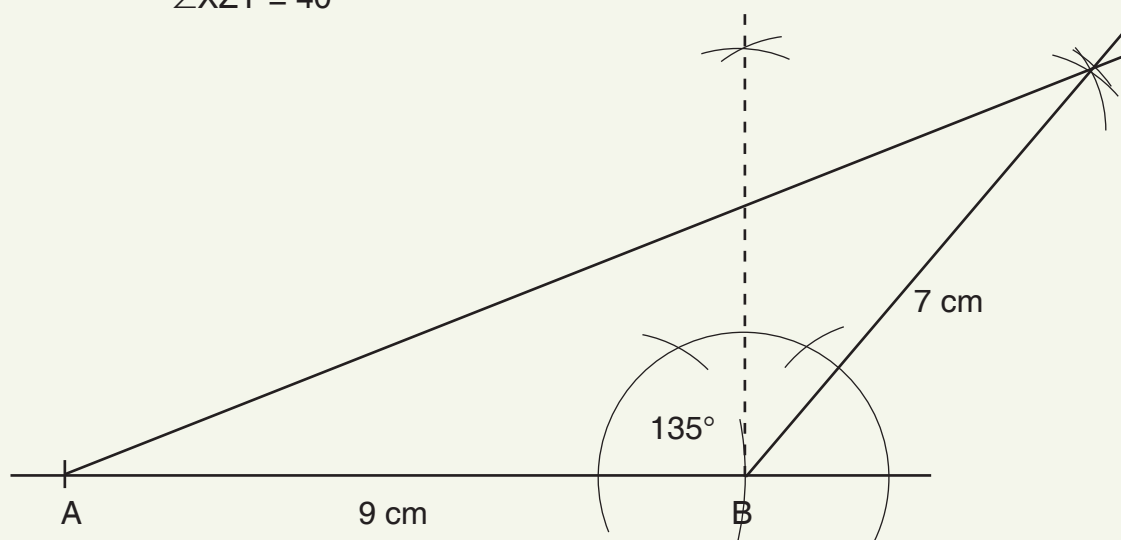


Measure: $\angle XYZ = 70^\circ$

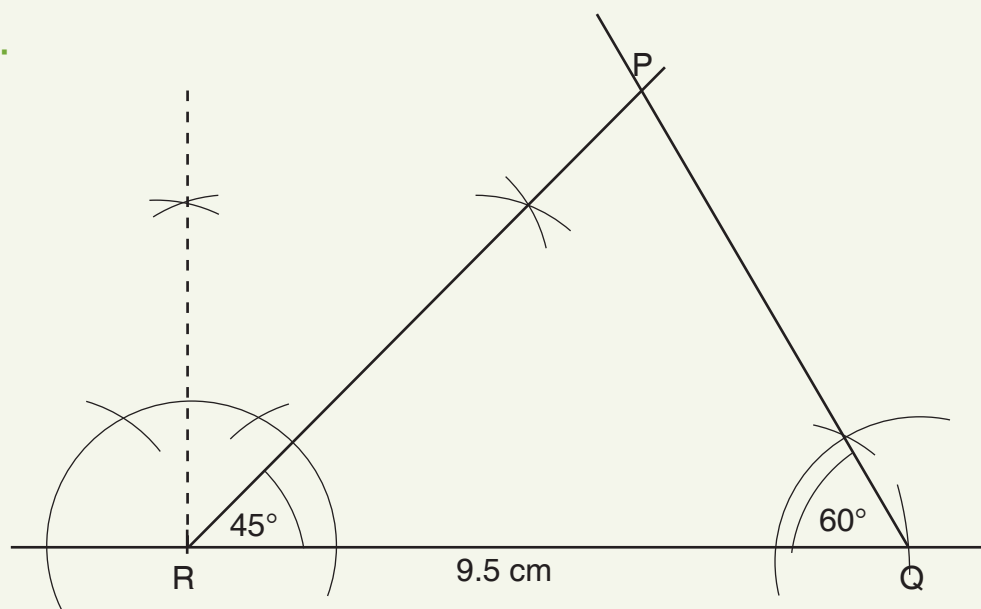
$\angle YXZ = 70^\circ$

$\angle XZY = 40^\circ$

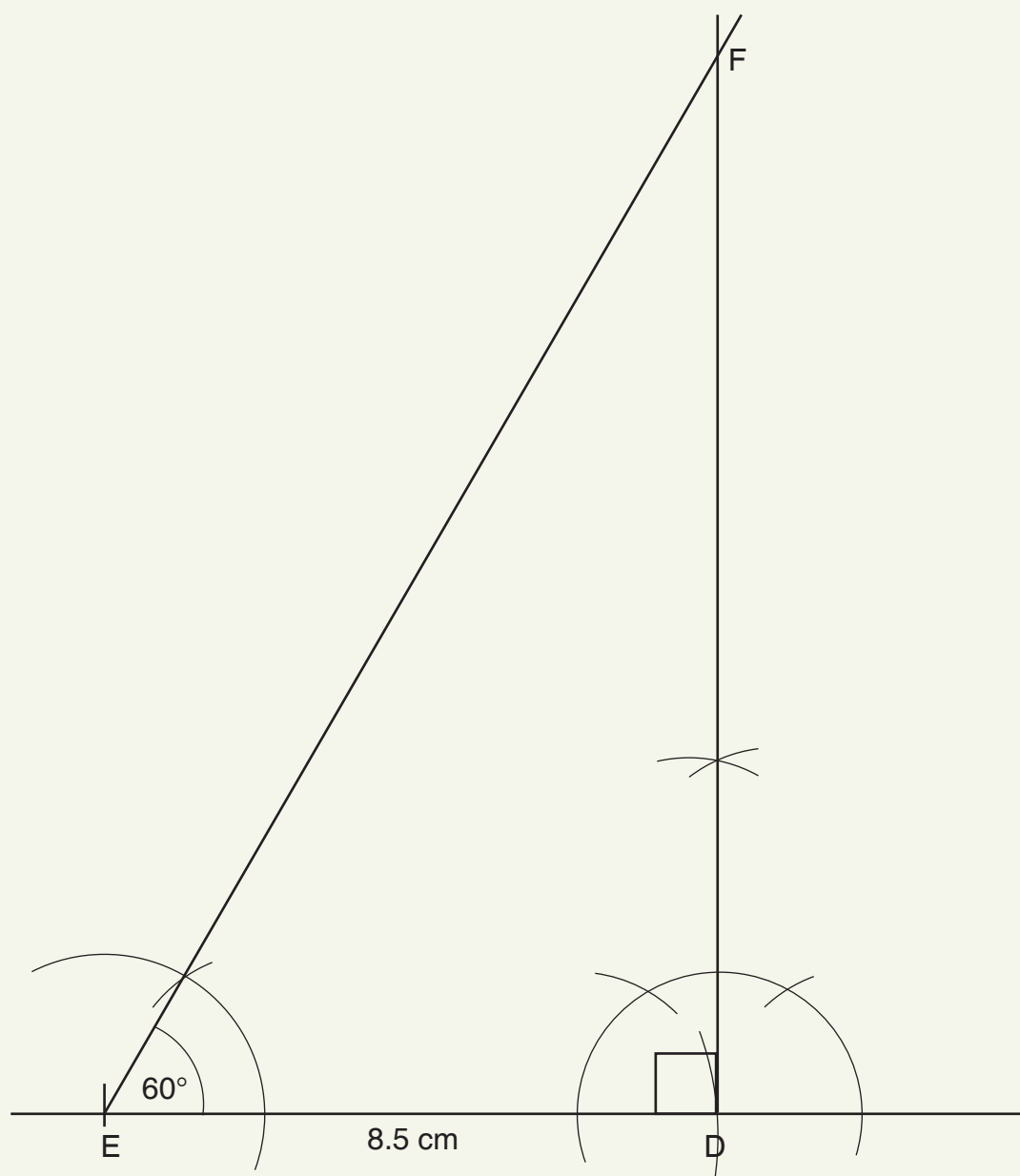
4.



5.



6.



Sub-strand 1: Shapes and space

Module 5

Construction of loci

Content standard

B8.3.1.2 Demonstrate the ability to perform geometric constructions of angles (75° , 105° , 60° , 135° and 150°), and to construct triangles and find locus of points under given conditions.

Indicator

B8.3.1.2.3 Construct loci under given conditions including:

- i. the locus of sets of points from a fixed point.
- ii. the locus of points equidistant from two fixed points.
- iii. the locus of points equidistant from two intersecting straight lines.
- iv. the locus of points equidistant from two parallel lines.

Learning expectations: In this module, learners will learn how to:

- Construct the locus of points that are equidistant from two:
 - » fixed points
 - » intersecting straight lines
 - » parallel lines.

Essential for learning: Learners can construct circles with given radii.

Resources: Mathematical set.

Keywords: loci, equidistant, parallel

Competencies: Creativity and innovation.

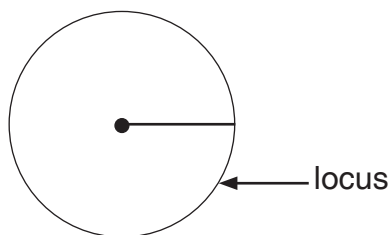
Starter: Refer learners to Starter on page 206 of the Learner's Book for quick mental activity.

Main idea 1

The locus of points equidistant from a fixed point **LB page 206**

Activity 1: Refer learners to page 206 of the Learner's Book. Let them read through the Main idea on locus. Let them know that when a point moves in a plane according to some given conditions, the path along which it moves is called a locus. The plural is loci.

Activity 2: Ask Learners to draw a circle with radius e.g. 3 cm. Let them know that the locus of all points 3 cm equidistant from a fixed point is a circle.



Review exercise

Have learners review the lesson by working the two examples on page 207 of the Learner's Book.

Assessment tasks ----- LB page 207

Refer learners to pages 207 - 208 of the Learner's Book for exercise.

Suggested homework

Using a ruler and a pair of compasses only, construct a locus of point 3.5 cm from centre O.

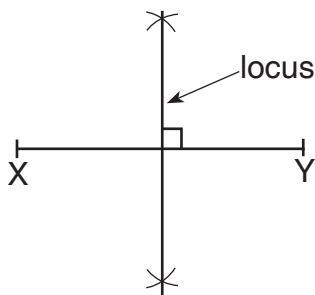
Main idea 2

The locus of points equidistant from two fixed point
LB page 208

Activity 1: Ask learners to draw a given length of a straight line e.g. 8 cm and name it XY.

Ask Learners to bisect the line XY.

Let them know that the perpendicular bisector or the mediator of the line joining the two fixed points is the locus.



Review exercise

Have learners work in pairs to construct worked example on page 208 of the Learner's Book.

Assessment tasks ----- LB page 209

Refer learners to page 209 of the Learner's Book for exercise.

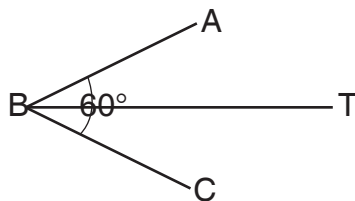
Suggested homework

Construct triangle ABC such that $AB = 8$ cm, $BC = 7$ cm and $\angle ABC = 120^\circ$. Construct the locus of point 5 cm from C.

Main idea 3

The locus of points equidistant from two intersecting straight lines
LB page 209

Activity 1: Have Learners construct any angle. E.g. $\angle ABC = 60^\circ$. Let them bisect the angle and name it BT as drawn.



Ask them to tell you what line TB is. (It is the locus of all points equidistant from two intersecting lines i.e. AB and CB which is the angle bisector of the angle formed by the intersecting lines.)

Review exercise

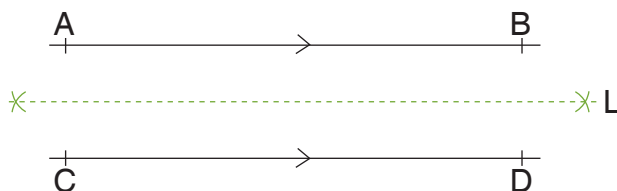
Have learners work in pairs to construct the worked examples. They should verify by measuring.

Main idea 4

The locus of points equidistant from two parallel lines
LB page 211

Activity 1: Guide learners to construct two parallel lines AB and CD. Let them follow the steps on page 211.

Demonstrate first.



The line L is the locus of point from the two parallel lines AB and CD.

Activity 2: Have learners construct Worked example 1 on page 211 of the Learner's Book in pairs.

Review exercise

Pair learners to construct the following.

Using a ruler and a pair of compasses only.

1. $\triangle ABC$ such that $AB = 5$ cm, $\angle ABC = 90^\circ$ and $\angle ACB = 60^\circ$.
2. Construct the locus of points equidistant from AB and BC.

Assessment tasks ----- LB page 213

Refer learners to page 213 of the Learner's Book for exercise.

Suggested homework

Draw the locus of points that are equidistant from lines PQ and QR.

1. Construct triangle ABC such that $AB = 8\text{ cm}$, $\angle ABC = 30^\circ$ and $\angle BAC = 90^\circ$.

Construct the locus L of points equidistant from AC and CB.

