LEARNER'S
RESOURCE PACK

Mathematics BASIC 7

NATIONAL COUNCIL FOR
CURRICULUM & ASSESSMENT
OF MINISTRY OF EDUCATION

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Contents

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About the Basic 7 Learner's Resource Pack

This Learner's Resource Pack is to help you learn the standards-based Mathematics curriculum efficiently. It provides you with guidelines to plan your learning before, during and after classes for the attainment of desired learning standards. Furthermore, it gives you information and procedures to carry out mathematical tasks efficiently.

This resource pack contains activities and exercises that are contained in your teachers' lesson frames. Your teachers will guide you on which activities and exercises you will be doing before, during and after classes. In addition, the resource pack contains:

- content standard
- what you should know already before learning the new topic
- what you will be learning
- what skills you will be developing
- language and vocabulary, you will need to use
- ways to extend your understanding
- things you will need to remember for future lessons
- worksheets that contains activities and exercises
- command words that will be used in the lesson;
- suggested activities self-assessment
- equipment and resources for learning;
- suggestions for homework, project work.

To use the resource pack, you are encouraged to do the following:

- Discuss with your teacher and colleagues, share your ideas and plan how you will carry out the activities.
- Gather the materials you will need to do the activities.

  Be abreast with command words in the curriculum. You can see a table of command words and what they mean on the next page:

Some command words in mathematics

S/N	Command words	What you need to know
1.	Analyse	Break down the content of a topic, or issue, into its constituent elements in order to provide an in-depth account and convey an understanding of it.
2.	Annotate	Add to a diagram, image or graphic, a number of words that describe and/or explain features, rather than just identify them (which is labelling).
3.	Assess	Consider several options or arguments and weigh them up so as to come to a conclusion about their effectiveness or validity.
4.	Calculate	Work out the value of something.
5.	Change	Usually convert from one unit to another; either using known metric unit conversions or a conversion graph.
6.	Complete	Fill in missing values.
7.	Define	State the precise meaning of an idea or concept. There is usually a low tariff of marks for this.
8.	Describe	Write a sentence that gives the features of the situation.
9.	Discuss	Set out both sides of an argument (for and against), and come to a conclusion related to the content and emphasis of the discussion. There should be some evidence of balance, though not necessarily of equal weighting.
10.	Draw	Produce an accurate drawing (unless a sketch is being drawn).
11.	Draw a sketch of ... or Sketch …	Produce a drawing that does not have to be drawn to scale, or a graph that is drawn without working out each coordinate.

S/N	Command words	What you need to know
12.	Evaluate	Consider several options, ideas or arguments and come to a conclusion about their importance/ success/worth.
13.	Examine	Consider carefully and provide a detailed account of the indicated topic.
14.	Expand	Remove brackets.
15.	Expand and simplify	Remove brackets and the collect like terms.
16.	Explain	Write a sentence or a mathematical statement to show how you got to your answer or reached your conclusion.
17.	Express	Re-write in another form; some working may be needed.
18.	Factorise	Insert brackets by taking out common factors.
19.	Factorise fully/ completely	Insert brackets by taking out all the common factors.
20.	Find	Some working will be needed to get to the final answer.
21.	Give a reason	Must be clear and accurate reasons. If the reasons are geometrical then make sure you: - provide a reason for each stage of working (if required), - use correct geometric terminology.
22.	Interpret	Ascribe meaning.
23.	Justify	Show all working and/or give a written explanation. It also means give reasons for the validity of a view or idea why some action should be undertaken. This might reasonably involve discussing and discounting alternative views or actions. Each of the views present or options available will have positives and negatives. For the outcome(s) chosen, the positives outweigh the negatives.

S/N	Command words	What you need to know
24.	Outline	Provide a brief account of relevant information.
25.	Prove	More formal than 'show', all steps must be present. In the case of a geometrical proof, reasons must be given.
26.	Prove algebraically	Use algebra in the proof
27.	Simplify	Simplify the given expression
28.	Simplify fully	Simplify the given expression. Answer must be given in its simplest form.
29.	Solve	Find the solution of an equation or inequality.
30.	Solve algebraically	Find the solution of an equation or inequality; algebraic manipulation **must** be shown.
31.	Summarise	Provide a brief account of relevant information.
32.	Work out	Some working will be needed in order to get the answer
33.	Write	No working needed for 1mark questions. Working may be needed questions with more than 1 mark.
34.	Write down	No working is needed.