Revision 8

Shapes and space ----- (LB page 215)

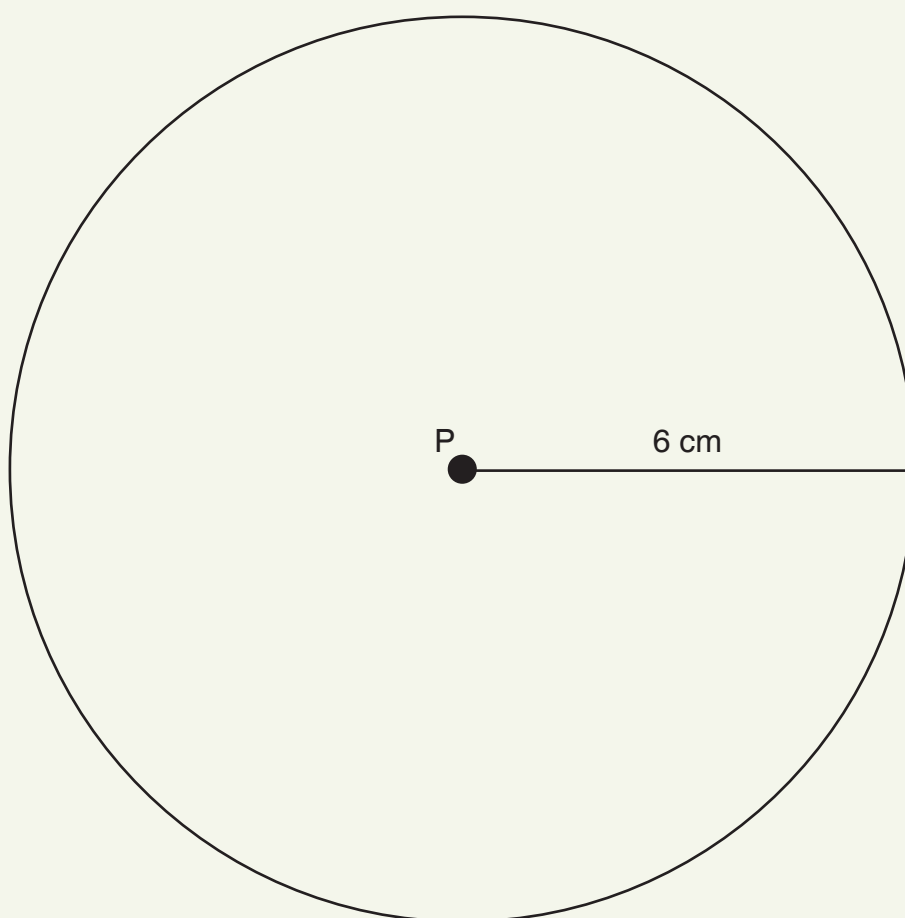
Learners answer the Revision questions as a class test.

Answers to Assessment tasks

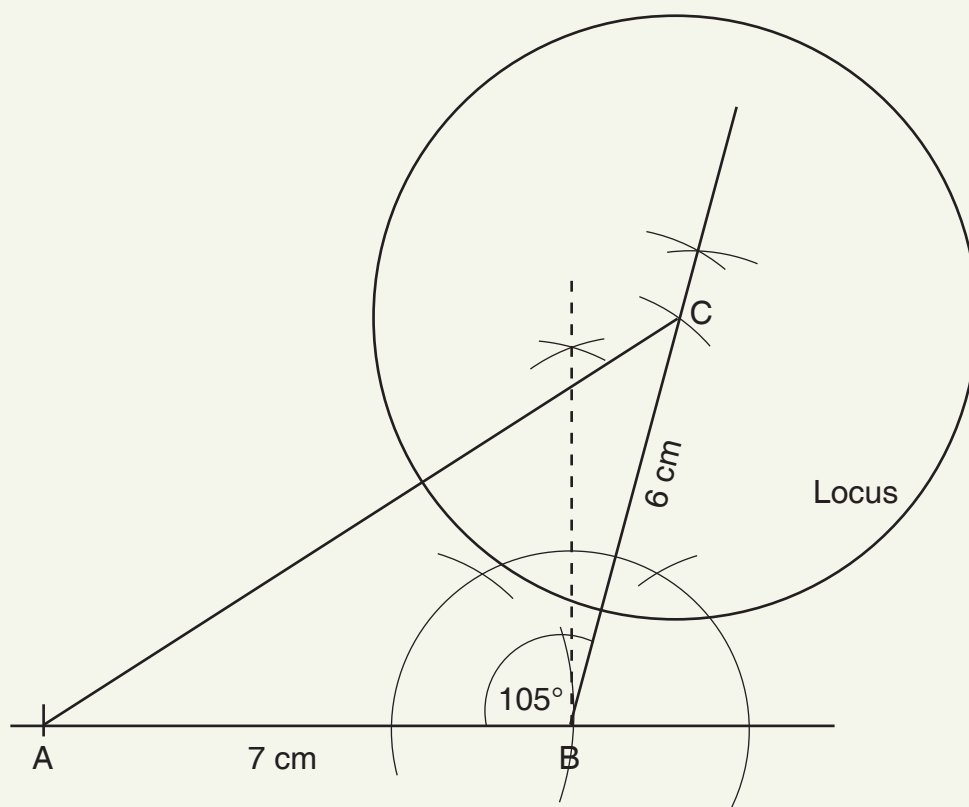
Main Idea 1

(LB page 207)

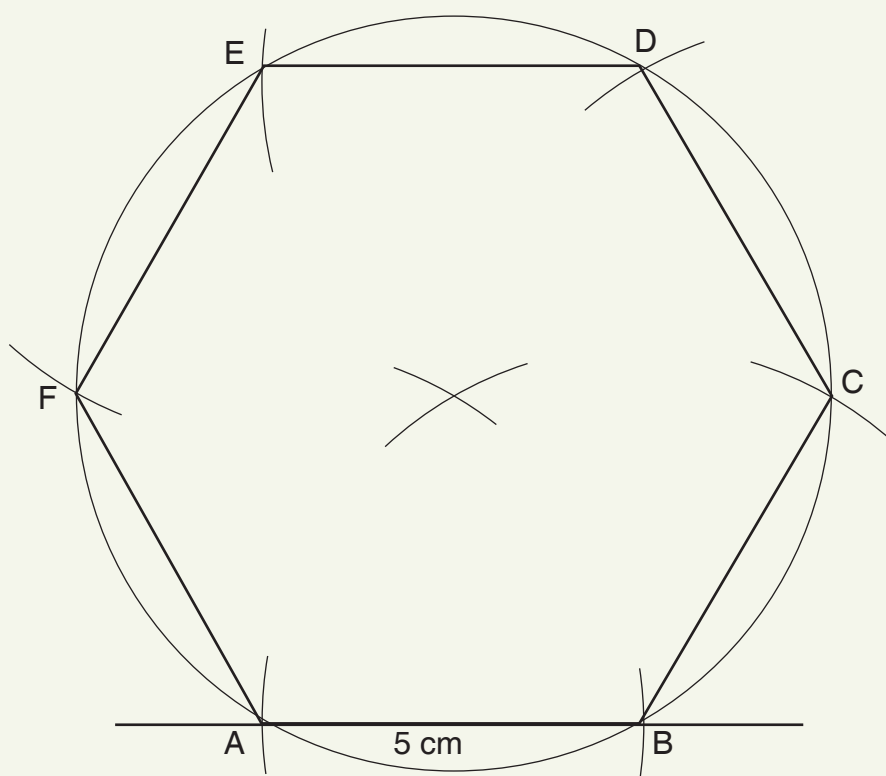
1.



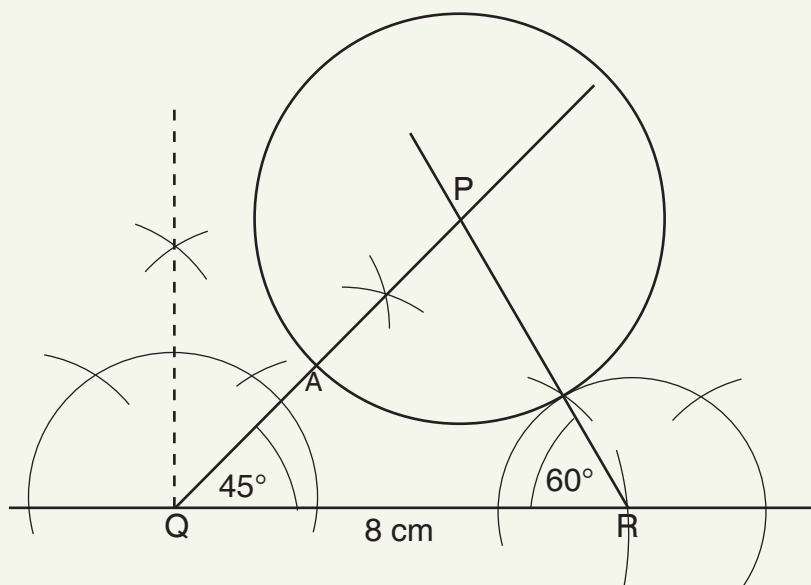
2.



3.



4.

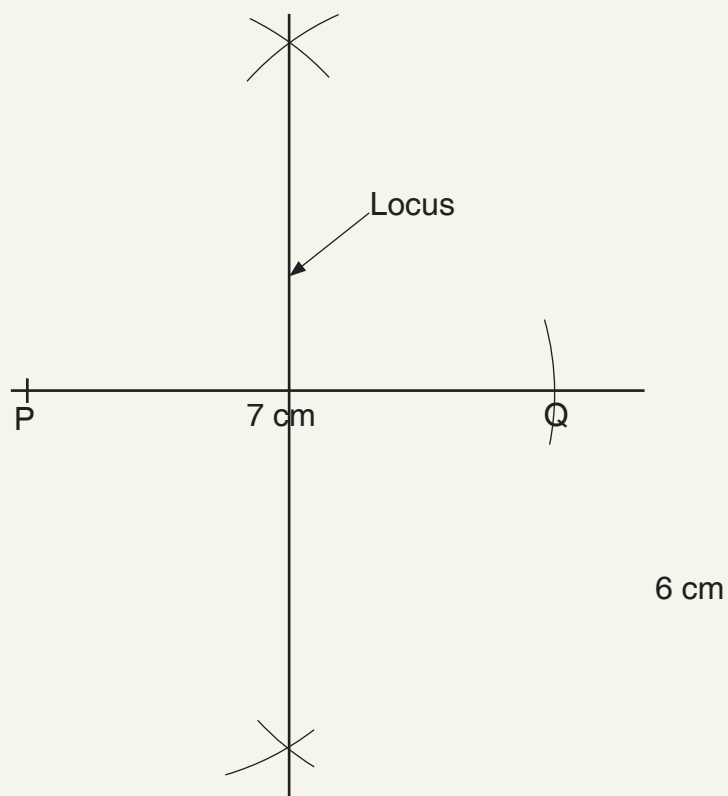


Length $QA = 2.6 \text{ cm} \pm 0.1 \text{ cm}$

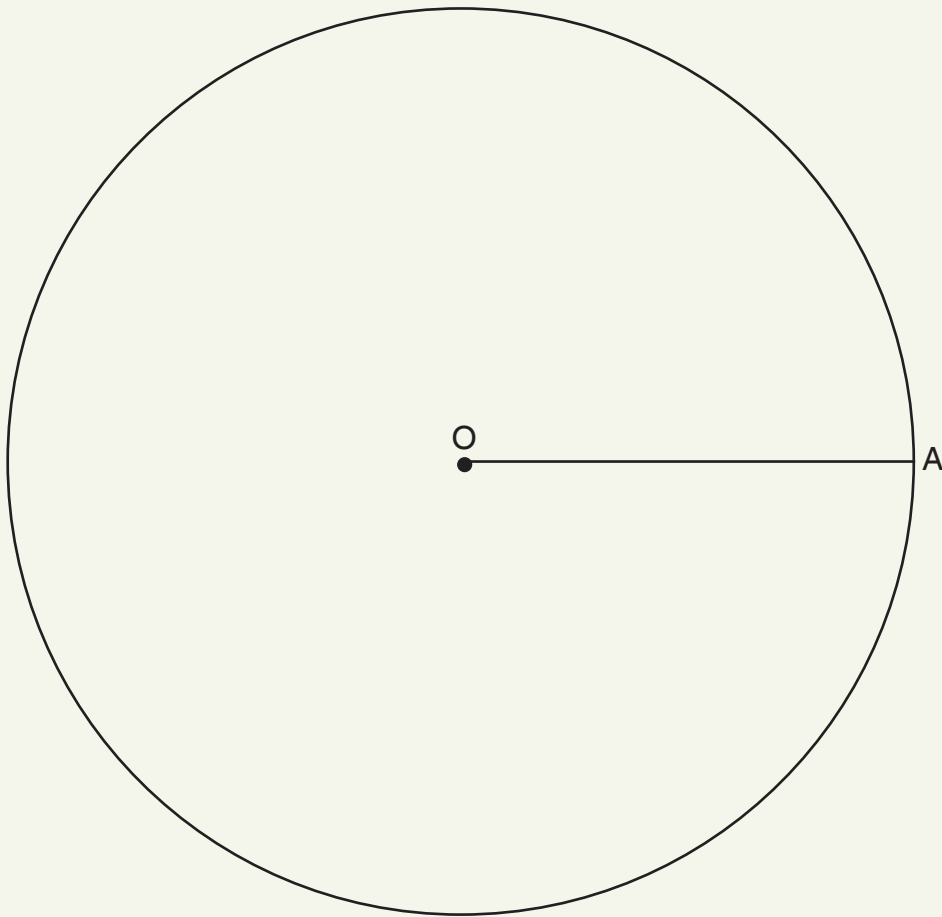
Main Idea 2

(LB page 209)