Note that the above list is not exhaustive, you are advised to add to the list and be conversant will all the command words and their meaning.

Mathematics Content Standards for Basic 7

Table 1 shows the Content Standards for B7. It is important for learners to note that the Strands in Table 1, have not been necessarily organised sequentially for learning.

Table 1: B7 Content Standards

S/N	Strand	Sub-strand/Topic	Content Standard
1.	Number	Number and numerals	B7.1.1.1 Demonstrate understanding and the use of place value for expressing quantities recorded as base ten numerals as well as rounding these to given decimal places.
2.		Number Operations	B7.1.2.1 Apply mental mathematics strategies and number properties used to solve problems.
3.		Number Operations	B7.1.2.2 Demonstrate an understanding of addition, subtraction, multiplication and division of (i) whole numbers, and (ii) decimals, to solve problems.
4.		Number Operations – Powers	B7.1.2.3 Demonstrate understanding and the use of powers of natural numbers in solving real life problems.
5.		Number Operations – Integers	B7.1.2.4 Demonstrate an understanding of the basic operations on integers.
6.		Number Fractions	B7.1.3.1 Simplify, compare and order a mixture of positive fractions (i.e. common, percent and decimal) by changing all to equivalent (i) fractions (ii) decimals, or (iii) percentages.
7.		Number Fractions	B7.1.3.2 Demonstrate an understanding of the process of addition and/or subtraction of fractions and apply this in solving problems.

S/N	Strand	Sub-strand/Topic	Content Standard
8.		Number Fractions	B7.1.3.3 Demonstrate an understanding of the process of multiplying and dividing positive fractions and apply this in solving problems.
9.		Number - ratios	B7.1.4.1 Demonstrate an understanding of the concept of ratios and its relationship to fractions and use it to solve problems that involve rates, ratios, and proportional reasoning.
10.	Algebra	Algebra – pattern and relations	B7.2.1.1 Derive the rule for a set of points of a relation, draw a table of values to graph the relation in a number plane and make predictions about subsequent elements of the relation.
11.		Algebra – algebraic expressions	B7.2.2.1 Simplify algebraic expressions involving the four basic operations and substitute values to evaluate algebraic expressions.
12.		Algebra – equations	B7.2.3.1 Demonstrate an understanding of linear equations of the form x + a = b (where a and b are integers) by modelling problems as a linear equation and solving the problems concretely, pictorially, and symbolically.
13.	Geometry & Measurement	Geometry – Angles	B7.3.1.1 Demonstrate understanding of angles including adjacent, vertically opposite, complementary, supplementary and use them to solve problems
14.		Geometry – Construction 1	B7.3.1.2 Demonstrate how to construct a perpendicular to a line from a given point, bisect a line, and bisect angles.
15.		Geometry – Construction 2	B7.3.1.2 Demonstrate how to construct a perpendicular to a line from a given point, bisect a line, bisect angles, and construct angles of the following sizes: 30˚, 45˚, 60˚, 75˚ and 90˚.

S/N	Strand	Sub-strand/Topic	Content Standard
16.	Geometry & Measurement	Measurement – Perimeter	B.7.3.2.1 Demonstrate the ability to find the perimeter of plane shapes including circles using the concept of pi (**π**) to find the circumference of a circle.
17.		Measurement – Area	B.7.3.2.2 Derive the formula for determining the area of a triangle and use it to solve problems.
18.		Measurement – bearings and vectors	B7.3.3.1 Demonstrate understanding of the concept of bearings, vectors and their components using real life cases.
19.		Geometry – transformation	B7.3.3.2 Perform a single transformation (i.e. reflection and translation) on a 2D shape using graph paper (including technology) and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.).
20.	Data and Probability	Data and Probability – Data	B7.4.1.1 Select, justify, and use appropriate methods to collect data (quantitative and qualitative), display and analyse the data (grouped/ungrouped) presented in frequency tables, line graphs, pie graphs, bar graphs or pictographs and use these to solve and/or pose problems.
21.		Data and Probability – Data	B7.4.1.2 Determine the measures of central tendency (mean, median, mode) for a given ungrouped data and use them to solve problems.
22.		Data and Probability – probability	B7.4.3.1 Identify the sample space for a probability experiment involving single events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.

In the new curriculum, learners are expected to make connections across standards and given sub-strands.

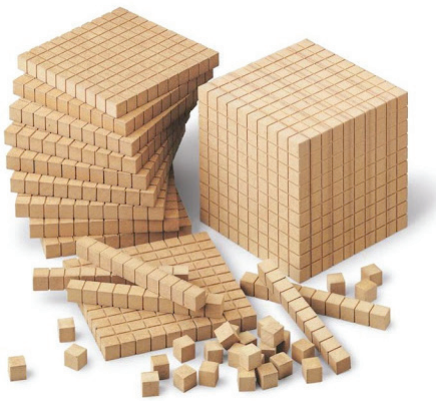
Lesson B7.1 Number and Numerals - Whole Numbers Up to 10,000,000,000

Content standard	B7.1.1.1 Demonstrate understanding and use of place value for expressing quantities.
What you should know already	Counting forward and backwards, read and write number names of number quantities and vice versa, addition and subtraction of numbers.
What will you learn? What skills will you develop?	You will learn to: • Find strategies to solve number operations easier and faster.
Language and vocabulary, you will need to use	Model, place value, strategy, rounding up, rounding down, rounding off, less than, greater than, equal to.
Ways to extend your understanding	Ordering numbers, approximation and estimation
Things you will need to remember for future lessons	Size of numbers, tens, hundreds, ten-thousands (place value chart)

For each content standard, create activity instructions, worksheets, other teaching resources (e.g. charts, maps, photos) as applicable, homework and assessment tasks.

Worksheet B7.1 Number And Numerals - Whole Numbers Up to 10,000,000,000

A. Form numbers with given multi-base ten materials, given that a small cube is 1,000; 10 small cubes is a rod (i.e. 10,000), 10 rods is a flat (i.e. 100,000); and 10 flats is a block (i.e. 1000,000)



B. Model the following numbers with multi-base ten materials or graph sheet:

a. 150,000

b. 485,000

C. Compare the following numbers using < or >:

a) 345 and 395

b) 4,726 and 9,726

c 57,821 and 52,821

d) 209,481 and 279,481

d) 63,237 and 23,237

e) 368,7693 and 9,687,693

D. Round off the following numbers to the nearest thousand and ten thousand:

a. 679,598

b. 390,409

c. 12,987,657

Learning Resources

- Multi base ten materials - (or manipulatives) including bagged 10 bundles of 10s straws, bundles of 10s straws and loose straws
- Graph sheets
- Place value chart
- Number lines

Assessment Task

A. Write these numbers using words.

a) 3,500 _____

b) 17,100 _____

c) 54,400 _____

B. Shade the number quantities in A above using graph sheets given that 1cm by 1cm square on the graph sheet = 100 units.

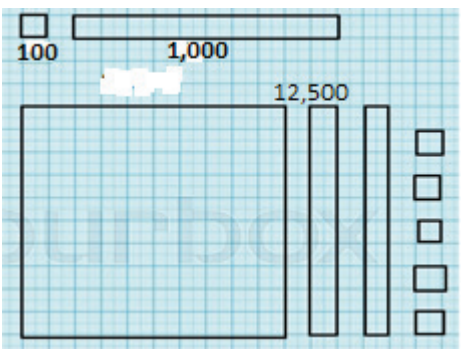


Figure 1 shows the result of shading **12,500**, where 1cm×1cm square represents 100 units

Figure 1

C. Model the number quantities in B above using graph sheets given that 1 cube = 1000 units; a rod = 10,000 units; and a flat = 100,000 units.

a. _____

b. _____

c. _____

D. Write these numbers in figures.

a) Four hundred and seventy-six thousand, two hundred and fifty.