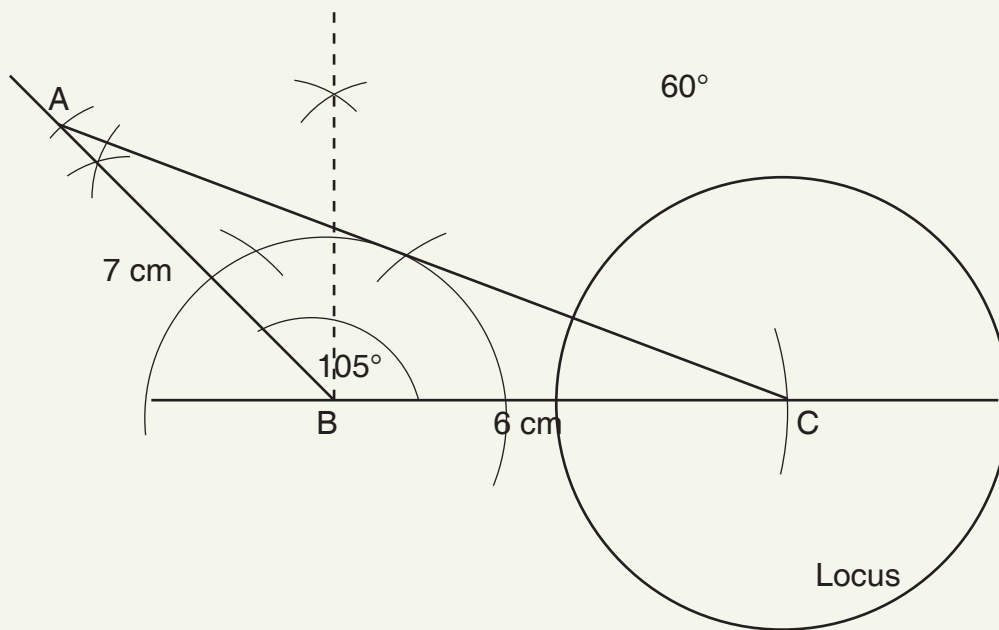
1.



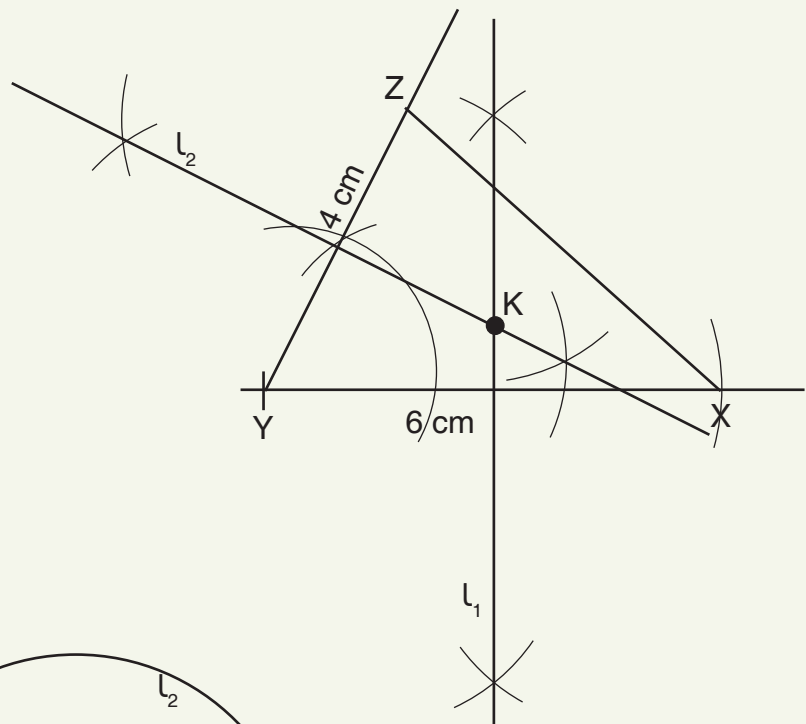
2.



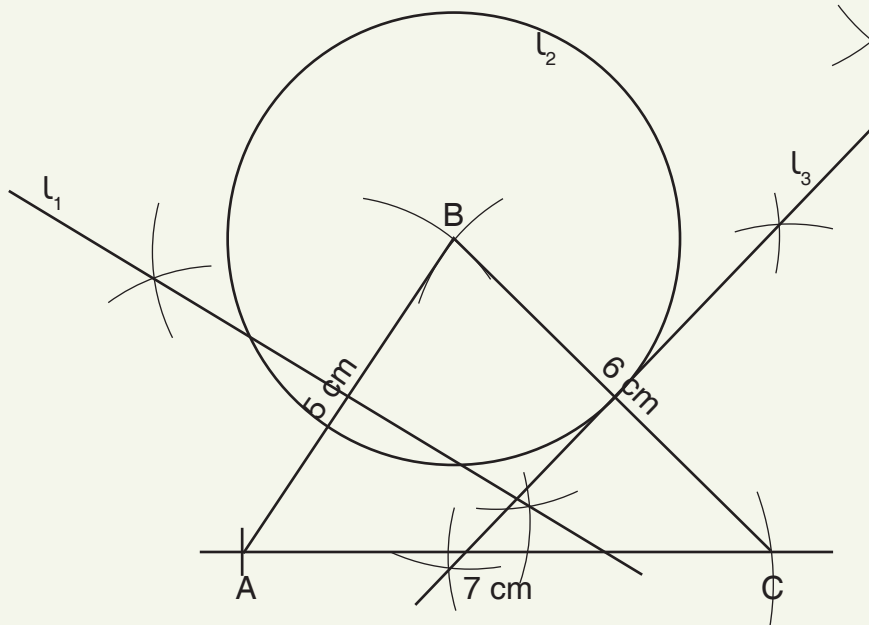
3.



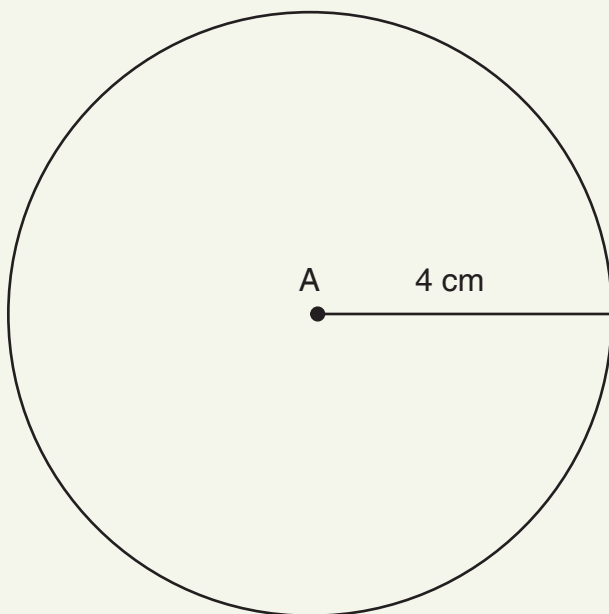
4.



5.



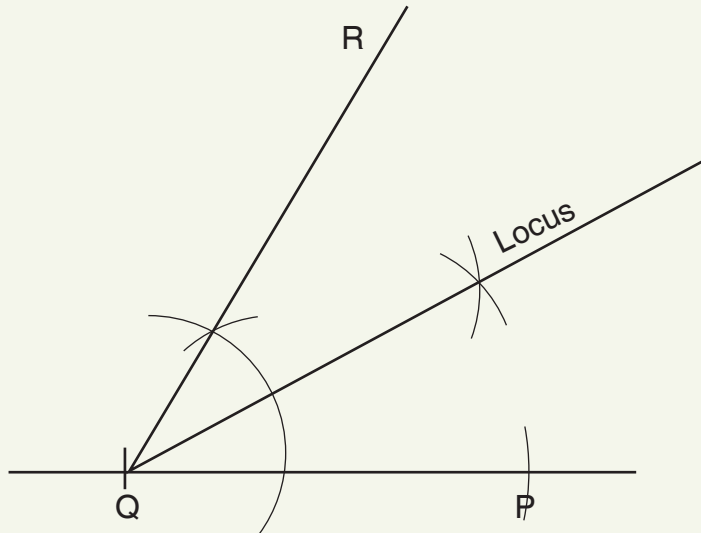
6.



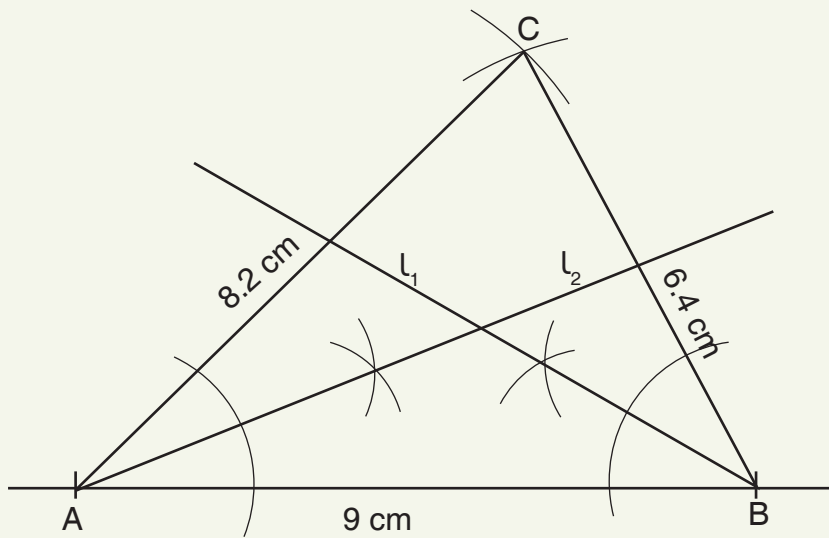
Main Idea 3

(LB page 213)

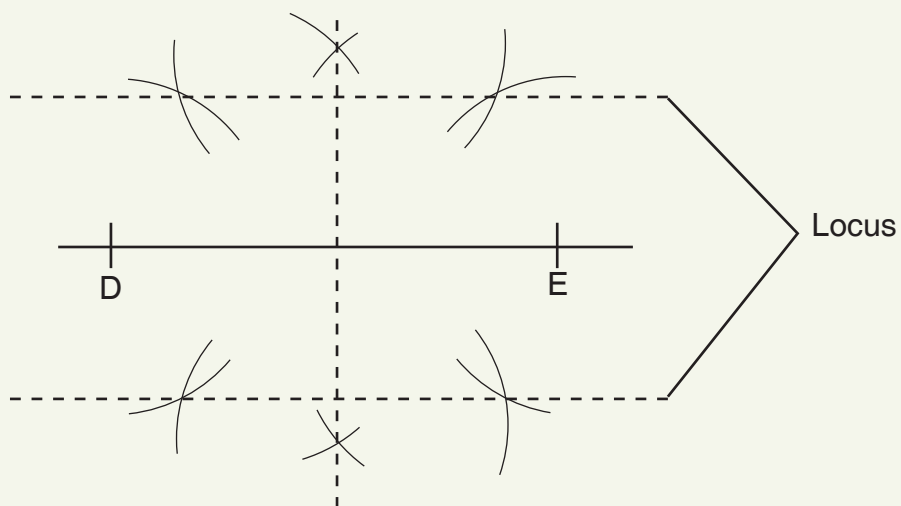
1.



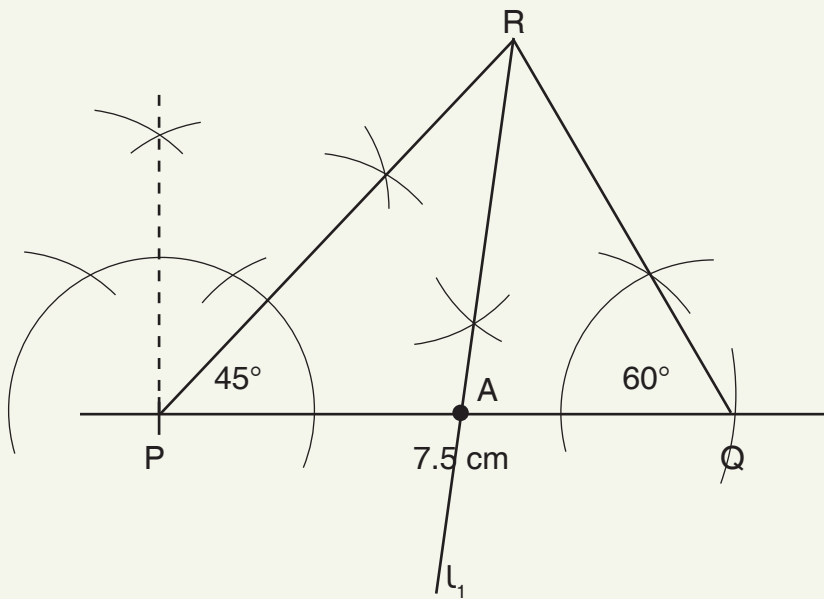
2.



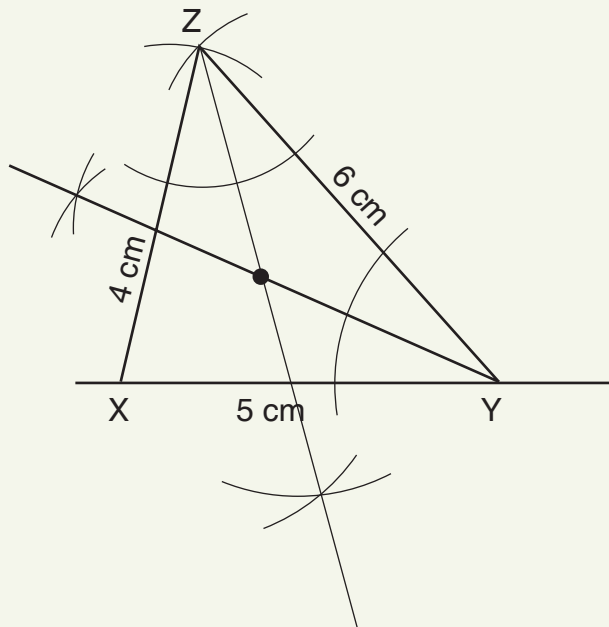
3.



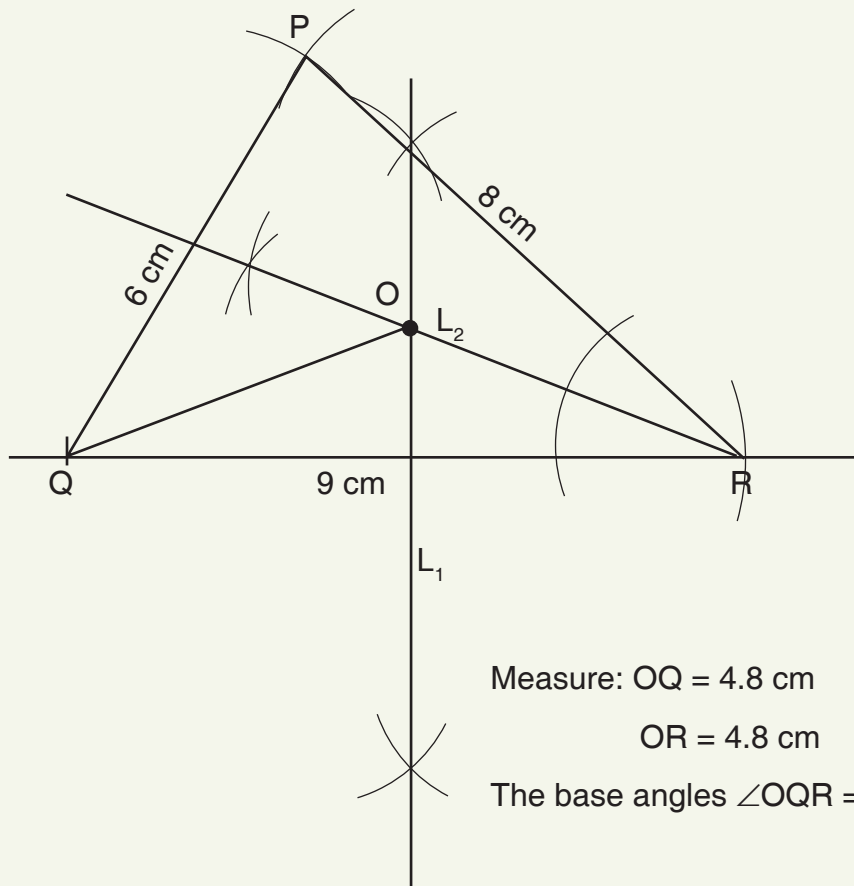
4.



5.

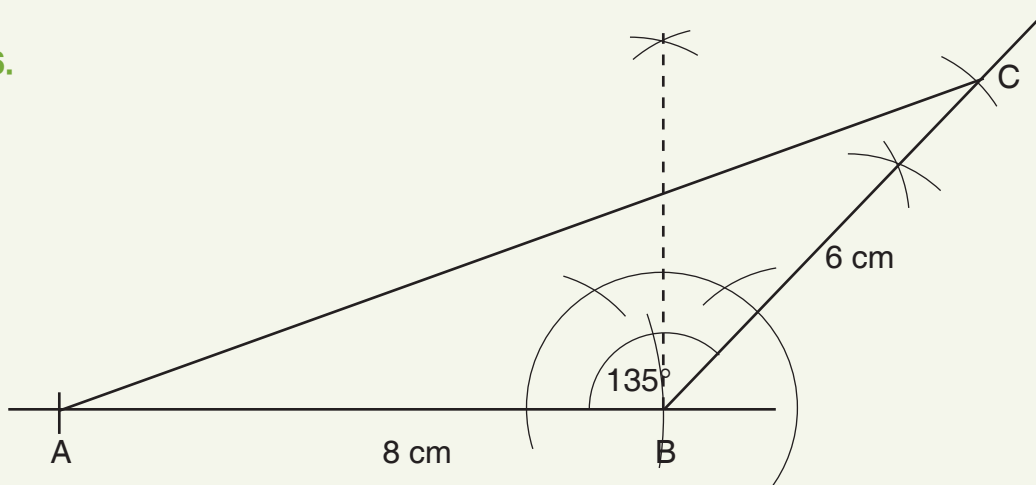


1. 105°
2. 120°
3. $x = 10$
- 4.



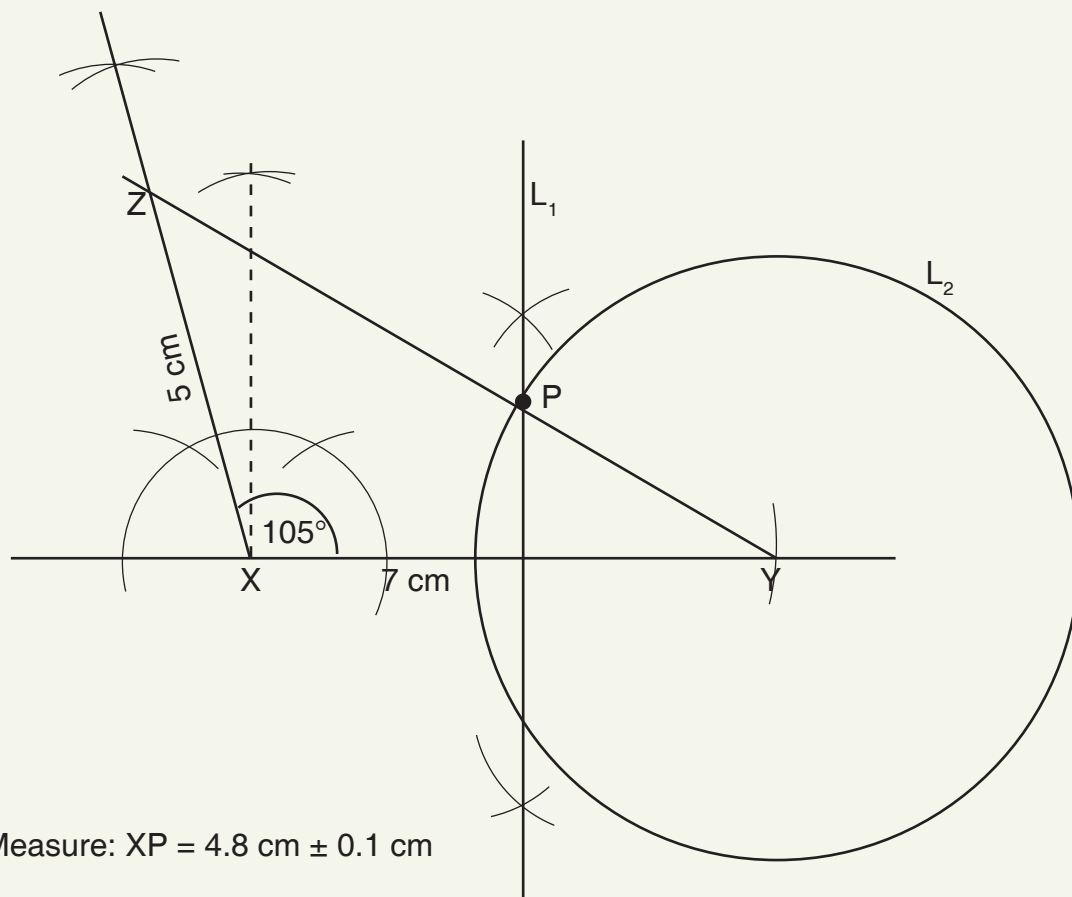
5. a. $\angle RQU = 50^\circ$ b. $\angle SRU = 130^\circ$ c. $x = 80^\circ$

6.



7. $x = 35^\circ$, $w = 145^\circ$ and $z = 145^\circ$
8. $1,080^\circ$

9.



10. a. $x = 103^\circ$

b. $y = 115^\circ$

11. 160°

Sub-strand 2: Measurement

Module 1

Area of a circle

Content standard

B.8.3.2.1 Apply the Pythagoras theorem, the primary trigonometric ratios and the formulas for determining the area of a circle to solve real problems.

Indicator

B.8.3.2.1.1 Use the relationship between the diameter and circumference of a circle to deduce the formula for finding its area, and use this to solve problems.

B.8.3.2.1.2 Establish the relationship between the hypotenuse c and the two other sides a and b of a right-angled triangle (i.e. $a^2 + b^2 = c^2$) and use it to solve problems.

Learning expectation: In this module, learners will learn how to:

- Apply Pythagoras' theorem, the primary trigonometric ratios and the formulas for determining the area of a circle to solve real problems.
- Use the relationship between the diameter and circumference of a circle to deduce the formula for finding its area, and use this to solve problems.
- Establish the relationship between the hypotenuse 'c' and the two other sides 'a' and 'b' of a right-angled triangle and use it to solve problems.

Essential for learning: Learners can:

- Identify the various plane shapes.
- Draw triangles.

Resources: Pencils, notebooks, a straight ruler, geodot/graph sheet, empty containers (milk, milo, tin tomatoes etc.).

Keywords/phrase: hypotenuse, circumference, Pythagoras' theorem, trigonometric ratios

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration, personal development and leadership and digital literacy

Starter: Refer to Learner's Book page 216. Allow learners to pair share their ideas.

Main idea 1

Understanding the concept of pi and the area of a circle

LB page 216

Activity 1: Put learners into convenient groups.

Task them to draw and label a circle and discuss the parts.

Engage the learners to brainstorm on the relationship between diameter and circumference.

Engage learners to perform an activity on determining the value of pi using the relationship between diameter and circumference (refer to Learner's Book page 216 for information).

Engage learners to discuss the value of pie in terms of a decimal and a fraction.

Activity 2: Demonstrate (or call a learner to volunteer) how to determine the area of a circle.

Assign each group to solve similar problems. Visit groups to offer assistance where necessary.

Call up groups to present their work to the class.

Give the class the opportunity to contribute to the presentations.

Wrap up on the presentations by giving all information missing from learners' presentations and address all misconceptions.

Activity 3: Engage learners with some real-life examples on area to solve.

Encourage learners to explain the strategies they used in breaking the word problem into a mathematical sentence.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (finding area of a circle).

Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Learners determine the area of circles and solve real-life problems.

Challenging activity

Learners create their own problems and determine the area of circles and solve real-life problems.

Assessment tasks ----- LB page 220

Refer learners to pages 220 - 223 of the Learner's Book for exercise.

Activity 1: Review previous lesson on finding the area of a circle.

Put learners into convenient groups and task them to discuss the parts of a triangle and the types of triangles.

Call up groups to take turns to present their findings. Allow the class to contribute to the presentations.

Ask groups to research and write a brief note on Pythagoras.

Discuss the concept of right-angled triangle with respect to the terms/sides hypotenuse, opposite and adjacent.

Activity 2: Assign each group to investigate the relationship among the hypotenuse, opposite and adjacent sides of a right-angled triangle.

Lead class to deduce the formula for Pythagoras' theorem including using the algebraic method.

Solve some examples with learners and task the groups to solve more examples.

Engage learners with some real-life application of Pythagoras' theorem to solve.

Wrap up on the presentations by giving all information missing from learners' presentations and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (Pythagoras' theorem). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Solve problems on Pythagoras' theorem.

Challenging activity

Deduce/prove the formula for Pythagoras' theorem and solve real-life problems.

Assessment tasks ----- LB page 227

Refer learners to page 227 of the Learner's Book for exercise.

Main idea 3

Basic trigonometric ratios

LB page 231

Activity 1: Review previous lesson on Pythagoras' theorem.

Put learners into convenient groups.

Ask groups to research the basic trigonometric ratios and present their findings to the class.

Activity 2: Using the right-angled triangle, deduce the ratios for sine, cosine and tangent.

Engage learners with some task sheets and real-life examples to solve.

Wrap up on the lesson by providing any further information and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (trigonometric ratios). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Solve problems using the basic trigonometric ratios.

Challenging activity

Create and solve real-life problems using the basic trigonometric ratios.

Main idea 4

Angles of elevation and depression

LB page 234

Activity 1: Review previous lesson on Pythagoras' theorem and the basic trigonometric ratios.