_____

b) Four hundred and five thousand, four hundred and sixty-six.

_____

c) Five hundred thousand, three hundred and twenty.

_____

E. Round the figures obtained in D above to the nearest thousand.

a. _____

b. _____

c. _____

F. Model the number quantities in E above using given multi-base ten materials, where 1 cube = 1000 units; a rod = 10,000 units ; and a flat = 100,000 units.

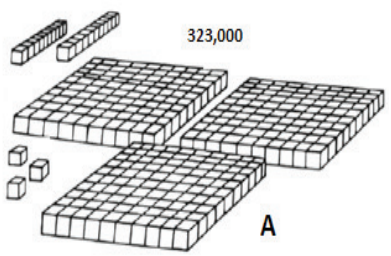


Figure 2 shows the result of shading 323,500, where 1 cube = 1000s units; a rod = 10,000s; and a flat = 100,000s unit.

Figure 2

G. What is the value of the digit that is underlined in the following numbers?

a. 4,5<u>6</u>7

b. 3<u>4</u>2,893

c. 4,573,934

d. 7,657,894

e. 32,467,815

H. Try using place value to complete the following:

a. Decrease 194,753 by two thousand.

b. Increase 2,384,598 by six million.

c. Decrease 980,9821 by sixty thousand.

d. Increase 2,049,342 by three hundred thousand.

I. Compare the following numbers using < or >.

a) 345 and 395 b) 4,726 and 9,726

c) 57,821 and 52,821 d) 209,481 and 279,481

e) 63,237 and 23,237 f) 3,687,693 and 9,687,693

J. Circle the number which is nearest in value to 7508.

5,706 6,993 8,108 8,522 1,050

K. Rewrite these numbers in the boxes below in order of size.

4,565 2,996 9,013 4,720 5,758

Smallest

L. Find the missing numbers and complete the sequence.

a. 1,013 2,013 3,013 _____ 5,013 _____ _____

b. 11,492 10,492 _____ 8,492 7,492 _____ _____

c. _____ 560,149 460,149 _____ _____ 160,149 _____

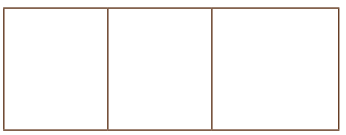
Homework Task

A. Go to three or four local churches in the community and take data on the number of people in each church and compare.

Use the three digits below to do Task B.

6 1 3

B. Use **all** the digits **6**,**1** and **3** to write a number that is **between 100** and **140**.



Lesson B7.2 Number Operations – Mental Maths Strategies

Content standard	**B7.1.2.1 Apply mental mathematics strategies and number properties in solving problems**
What you should know already	Know basic multiplication, decimals and fractions, idea of sharing, doubling of numbers, addition and subtraction of numbers.
What will you learn? What skills will you develop?	You will learn to: i. Recall and recite multiplication facts. ii. Identify decimal names of the benchmark fractions and their equivalent percentages.
Language and vocabulary, you will need to use	Halving, doubling, distributive property
Ways to extend your understanding	Practise with peers in class and at home and explore further.
Things you will need to remember for future lessons	Applying strategies of halving and doubling of decimals, fractions and percentages in everyday life

For each content standard, create activity instructions, worksheets, other teaching resources (e.g. charts, maps, photos) as applicable, homework and assessment tasks.

Worksheet B7.2 Number Operations – Mental Mathematics Strategies

A. Play mental mathematics games in groups using activities that involve the following mental strategies:

i. Addition through words like plus, add, calculate the sum, increase a number by, and find the total;

ii. Subtraction from words like minus, from a number take, minus, find the difference, and what must be added to make;

iii. Multiplication through words like times, multiply, find the product, square, and what must be divided by … to give …;

iv. Division through words like divide, share, how many times does it go into? And what must be multiplied by … to give …

1. Play mental mathematics games using mental exercises such as:

Addition

1. 27 plus 9.
2. Add 18 and 5.
3. What is the sum of 36 and 7?
4. Increase 43 by 5.
5. Find the total of 71 and 9.