Put learners into convenient groups.

Ask groups to research on the concept of angle of elevation and depression and present their findings to the class.

Engage the class to talk about everyday life examples of angle of elevation and depression.

Activity 2: Engage learners with some task sheets and real-life examples to solve.

Wrap up on the lesson by providing any further information and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (angle of elevation and depression). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Solve problems on angle of elevation and depression.

Challenging activity

Create and solve real-life problems on angle of elevation and depression.

Assessment tasks ----- LB page 237

Refer learners to page 237 of Learner's Book for exercise.

Answers to Assessment tasks

Main Idea 1

(LB page 220)

- | | | |
|----------------------------|-------------------------|----------------------|
| 1. 12.56 cm | 2. 28.3 cm ² | |
| 3. 314 cm ² | 4. 453 cm ² | |
| 5. a. 19.6 cm ² | b. 28.3 square inches | c. 50.3 square feet |
| d. 7.1 square yards | e. 95.1 square inches | f. 154.0 square feet |

Main Idea 2

(LB page 221)

- | | |
|-----------------------|-----------------------|
| 1. 12.6 square yards | 2. 113.1 square feet |
| 3. 7.1 square inches | 4. 38.5 square yards |
| 5. 78.6 square miles | 6. 13.5 inches |
| 7. 62.9 square inches | 8. 100.4 square yards |

Main Idea 3

(LB page 227)

- | | | |
|--------------|-------------|-------------|
| 1. 12 inches | 2. 24 ft | |
| 3. a. 10 cm | b. 13.86 cm | c. 17.09 cm |
| d. 10.91 cm | e. 20 cm | f. 11.18 cm |

Main Idea 4

(LB page 230)

1. The ladder will not reach the top of the wall. It will be short by 1 foot.
2. $\sqrt{13^2 + 34^2} = 36.40$ feet

Main Idea 5

(LB page 237)

- | | | |
|----------|---------|------------|
| 1. 24 ft | 2. 30 m | 3. 14.14 m |
|----------|---------|------------|

Sub-strand 2: Measurement**Module 2****Vectors****Content standard**

B.8.3.2.2 Demonstrate understanding of addition and subtraction of vectors and their applications in solving basic problems

Indicator

B.8.3.2.2.1 Add, subtract and find the scalar multiplication of vectors in the component form.

B.8.3.2.2.2 Demonstrate understanding of vector equality.

Learning expectation: In this module, learners will learn how to:

- Add, subtract and find the scalar multiplication of vectors in the component form.

Essential for learning: Learners can:

- Calculate bearings.
- Perform addition, subtraction and multiplication.

Resources: Pencils, notebooks, a straight ruler

Keywords: vector, magnitude, direction

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration, personal development and leadership and digital literacy

Starter: Refer to the Learner's Book page 238. Allow learners to pair share their ideas.

Main idea 1

Add and subtract vectors

LB page 239

Activity 1: Review previous lessons on bearings and vectors.

Put learners into convenient groups and task them to discuss the concept of vectors and their application.

Demonstrate (or call a learner to volunteer) how to add and subtract vectors.

Present learners with some task sheets on addition and subtraction of vectors to solve.

Activity 2: Present learners with more problems to solve.

Wrap up on the presentations by giving all information missing from learners' presentations and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (addition and subtraction of vectors). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Add and subtract vectors.

Challenging activity

Create and solve problems on addition and subtraction of vectors.

Main idea 2

Multiply a vector by a scale factor

LB page 240

Activity 1: Review previous lessons on addition and subtraction of vectors.

Put learners into convenient groups.

Demonstrate (or call a learner to volunteer) how to multiply a vector by a scale factor.

Present learners with some task sheets on multiplication of a vector by a scale factor to solve.

Activity 2: Present learners with more problems to solve.

Wrap up on the presentations by giving all information missing from learners' presentations and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (multiplication of a vector by a scale factor). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Solve problems on multiplication of a vector by a scale factor.

Challenging activity

Create and solve problems on multiplication of a vector by a scale factor.

Assessment tasks ----- LB page 240

Refer learners to pages 240 - 241 of Learners' Book for exercise.

Revision 9

Measurement ----- (LB page 243)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 240)

1. $\begin{pmatrix} 9 \\ -6 \end{pmatrix}$

2. a. $\begin{pmatrix} -5 \\ 17 \end{pmatrix}$

b. $\begin{pmatrix} 10 \\ -2 \end{pmatrix}$

3. a. $\begin{pmatrix} 6 \\ 10 \end{pmatrix}$

b. $\begin{pmatrix} 4 \\ 8 \end{pmatrix}$

4. a. $\begin{pmatrix} -3 \\ 3 \\ 2 \end{pmatrix}$ or $\begin{pmatrix} -3 \\ 11 \\ 2 \end{pmatrix}$

b. $\begin{pmatrix} -6 \\ -15 \end{pmatrix}$

5. a. $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$

b. $\begin{pmatrix} 5 \\ 3 \\ 5 \\ 3 \end{pmatrix}$ or $\begin{pmatrix} 1\frac{2}{3} \\ 1\frac{2}{3} \\ 1\frac{2}{3} \\ 1\frac{2}{3} \end{pmatrix}$

6. $\begin{pmatrix} 3 \\ 9 \end{pmatrix}$

7. $\begin{pmatrix} 4 \\ 9 \end{pmatrix}$

8. $\begin{pmatrix} 12 \\ -1 \end{pmatrix}$

9. $\begin{pmatrix} 14 \\ 0 \end{pmatrix}$

Answers to Revision

9

Main Idea 1

(LB page 242)

1. a. 226.9 cm²

b. 139.6 cm²

c. 176.6 sq. inches

d. 78.5 m²

2. 37.73 cm²

3. a. 7 cm

b. 154.0 cm²

4. 14 cm

5. $\begin{pmatrix} -5 \\ 75 \end{pmatrix}$

6. -5

7. a. $x = 1$ and $y = 2$

b. $p = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$

8. 10 m

9. 12 m

10. radius = 7 cm, circumference = 44 cm

11. a. $\frac{4}{5}$ or 0.8

b. $\frac{3}{5}$ or 0.6

c. $\frac{4}{3}$ or 1.3

12. 4 m

13. 8.40 m

Sub-strand 3: Position and transformation**Module 1****Transformation****Content standard**

B.8.3.3.1 Perform a single transformation (i.e. rotation) on a 2D shape using graph paper (including technology) and describe the properties of the image under the transformation (i.e. congruence).

Indicator

B.8.3.3.1.1 Understand rotation and identify real-life situations involving rotation.

B.8.3.3.1.2 Draw a rotation image in a coordinate plane and determine the angle of rotation.

B.8.3.3.1.3 Investigate the concept of congruent shapes.

Learning expectations: In this module, learners will learn how to:

- Explain the concept of rotation and identify real-life situations involving rotation.
- Draw a rotation image in a coordinate plane and determine the angle of rotation.
- Investigate the concept of congruent shapes.

Essential for learning: Learners can:

- Draw the Cartesian plane and plot given coordinates.
- Describe shapes that are similar.
- Draw images under reflection in given lines.
- Draw images under translation by a given vector.
- Determine congruence and similarity.

Resources: Pencils, notebooks, a straight ruler

Keywords: Image, rotation, congruence

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration, personal development and leadership and digital literacy

Starter: Refer to the Learner's Book page 244. Allow learners to share ideas among themselves.

Main idea 1

Review the concept of transformation (rotation) **LB page 245**

Activity 1: Review learners' previous ideas reflection, translation, congruence and similarity.

Put learners into convenient groups. Task them to brainstorm on some real-life examples of rotation. Groups may draw to support their examples where necessary.

Call out groups to make a presentation to the class and wrap up on their presentations.

Activity 2: Demonstrate how to make a rotated image.

Refer to Learner's book for notes to discuss angle of rotation.

Demonstrate how to rotate a point on a Cartesian plane.

Wrap up on the lesson by summarising the main ideas and address all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (rotation). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Solve problems of rotation.

Challenging activity

Create their own problems on rotation and solve them.

Assessment tasks ----- **LB page 255**

Refer learners to pages 255 - 257 of Learners' Book for exercise.

Main idea 2

Congruent shapes

LB page 258

Activity 1: Review previous lessons on rotation and congruence and similarities from B7/JHS 1.

Use learners' groups from previous class. Alternatively, form new convenient groupings.

Task groups to discuss the term "congruence".

Groups to present their findings for the class to make contributions.

Activity 2: Present learners with some examples from the Learner's Book pages 258 - 259 to sort out the shapes that are congruent.

Groups present their work to class and justify their answers. Allow the class to make contributions and ask for justification when they believe it should be otherwise.

Wrap up on the presentations by giving all information missing from learners' presentations and addressing all misconceptions.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (Congruence). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Identify congruent shapes and solve problems involving congruence.

Challenging activity

Identify congruent shapes in real life and create congruent problems and solve them.

Assessment tasks ----- LB page 260

Refer learners to pages 260 - 261 of the Learner's Book for exercise.

Revision 10

Position and transformation ----- (LB page 262)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 255)

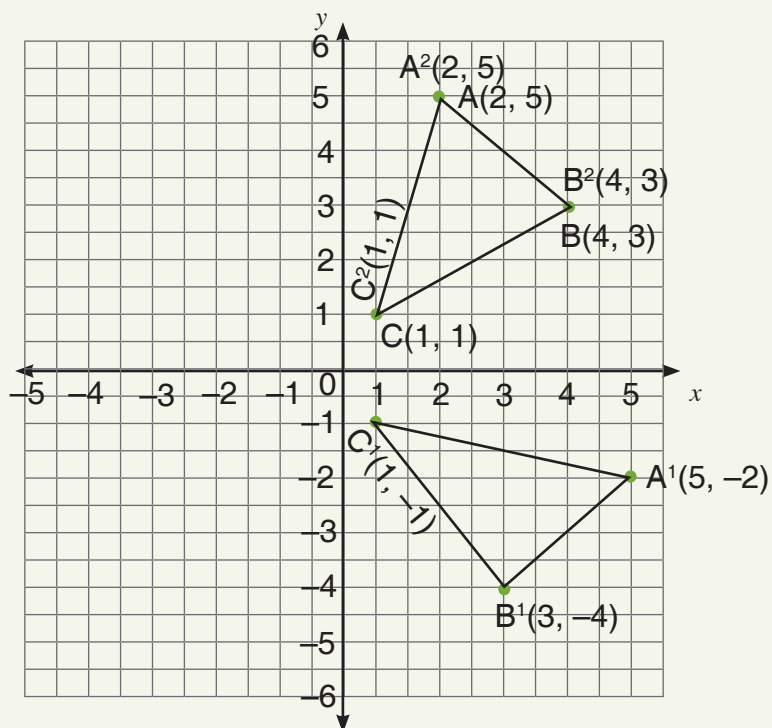
1. The rule: $(x, y) \xrightarrow[\text{about the origin}]{90^\circ \text{ clockwise}} (-y, x)$

2. $(x, y) \xrightarrow[\text{about the origin}]{180^\circ \text{ clockwise/ anticlockwise}} (-x, -y)$

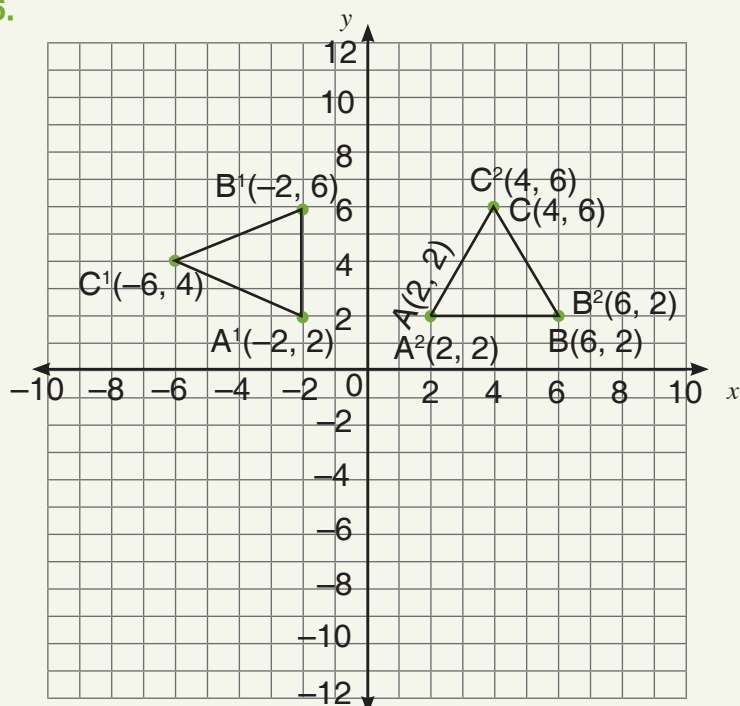
3. $(x, y) \xrightarrow[\text{about the origin}]{270^\circ \text{ clockwise}} (-y, x)$

4. $A^1(1, 2) \quad B^1(4, -2) \quad C^1(2, -4)$

5.



6.



7. Rotation through 270° anticlockwise or 90° clockwise about the origin.

8. Rotation through 270° clockwise or 90° anticlockwise about the origin.

Main Idea 2

(LB page 260)

1. a. \overline{XZ}

b. $\angle Q$

c. $\angle A$

d. \overline{XY}

2. a. $\angle U$

b. \overline{ED}

c. \overline{EF}

d. $\angle P$

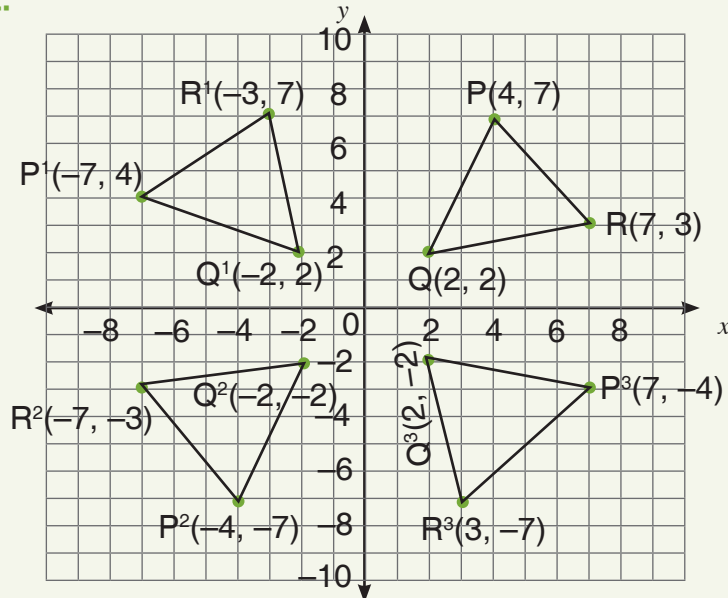
3. \overline{DB}

(LB page 262)

1. a. $A^1(1, 3)$ $B^1(1, 10)$ $C^1(-1, -1)$ and $D^1(-3, 2)$

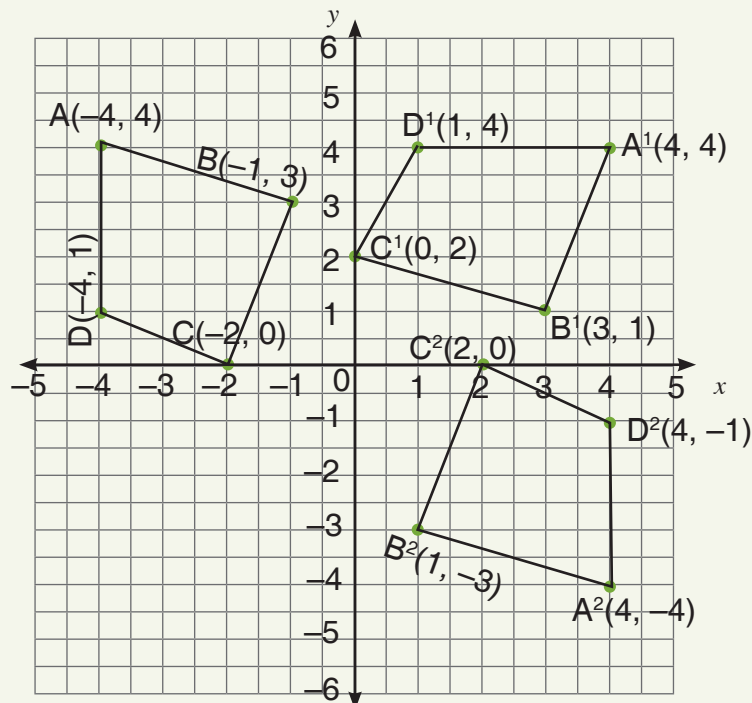
b. $E^1(-4, -1)$ $F^1(0, -1)$ and $G^1(-4, -3)$

2.



3. A rotation of 90° anticlockwise about $P(2, 4)$.

4.



5. a. A and G, B and D.

Sub-strand 1: Data

Module 1

Types of data

Content standard

B.8.4.1.1 Select, justify, and use appropriate methods to collect data (quantitative and qualitative), use the data (grouped/ungrouped) to construct and interpret frequency tables, bar charts, pie charts, and pictograms to solve and/or pose problems.

Indicator

B.8.4.1.1.1 Identify types of given data including numerical, categorical, ungrouped and grouped data.

B.8.4.1.1.2 Select and justify a method to collect data (quantitative and qualitative) to answer a given question.

Learning expectations: In this module, learners will learn how to:

- Identify given data as numerical, categorical, ungrouped and grouped data.
- Discuss some examples of data that fall under each of the types.
- Talk briefly about the differences and importance of using a particular type of data in a particular situation.

Essential for learning Learners can:

- Identify and discuss some methods for collecting data.
- Discuss some activities that each data collection method can be used to collect data on.

Resources: Pencils, notebooks

Keywords: numerical, categorical, ungrouped data, grouped data

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration, cultural identity and global citizenship, personal development and leadership and digital literacy.

Starter: Refer to the Learner's Book page 265, have learners play the die game and discuss the importance/mathematical connections associated with the game. Allow learners to pair share their understanding.

Activity 1: Put learners into convenient groups.

Task them to write at least four examples of data that they collected or talked about in B8.

Call up groups to present their notes to the class. Where necessary, ask them to justify why that particular data.

Engage the class to brainstorm on which of the examples can be considered as numerical and non-numerical.

Activity 2: Engage learners to discuss in their groups the different types of numerical data. Get learners to write short notes about them and discuss them in their groups.

Call up groups in turns to present their work for class discussions.

Engage the whole class to discuss, with examples, non-numerical data.

Activity 3: Pair/square learners. Assign each pair/square to create a real-life problem/situation where they can collect data and state the kind of data to be collected (numerical or non-numerical or both).

Let learners present their work to the class.

Wrap up on each presentation by offering the class the opportunity to ask questions or suggestions then add the necessary information that learners missed.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Identify a date that is numerical or non-numerical.

Challenging activity

Generate a date that is numerical or non-numerical.

Assessment tasks ----- LB page 270

Refer learners to page 270 of Learners' Book for exercise.

Activity 1: Put learners into convenient groups.

Task them to write at least four different information/data that they would like to collect about their friends/family/teachers/sports/food/technology etc.

Call up groups to present their notes to the class. Where necessary, ask them to justify why that particular data.

Activity 2: Engage learners to brainstorm on some of the methods that can be used to collect data from friends and family. Draw learners' attention to some of the methods they talked about from Basic 6 class.

Write their responses on the board and add up the ones they are unable to bring out (refer to the Learner's Book pages 267 - 268 for the various methods for collecting data).

Activity 3: Pair/square learners. Assign each pair/square two data collecting methods.

Now, task them to write anything they know about the two methods.

Call up pairs/squares to present their notes and allow the whole class to contribute to the presentation.

Wrap up on each presentation by adding the necessary information that learners missed.

Activity 4: In convenient groups, task learners to give reasons to justify why they will choose to use a particular data collection method.

Facilitate group presentations and discussions.

Wrap up the entire lesson by engaging the class to brainstorm on other reasons that were not captured by any of the groups.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

State at least two different information they would like to collect about friends and family.

Mention at least three data collecting tools/methods.

State three things to consider when selecting a particular data collection method.

Challenging activity

State with reason three different information they would like to collect about friends, family and events.

State and explain at least four data collecting methods/tools.

Briefly discuss three (3) things to consider when selecting a particular data collection method.

Refer learners to page 270 of Learners' Book for exercise.

Answers to Assessment tasks

Main Idea 1

(LB page 270)

1. **a.** Questionnaire
b. It is cheaper to use
2. **a.** Electronic media
c. This is because he cannot be there in person.
4. Check learners' answers.
5. Check learners' answers.

5. a.	Questionnaire	Interview
1.	It is useful for large population	Useful for small population
2.	It does not involve social media	It involves social media

b. Merits:

Questionnaire: It is cheaper to use.

Interview: The researcher can ask different questions.

Sub-strand 1: Data

Module 2

Organise data tables and graphical representations of data

Content standard

B.8.4.1.1 Select, justify, and use appropriate methods to collect data (quantitative and qualitative), use the data (grouped/ungrouped) to construct and interpret frequency tables, bar charts, pie charts, and pictograms to solve and/or pose problems.

Indicator

B.8.4.1.1.3 Organise data (grouped/ungrouped), present it in frequency tables, line graphs, pie graphs, bar graphs and/or pictographs (representations include info graphics, waffle diagrams, box-and-whisker plots, and stem-and-leaf plots) and analyse it to solve and/or pose problems.

Learning expectations: In this module, learners will learn how to:

- Organise a given data into a frequency distribution table.
- Draw and interpret bar graphs for given data.
- Draw and interpret pie charts for given data.
- Draw and interpret pictographs for given data.
- Draw and interpret line graphs for given data.
- Draw and interpret waffle charts for given data.

Essential for learning: Learners can:

- Collect and record information using questionnaires and interview guides.
- Organise data into a frequency table, draw simple bar graphs and pie charts.

Resources: Pencils, notebooks.

Keywords: frequency, distribution, organise, data, waffle chart

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration and personal development and leadership.

Starter: Refer to the Learner's Book page 271. Allow learners to pair share their understanding.

Activity 1: Put learners into convenient groups.

Present the scenario to each group and task them to organise the data. (The aim of the activity is to find the different ways that learners may organise the data.)

Inspect learners' work and call up the groups with different ways to present their work.

If any group organised the data into a frequency table, engage the class to talk more about the table and use it to introduce the day's lesson.

Activity 2: Engage learners to brainstorm on the features of a frequency distribution table and task them to sketch out the table with only the headings.

Give learners examples to try. As you go round the groups, note down the mistakes for class discussion.

Alternatively, first demonstrate the whole process then task learners to do the same in their groups.

Have a whole class discussion and do some class voting to ensure learners are on course.

Activity 3: Give one more example, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (how to organise data). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a frequency data table with at least 30 items in the data.

Challenging activity

Draw a frequency data table with at least 50 items in the data.

Activity 1: Review previous lesson on grouped data and ungrouped data.

Lead the class to brainstorm to come up with what line graphs are.

Put learners into convenient groups (preferably, use their groups from previous lesson)

Present them with the first example in the Learner's Book on page 277.

Activity 2: Task learners to solve the first example in their groups.

Allow groups ample time to present their charts by talking about the features.

Give them another example from the Learner's book to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3

- Discuss the example and do a simple class voting to find out if there are still some learners having difficulties.
- Ask learners to square up with friends and write their own examples and to draw the line graph for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (line graphs). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a line graph for a given data.

Interpret a given line graph.

Challenging activity

Write their own examples (data) and draw line graphs for the data.

Interpret a given line graph.

Assessment tasks ----- LB page 279

Refer learners to page 279 of Learner's Book for exercise.

Main idea 3

Bar graphs

LB page 280

Activity 1: Review the previous lesson on frequency distribution tables.

Lead the class to brainstorm to come up with what a bar graph is.

Put learners into convenient groups (preferably, use their groups from previous lessons).

Task them to use their data in their frequency distribution table from the previous lesson to draw a bar graph.

Activity 2: Allow groups ample time to present their graphs by talking about the features and the bars.

Give them an example from the Learner's Book pages 281 - 283 to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3: Discuss the example and do a simple class voting to find out if there are still some learners with difficulties.

Ask learners to square up with friends and write their own examples and to draw the bar graph for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (bar graphs). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a bar graph for a given data.

Interpret a given bar graph.

Challenging activity

Write their own examples (data) and draw a bar graph for the data.

Interpret a given bar graph.

Assessment tasks ----- **LB page 283**

Refer learners to page 283 of Learner's Book for exercise.

Main idea 4

Pie charts

LB page 284

Activity 1: Review previous the lesson on frequency distribution tables, bar graphs and pictographs.

Lead the class to brainstorm to come up with what a pie chart is.

Put learners into convenient groups (preferably, use their groups from previous lessons).

Present them with the first example in the Learner's Book page 286.

Take time to explain and guide learners through the determination of the sector angles.

Activity 2: Task learners to solve the first example in their groups.

Allow groups ample time to present their charts by talking about the features.

Give them another example from the Learner's Book pages 286 - 287 to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3: Discuss the example and do a simple class voting to find out if there are still some learners with difficulties.

Ask learners to square up with friends and write their own examples and to draw the pie chart for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (pie chart s). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a pie chart for a given data.

Interpret a given pie chart.

Challenging activity

Write their own examples (data) and draw a pie chart for the data.

Interpret a given pie chart.

Assessment tasks ----- LB page 287

Refer learners to pages 287 - 289 of Learner's Book for exercise.

Main idea 5

Pictographs

LB page 290

Activity 1: Review the previous lesson on frequency distribution tables.

Lead the class to brainstorm to come up with what a pictograph is.

Put learners into convenient groups (preferably, use their groups from previous lessons).

Task them to use their data in their frequency distribution table from the previous lesson to draw a pictograph.

Activity 2: Allow groups ample time to present their graphs by talking about the features of pictographs.

Give them another example from the Learner's Book on pages 291 - 292 to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3: Discuss the example and do a simple class voting to find out if there are still some learners with difficulties.

Ask learners to square up with friends and write their own examples and to draw the pictograph for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (pictograph). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a pictograph for a given data.

Interpret a given pictograph.

Challenging activity

Write their own examples (data) and draw a pictograph for the data.

Interpret a given pictograph.