Subtraction

1. Subtract 8 from 22.
2. From 41 take 5.
3. 25 minus 9.
4. What is the difference between 40 and 16?
5. What must be added to 18 to make 33?

Multiplication

1. 12 times 9.
2. Multiply 13 by 7.

3. What is the product of 6 and 8?
4. Find the square of 12.
5. What must be divided by 11 to give 33?

Division

1. Divide 96 by 8.
2. 11 into 110.
3. Share 42 pins amongst 6 girls.
4. How many times is 5 contained in 35?
5. What must be multiplied by 11 to give 132?

2. Play mental mathematics games using mental exercises such as:

i. Find the cost of three 5 kg bags of rice at ¢2 per kg.
ii. What is the cost of 1 dozen of eggs at 80 pesewas each?
iii. 8 x 99.
iv. 28 x 25.
v. How many 21cm pieces can I cut off a string of one metre long?
vi. What fraction of a litre is 250ml?
vii. The area of a square board is 81 cm^2. What is its perimeter?
viii. Two angles of a triangle add up to 98°. What is the size of the third angle?
ix. How many minutes is it from 10.15 a.m. to noon?
x. What is 60 pesewas as a decimal of ¢2.40?

B. Do the multiplication tasks.

(I) 18 × 6

9 × 12 = 108

(ii) 16 × 5.5 =

8 × 11 = 88

(iii) 2.25 × 36

4.5 × 18

Try these:

a. 18 × 12
b. 24 × 5.5
c. 3.25 × 16
d. 5.5 × 36

Learning Resources

Multiplication chart, number grids

Assessment Task

Find more tasks to do similar to those on the worksheet.

Homework Task

A. Have more investigations about numbers with peers at home.

B. Solve problems on real life situations involving multiplication and division.

1. Musah works for 28 days in a month. He is paid Gh¢350.00 a week.
   a. How much is Musah paid altogether for the 28 days he works?
   b. How much is Musah paid in a day?
2. Five friends each has 20 oranges and decided to give all their oranges to four sportsmen. How many oranges will each sportsman get if they share them equally?

Lesson B7.3 Number Operations – Basic Operations on Whole and Decimal Numbers

Content standard	B7.1.2.2 Demonstrate an understanding of addition, subtraction, multiplication and division of whole numbers, and decimals, to solve problems.
What you should know already	Addition and subtraction of 2-digit numbers. Multiplication and division of 2- and 3-digit numbers by a 1-digit number. Use of partitioning or expanded forms and place value to add, subtract, multiply and divide numbers including decimals.
What will you learn? What skills will you develop?	You will learn to: • Find methods to solve addition, subtraction, multiplication and division problems.
Language and vocabulary, you will need to use	Number operations, whole numbers and decimal numbers, partitioning or expanded form, place value, lattice method, carrying/remainder, long division method
Ways to extend your understanding	Adding, subtracting, multiplying and dividing things. Sharing things with peers.
Things you will need to remember for future lessons	Numbers including decimals, place value, number operation, multiplication chart, lattice method, carrying/ remainder, long division method

Worksheet B7.3 Number Operations – Basic Operations on Whole and Decimal Numbers

1. Use partitioning/ expanded form and place value system to add the following numbers:
   - **a.** 967 + 364
   - **b.** 698.93 + 45.68
   - **c.** 36750 + 5678
   - **d.** 896.564 + 245.453
2. Use partitioning/expanded form and place value system to subtract the following numbers:
   - **a.** 67895 – 37798
   - **b.** 7653.78 – 4558.18
   - **c.** 98345 – 34569
   - **d.** 897.65 – 791.09
3. Multiply the following numbers using the vertical place value or lattice method
   - **a.** 4477 × 332
   - **b.** 567.98 × 372. 14
   - **c.** 9987 × 456
   - **d.** 6743.53 × 5786.02
4. Divide the following numbers using the long division method.
   - **a.** 4422 ÷ 12
   - **b.** 668.88 ÷ 2. 4
   - **c.** 5000 ÷ 20
   - **d.** 608.44 ÷ 2.2

Activity Instructions

Use the place value chart to add and subtract numbers including decimals numbers. Use the vertical lattice method to multiply and divide numbers including decimals.