Assessment tasks ----- LB page 293

Refer learners to page 293 of Learner's Book for exercise.

Main idea 6

Stem-and-leaf plot

LB page 294

Activity 1: Review the previous lesson on frequency distribution tables.

Lead the class to brainstorm to come up with what a stem-and-leaf plot is.

Demonstrate how a stem-and-leaf plot is constructed using the notes from the Learner's Book on page 295.

Put learners into convenient groups (preferably, use their groups from previous lessons).

Assign them an example from Learner's Book pages 297 - 298 to solve.

Ensure to visit groups to offer assistance.

Activity 2: Allow groups ample time to present their graphs by talking about the features of a stem-and-leaf plot.

Give them another example from the Learner's Book on pages 297 - 298 to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3: Discuss the example and do a simple class voting to find out if there are still some learners with difficulties.

Ask learners to square up with friends and write their own examples and to draw the stem and leaf plot for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (stem and leaf plot).

Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a stem-and-leaf plot for a given data.

Interpret a given stem-and-leaf plot.

Challenging activity

Write their own examples (data) and draw a stem-and-leaf plot for the data.

Interpret a given stem-and-leaf plot.

Assessment tasks ----- LB page 298

Refer learners to pages 298 - 299 of the Learner's Book for exercise.

Main idea 7

Waffle chart

LB page 299

Activity 1: Review previous lessons on line graphs.

Lead the class to brainstorm to come up with what waffle charts are.

Put learners into convenient groups (preferably, use their groups from previous lessons).

Present them with the first example in the Learner's Book on page 299.

Activity 2: Task learners to solve the first example in their groups.

Allow groups ample time to present their charts by talking about the features.

Give them another example from the Learner's Book on page 300 to do.

Allow learners to pair share their work and discuss their difficulties with friends.

Activity 3: Discuss the example and do a simple class voting to find out if there are still some learners with difficulties.

Ask learners to square up with friends and write their own examples and to draw the waffle chart for it.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (waffle charts). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Draw a waffle chart for a given data.

Interpret a given waffle chart.

Interpret a given waffle charts.

Assessment tasks ----- LB page 301

Refer learners to page 301 of Learner's Book for exercise.

Answers to Assessment tasks

Main Idea 1

(LB page 279)

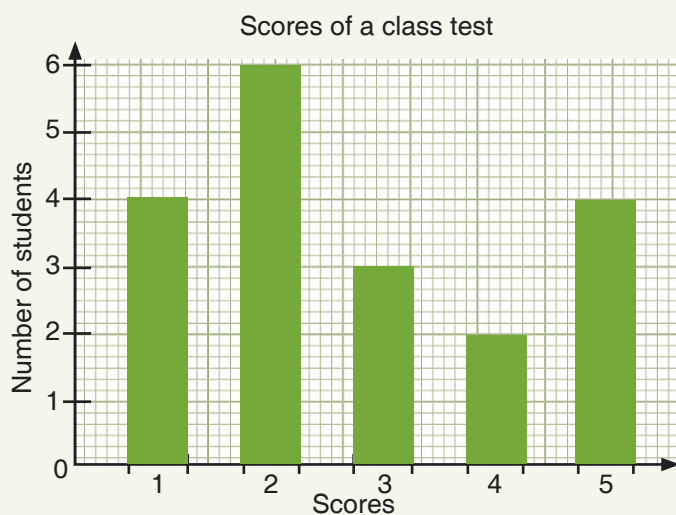
- [illegible]

Main Idea 2

(LB page 283)

- 1.**
- | | |
|------------------|-------------------------------|
| <p>a. Friday</p> | <p>b. 60 cakes were baked</p> |
|------------------|-------------------------------|

2.	Scores	1	2	3	4	5
	Number of students	4	6	3	2	4



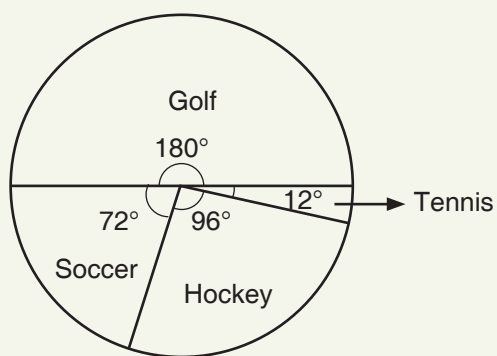
The mode is 2.

Main Idea 3

(LB page 287)

1. a. 122.4° b. 90° c. 28.8°

2.



3. 20%

4. 36°

5.

Name of the sector	The sector as fraction of the whole (in its lowest form)	Central angle of the sector
Ryan	$\frac{25}{100} = \frac{1}{4}$	$\frac{25}{100} \times 360^\circ = 90^\circ$
Patty	$\frac{15}{100} = \frac{3}{20}$	$\frac{15}{100} \times 360^\circ = 54^\circ$
Ted	$\frac{30}{100} = \frac{3}{10}$	$\frac{30}{100} \times 360^\circ = 108^\circ$
Mark	$\frac{10}{100} = \frac{1}{10}$	$\frac{10}{100} \times 360^\circ = 36^\circ$
Amy	$\frac{20}{100} = \frac{1}{5}$	$\frac{20}{100} \times 360^\circ = 72^\circ$
Total		360°

6. 33.3% → babysitting

29.2% → tutoring

16.7% → car wash

12.5% → yard work












8.3% → newspaper delivery


Main Idea 4

(LB page 293)

1. **a.** School A **b.** 100 **c.** School B **d.** 450

2.

Days	Number of visitors
Monday	 
Tuesday	  
Wednesday	     

 = 100

Main Idea 5

(LB page 298)

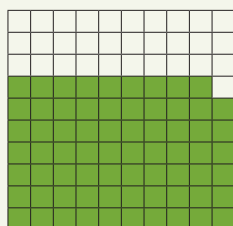
1. **a.** 23 and 28 **b.** 2 values are smaller than 16
2. mean = 47.74 median = 45 mode = 26 and 82

Main Idea 6

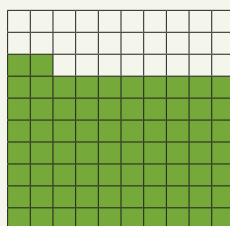
(LB page 301)

1. **a.** English **b.** 17% **c.** 56% **d.** 53.75%

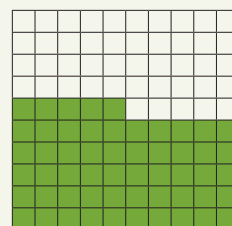
2.



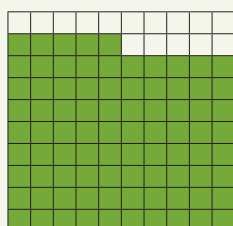
English



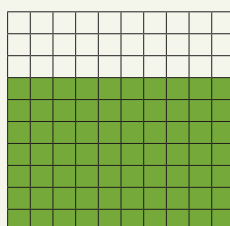
Maths



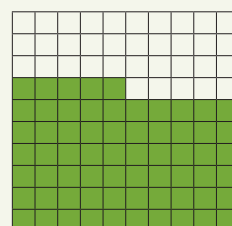
Science



Social studies



French



ICT

Sub-strand 1: Data

Module 3

Measures of central tendency

Content standard

B.8.4.1.2 Demonstrate an understanding of measures of central tendency (mean, median, mode) and range for grouped data and explain when it's most appropriate to use the mean, median, or mode.

Indicator

B.8.4.1.2.1 Calculate the mean, median and mode for a given set of ungrouped data, and explain why these values may be the same or different.

B.8.1.2.2 Justify a context in which the mean, median or mode is the most appropriate measure of central tendency to use when reporting findings.

Learning expectations: In this module, learners will learn how to:

- Calculate the median and mode for a given ungrouped data.
- Calculate the mean for a given ungrouped data.
- Solve problems involving mean, median and mode.

Essential for learning: Learners can:

- Organise data into frequency tables.
- Draw simple bar graphs, pie charts, pictographs, line graphs and waffle charts.

Resources: Pencils, notebooks, counters/bottle caps

Keywords: frequency, distribution, mean, median, mode

Competencies: Critical thinking and problem-solving, creativity and innovation, communication and collaboration and personal development and leadership

Starter: Refer to the Learner's Book pages 302 - 303. Allow learners to pair share their understanding.

Activity 1: Using think-pair-square, task learners to discuss and write short notes about what they learnt/know about mean and median from their B7 class.

Call out groups to present their findings to the class.

Lead a whole class discussion on the meaning of the concept of mode and median.

Note: Take time to address any misconceptions that may arise from learners' presentations and contributions.

Activity 2: Engage learners to solve the examples on mode and median from the learner's book.

Go round to offer help and address any challenges.

Task Challenging activity to create their own examples and to solve them.

Activity 3: Give some more examples from the Learner's Book on pages 303 - 306, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (the mode and median). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Determine the mode and median with at least 20 items in the data.

Challenging activity

Determine the mode and median with at least 40 items in the data.

Assessment tasks ----- **LB page 306**

Refer learners to pages 306 - 307 of Learner's Book for exercise.

Main idea 1a

Determine the Mean of a distribution

LB page 303

Activity 1: Put learners into convenient groups. Alternatively, use their previous groups.

Lead a whole class discussion on the meaning of the concept of mean.

Engage learners to talk about situations where the concept of mean can be applied.

Activity 2: Engage learners to solve more examples in the Learner's Book on pages 303 - 306.

Go round to offer help and address any challenges.

Task Challenging activity to create their own examples to solve them.

Activity 3: Give one more example from the Learner's book, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (the mean). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Determine the mean with at least 10 items in the data.

Challenging activity

Determine the mean with at least 20 items in the data.

Assessment tasks ----- LB page 306

Refer learners to pages 306 - 307 of the Learner's Book for exercise.

Main idea 1c

Determine the mode and median from a frequency table

LB page 303

Activity 1: Review lessons on determining mode, mean and median for raw or unorganised data.

Also, review learners' knowledge on organising data into frequency tables.

Activity 2: Put learners into convenient groups. Alternatively, use their previous groups.

Present each group with some raw data to organise into a frequency table.

Task learners to use their previous knowledge on the concept of mode and median to determine the mode and median in the table.

Explain to learners the mode is not the highest frequency itself but the score/mark/item with the highest frequency.

Activity 3: To determine the median guide learners to divide the total frequency by two and find the position from the frequency and trace to the score.

Explain to learners that when the total frequency is an even number (say 10), after you divide by 2 take the 5th and 6th position and trace it. However, if the total frequency is an odd number, (say 9) add 1 to make it even (10) then divide by 2 and trace only the 5th position.

Give one more example on median from the Learner's Book on pages 303 - 306, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (the mode/median from a frequency table). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Determine the mode and median with at least 20 items in the data.

Challenging activity

Determine the mode and median with at least 40 items in the data.

Assessment tasks ----- LB page 306

Refer learners to pages 306 - 307 of Learners' Book for exercise.

Main idea 1d

Determine the Mean of a given data from a frequency distribution table
LB page 303

Activity 1: Review previous lessons on mean for unorganised data.

Pair/square learners.

Task learners to bring out solved examples of organising data into frequency distribution table.

Lead learners to determine the values for the fx column.

Task them to do the summation for the fx and the f columns.

Guide learners to do the division to obtain the mean.

Activity 2: Task learners to solve more examples in the Learner's Book pages 303 - 306.

Go round to offer help and address any challenges.

Task Challenging activity to create their own examples and solve them.

Activity 3: Give one more example from the Learner's Book, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (the mean). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Determine the mean with at least 10 items in the data.

Challenging activity

Determine the mean with at least 20 items in the data.

Assessment tasks ----- **LB page 306**

Refer learners to pages 306 - 307 of Learners' Book for exercise.

Main idea 2

Selecting and justifying the best average (mean, median and mode) to represent a given data set

LB page 307

Activity 1: Review previous lessons on calculating the mean, median and mode for a given data set.

Pair/square learners.

Task learners to solve a problem on mode, median and mean.

Through questioning, provoke learners to think about choosing one of the averages to represent the data and give reasons for their decisions.

Activity 2: Task learners to solve some more examples in the Learner's Book on pages 307 - 310.

Continue to engage learners to make a choice out of one of the averages to represent the data with reasons.

Now, lead the class to discuss reasons for choosing a particular measure to represent a data.

Activity 3: Give one more example from the Learner's book, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (selecting and justifying the choice for a particular measure of central tendency). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Calculate the mode, median and mean of a given data and choose the best average to represent the data with reasons.

Challenging activity

Calculate the mode, median and mean of a given data and choose the best average to represent the data with reasons using one's example.

Assessment tasks ----- LB page 311

Refer learners to page 311 of the Learner's Book for exercise.

Revision 11

Data ----- (LB page 312)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

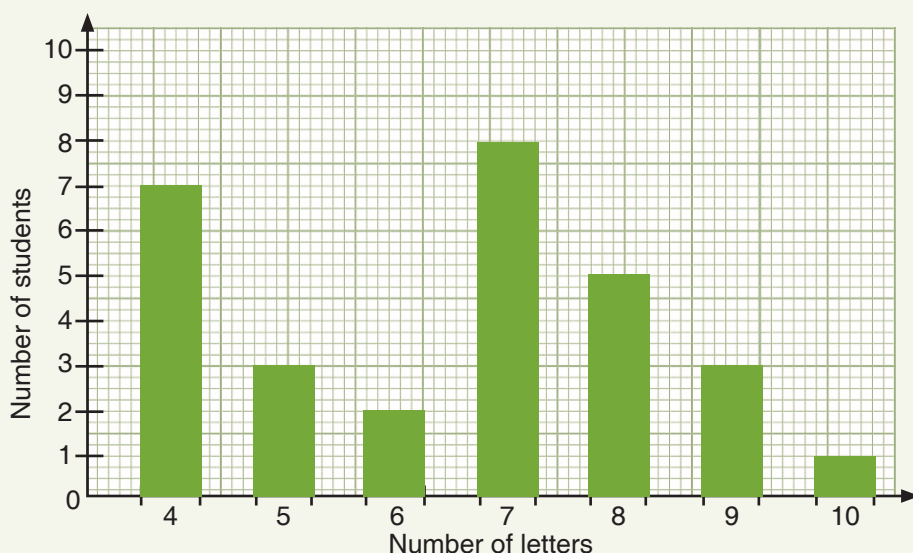
Main Idea 1

(LB page 306)

1. a. 180 b. 30 c. 25%

2. a. i. 7 ii. 6.48

b.



Main Idea 2

(LB page 311)

1. mode = 4, 5 and 10 mean = 6.38 median = 5

The best measure is the mean. This is because the average score is around 6.

2.

Marks	Tally	Frequency	F_x
0		3	0
1		7	7
2		5	10
3		2	6
4		4	16
5		6	30
		$\Sigma f = 27$	$\Sigma fx = 69$

Mode = 1

Median = 2

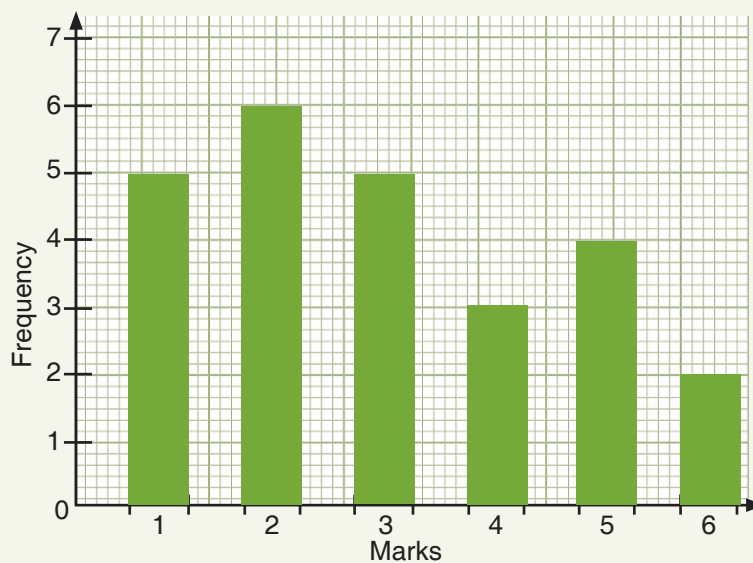
Mean = 2.56

The best measure is mean because, it is around the average score.

Answers to Revision**11**

(LB page 312)

1. a.



b. Mean = 3

2. a.

Stem	Leaf
1	0 1 3 4 4 7 9
2	2 4 4 5 7 8
3	2 8 9 9 9
4	2 3 5 6 9 9
5	2 5 6 7 7
6	1 3 4 5 7 9

b. 34

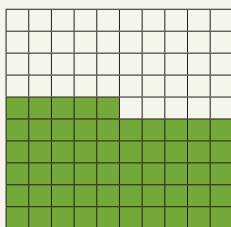
c. 7

d. 39

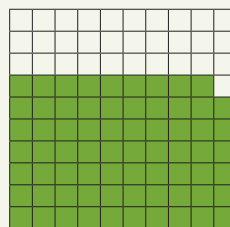
e. 59

3. Draw a 10-by-10 square grid and shade:

a. 54% for Adjetey



b. 67% for Bashiru



4. a.

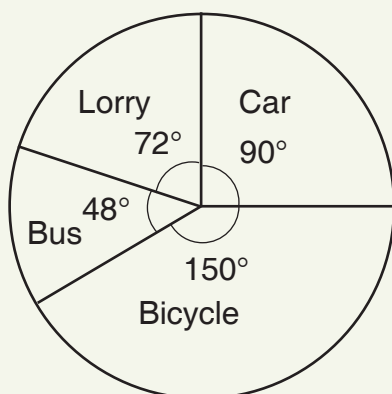
Marks	Tally	Frequency	F_x
3		6	18
4		9	36
5		6	30
6		4	24
7		3	21
8		2	16
		$\Sigma f = 30$	$\Sigma f_x = 145$

b. i. mode = 4.0

ii. median = 4.5

iii. mean 4.8 (1 dp)

5.



Sub-strand 2: Chance or probability

Module 1

Probability

Content standard

B.8.4.2.1 Identify the sample space for a probability experiment involving two independent events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.

Indicator

B.8.4.2.1.1 Perform a probability experiment involving two independent events such as drawing coloured bottle tops from a bag with replacement and list the elements of the sample space.

B.8.4.2.1.2. Express the probabilities of the events as fractions, decimals, percentages and/or ratios. e.g.by using a tree diagram, table or other graphic organiser.

Learning expectations: In this module, learners will learn how to:

- Explain probability and statistics.
- Outline some important notes on probability and statistics.
- Solved examples on probability and statistics.
- Think out of the box.

Essential for learning: Learners can:

- Predict certain events that occur around them.
- Be familiar with the dice and coin.
- Determine the probability of given events.

Resources: Pencils, notebooks, coins, dice.

Keywords: probability, experiment, theoretical, classical

Competencies: Critical thinking and problem-olving, communication and collaboration and personal development and leadership.

Starter: Refer to Learner's Book page 313, have learners study the magic square and allow them ample time to try it out. The aim of the activity is to encourage critical thinking. Also, allow learners to pair share their work.

Main idea 1

Theoretical or classic al and experimental probability
LB page 314

Activity 1: Put learners into convenient groups.

Task them to research, discuss and write short notes on theoretical and experimental probability.

Allow groups to present their work to the entire class. Encourage the class to contribute to the presentation.

Activity 2: Present learners with examples on probability to solve in their groups.

Lead the class to discuss their solutions.

Give some more examples from the Learner's Book on pages 315 - 316, this time for learners to do individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Calculate the probability of given events.

Challenging activity

Create their own examples on probability and solve them.

Assessment tasks ----- LB page 319

Refer learners to pages 319 - 320 of the Learner's Book for exercise.

Main idea 2

Independent and dependent events

LB page 319

Activity 1: Review the previous lesson on calculating probability.

Put learners into groups.

Present each group with a task of explaining some everyday examples of independent and dependent events.

Activity 2: Ask the various groups to link their understanding on dependent and independent events to probability events that can be considered as dependent and independent.

Encourage learners to question or criticise some of the activities if they believe it should be otherwise. Ensure that they justify their reason.

Activity 3: Task learners to solve some more examples on dependent and independent events from the Learner's Book on pages 317 - 319, in groups and individually.

Go round and offer support especially to the Remedial activity.

Note any more misunderstandings/mistakes for final class discussion.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (probability experiments). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Describe the outcome of an experiment as possible, impossible or certain.

Challenging activity

Perform an experiment and describe the outcome of an experiment as possible, impossible or certain.

Assessment tasks ----- LB page 319

Refer learners to pages 319 - 320 of Learner's Book for exercise.

Main idea 3

Tree diagrams

LB page 319

Activity 1: Review the previous lesson on dependent and independent events.

Put learners into groups or let learners move into their previous groups to save time.

With an appropriate example, explain how to use the tree diagram approach to solve probability problems.

Allow learners the opportunity to ask questions for deeper understanding of the strategy.

Activity 2: Square learners and assign them with a probability question to solve using a tree diagram.

Call up the groups/squares to present their solution. In the event where they make a mistake, use the other learners to help address the mistake.

However, wrap up on each presentation with further explanation and clarification if necessary.

Activity 3: Task pairs/individual learners to solve some more examples from the Learner's Book on pages 321 - 323.

Go round and offer support especially to the Remedial activity.

Note any more difficulties/mistakes for redress.

Plenary/Reflection

Engage learners to talk about what they have learnt for the day (calculate the probability of an event using tree diagrams). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated assessment

Remedial activity

Calculate the probability of given events using tree diagrams.

Challenging activity

Create their own problems on probability and solve using tree diagrams.

Assessment tasks ----- LB page 323

Refer learners to page 323 of the Learner's Book for exercise.

Revision 12

Chance or probability ----- (LB page 324)

Learners answer the Revision questions as a class test.

Answers to Assessment tasks

Main Idea 1

(LB page 319)

1.
 - a. Independent – the result of a die showing an odd number does not affect the result of a die showing 6.
 - b. Dependent – there are fewer number of students to be chosen from after the first selection.
 - c. Dependent – the number of cards is reduced for the second draw.
 - d. Independent – the result of guessing “true” in the first question does not affect the result of guessing “true” in the second question.
 - e. Independent – your neighbors call does not affect your brother's call after you hung up.
 - f. Independent – the meals are different so the order for one does not affect the other.

2. $\frac{1}{8}$

3. $\frac{4}{7} \times \frac{4}{7} = \frac{16}{49}$

4. $\frac{6}{36} = \frac{1}{6}$

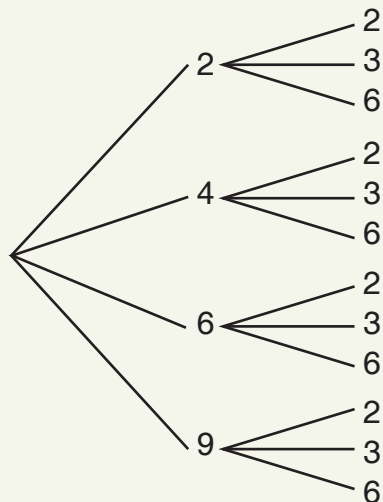
5. $\frac{4}{13} \times \frac{3}{12} = \frac{1}{13}$

6. $\frac{4}{7} \times \frac{3}{6} = \frac{2}{7}$

Main Idea 2

(LB page 323)

1.



2. a. $P(\text{different values}) = \frac{10}{12} = \frac{5}{6}$

b. $P(\text{both even}) = \frac{6}{12} = \frac{1}{2}$

c. $P(\text{both prime}) = \frac{2}{12} = \frac{1}{6}$

d. $P(\text{sum} > 5) = \frac{10}{12} = \frac{5}{6}$

e. $P(\text{product} > 16) = \frac{6}{12} = \frac{1}{2}$

Answers to Revision

12

Main Idea 1

(LB page 324)

1. a.

Second pen

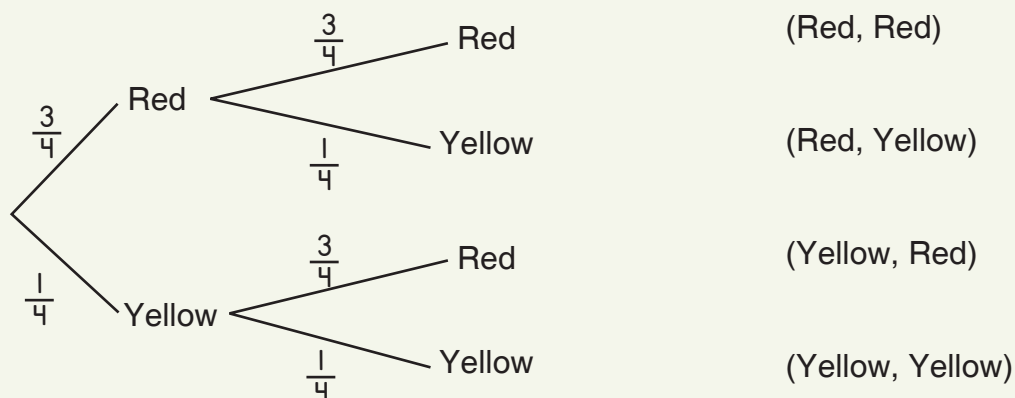
First pen	Second pen		
	Red	Blue	Green
Red	R,R	R,B	R,G
Blue	B,R	B,B	B,G
Green	G,R	G,B	G,G

b. $P(\text{same colour}) = \frac{3}{9} = \frac{1}{3}$

2. a. 1st Counter

2nd Counter

Outcome



b. $P(\text{different colours}) = 0.4$ (1 dp)

3. a. $P(\text{odd number}) = \frac{3}{6} = \frac{1}{2}$

b. $P(\text{prime number}) = \frac{3}{6} = \frac{1}{2}$

c. $P(x < 3) = \frac{2}{6} = \frac{1}{3}$

4. a. $P(\text{red balls}) = \frac{2}{10}$

b. $P(\text{white balls}) = \frac{4}{10}$

c. $P(\text{same colour}) = \frac{13}{25}$

5. $P(\text{same colour}) = \frac{1}{26} + \frac{14}{39} + \frac{1}{78} = \frac{64}{156} = \frac{16}{39}$

ESSENTIAL

Mathematics

Basic 8

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- regular assessments and review sections to monitor learners progress and reinforce learning
- answers to assessments in the Learner's Book

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