Learning Resources

Place value chart, Multiplication chart

Assessment Task

i. A group of 200 men and 700 women went to watch a basketball match in a stadium. An amount of Gh¢20 was collected at the gate from each person. How much money was collected all together?

ii. Mrs Kugblenu bought 40.8kgs of meat. Mrs Dzormeku bought 12.6kgs of meat less than Mrs Kugblenu. How many kilogrammes of meat did they buy all together?

iii. Kwame weighs 28.28kg. His father weighs four times as heavy.

   a. What is the weight of Kwame's father?

   b. What is the total weight of Kwame and his father?

iv. Mrs Armah bought 450.10 metres of Woodin cloth for her five children. If they share the material equally, how many meters of Woodin cloth did each receive?

Homework Task

Create word problems such as those above (in Assessment Task) and solve them.

Lesson B7.4 Number Operations – Powers of Natural Numbers

Content standard	**B7.1.2.3 Demonstrate understanding and the use of powers of natural numbers in solving real life problems.**
What you should know already	Multiplication facts Expressing whole numbers in their factors.
What will you learn? What skills will you develop?	You will learn to: • Express a number in indices form • Apply the concept of powers of numbers (product of prime) to find hcf. • Apply the concept of powers of numbers as unit of measurement for area.
Language and vocabulary, you will need to use	Power, base, index, indices, simplify, exponent
Ways to extend your understanding	• Understand the definitions and notation. That is, use correct terms always. • Practice lots of examples and non-examples.
Things you will need to remember for future lessons	A knowledge of powers or indices is essential for an understanding of work in algebra. You will need to practice a lot of exercises .

Worksheet B7.4 Powers of Natural Numbers

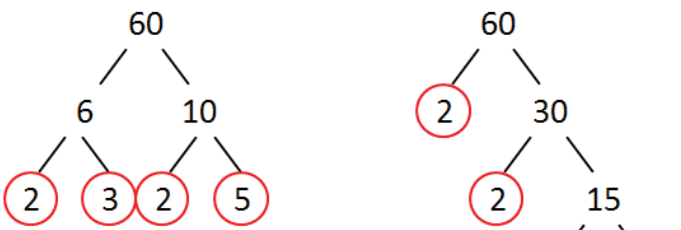
Answer the following questions and write the answers in the spaces provided.

A. Evaluate each of the following:

E.g. $5^3 = 5 \times 5 \times 5 = 25 \times 5 = 125$

i.	3^4	
ii.	6^3	
iii.	$\frac{1}{2^5}$	
iv.	4^5	
v.	7^2	

B Expand the following numbers using product of prime numbers. F.g. using prime factorisation 60 is



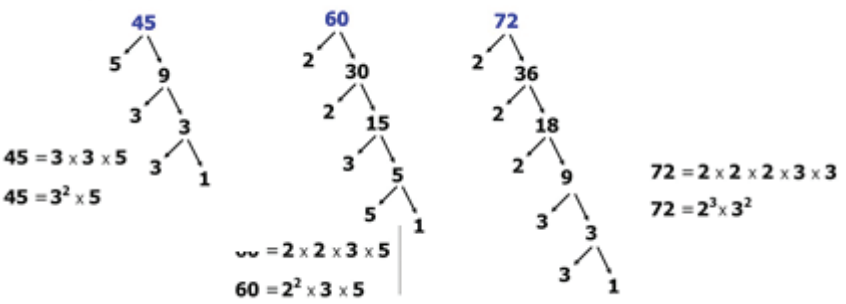
Either way, the result is:

$2 \times 2 \times 3 \times 5$ or $2^2 \times 3 \times 5$

C. Find the HCF of the following:

1) 36 and 72
2) 12 and 24
3) 36 and 48
4) 25 and 125
5) 16 and 48

E.g. Find the HCF using product of prime numbers.



So the highest common factor for 45, 60 and 72 = 3

Learning Resources

- Indices dominos,
- cut out shapes,
- counters,
- oware,
- Math set, etc.

Activity Instructions

Read the following instructions carefully

1. An index number is a number which is raised to a power. The power, also known as the index, tells you how many times you have to multiply the number by itself.
2. For example, 2^5 means that you have to multiply 2 by itself five times = 2×2×2×2×2 = 32.
3. On the other way round, when given 32, you have to find out how many times 2 will multiply itself to give 32. Then you raise 2 to the number of times got.
4. To find HCF using the knowledge of powers of numbers, say 36 and 72:
   I. First, find the prime factors of both numbers:

      36 = 2 x 2 x 3 x 3

$72 = 2 \times 2 \times 2 \times 3 \times 3$

II. Use one of each of the numbers that are in both lists:

HCF = 2 x 2 x 3 x 3

HCF = 36

Assessment Task

Answer the following questions in your exercise book.

1. Simplify the following:

   a. $a \times a \times a \times a \times a$

   b. $2cm \times 2cm \times 2cm \times$

   c. $2 \times 2 \times 2 \times 2 \times x^2 \times x^2 \times x^2$

2. Evaluate each of the following.

   a) 3^5

   b) 7^3

   c) 2^9

   d) 5^3

   e) 4^4

   f) 8^3

3. Study the table carefully and complete it with a partner.

Exponential Form	Expanded Form	Value
4^2		
	5×5×5	
		36
	2×2×2×2	
3^4		
5^2		
		216

Exponential Form	Expanded Form	Value
	1× 1 × 1 × 1× 1 × 1 × 1 ×1 × 1 × 1	
100^0		
		1,000,000

4. Solve for the HCF using product of prime.

i. 16 and 72

ii. 12 and 36

iii. 18 and 24

Homework Task

Answer the following questions in your homework books.

1. Simplify each of the following:

i. $b \times b \times b \times b \times b \times b$

ii. $3cm \times 2cm \times 1cm \times 2cm$

iii. $3 \times 3 \times 3 \times 3 \times x^3 \times x^3 \times x^3$

2. Solve for the HCF using product of prime.

iv. 2 and 72

v. 6 and 36

vi. 8 and 12

Lesson B7.5 Number Operations – Operations on Integers

Content standard	B7.1.2.4 Understand the relationship between integers as numbers in the rational number system and solve real life problems involving integers.
What you should know already	Counting/natural numbers Whole numbers Fractions - benchmark fractions and decimals.
What will you learn? What skills will you develop?	You will learn to: • Work on real practical examples of integers. • Explain the idea of integers as numbers and their opposite solving problems with different signs.
Language and vocabulary, you will need to use	Integers, rational numbers, real numbers Whole numbers, counting, natural numbers, Debt, credit, height above/below sea level depth Temperature below/freezing points. Negative/positive, directed numbers
Ways to extend your understanding	Apply and solve real life problems involving integers. Relate integers to temperature in refrigerators and weather conditions - freezing and above freezing point.
Things you will need to remember for future lessons	Integers are all positive and negative whole numbers

For each content standard, create activity instructions, worksheets, other teaching resources (e.g. charts, maps, photos) as applicable, homework and assessment tasks.

Worksheet B7.5 Number Operations – Operation on Integers

Perform the following tasks on the number line.

i. $2 + (^{-}5)$

ii. $^{-}3 - (^{-}5)$

iii. $2 \times (^{-}3)$

iv. $^{-}2 \times 4$

v. $^{-}4 \times 6$

vi. $^{-}2 \times (^{-}6)$

vii. 4×3

viii. $^{-}3 \times (8)$

ix. $2 \times (+6)$

x. $4 \times (^{-}7)$

xi. $3\times (^{-}3)$

Activity Instructions

A. At zero on the number line turn right and jump two spaces. Then at 2 turn to the left because the sign of the second number is negative.

Move 5 spaces (since the operation sign is plus).

The last position gives the answer.

B. At zero on the number line turn left. At our current position turn right and move 5 spaces backwards towards zero and stop at the number 2

Learning Resources

Number line, colours like green and red to represent positive and negative numbers respectively.

Assessment Task

a. $12 + (^{-}15)$

b. $(^{-}3) - (^{-}4)$

c. $(^{-}2) \times (4)$

d. $^{-}2 \times \square = 6$

e. $^{-}10 + (^{-}32) =$

f. $^{-}3 + (^{-}8) =$

g. $^{-}15 + \square = 20$

h. $^{-}4 \times 3 =$

i. $5 \times \square = {}^{-}30$

Homework Task

Explain how you will use the number line to explain the following problems:

A.

$^{-}3 - (^{-}7)$

$3 + (^{-}3) + (^{-}5)$

B. Complete by selecting the right word:

Height of 80 meters is 80 metres (above, below, or parallel to)

A depth of $^{-}50$ is 50 metres (above, below, or parallel to)

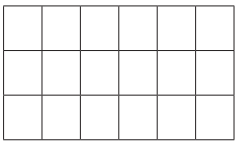
Lesson B7.6 Number – Comparing Fractions

Content standard	B7.1.3.1 Simplify, compare and order a mixture of positive fractions (i.e. common, percent and decimal) by changing all to equivalent (i) fractions (ii) decimals, or (iii) percentages.
What you should know already	Fractions notation and how it is read: i. $\frac{7}{12}$ is seven-twelfths ii. $\frac{8}{10}$ is eight-tenth
What will you learn? What skills will you develop?	You will learn to: • Simplify, compare and order a set of fractions in percentages, decimals and make square models to represent them.
Language and vocabulary, you will need to use	numerator, denominator, benchmark fractions, percentages and decimals; equivalent fractions; arrange; order; compare; ascending order; descending order
Ways to extend your understanding	Creating fraction patterns with Geodot paper in groups. Investigating fraction of colours in flags. Identify benchmark fractions used in the media and describe the context.
Things you will need to remember for future lessons	Benchmark fractions and their equivalents in percentages used in everyday life.

Worksheet b7.6 Number – comparing fractions

A. Review

i. Shade given fraction of squares in given shapes: i.e. shade $\frac{5}{6}$ of the rectangle.



ii. Write down 3 fractions equivalent to $\frac{2}{3}$.

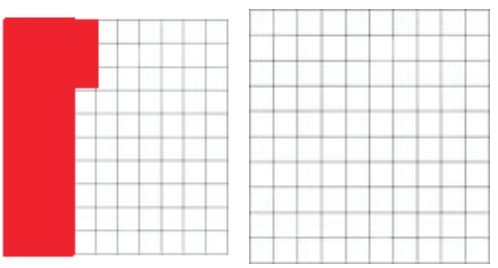
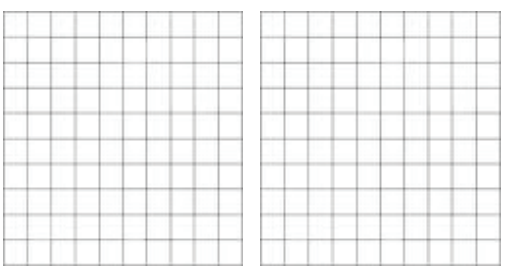
iii. Express the fraction $\frac{6}{10}$ in its simplest form: $\frac{6}{10} = \frac{3}{5}$

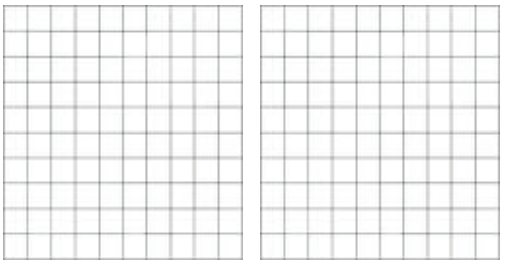
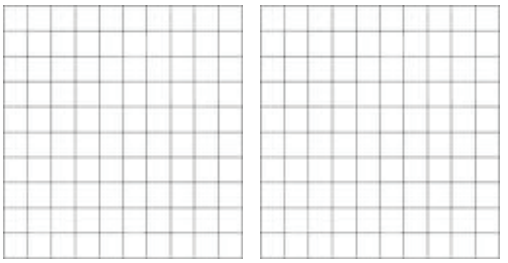
iv. Convert to mixed numbers: $\frac{12}{5}$

v. Convert to improper fractions: $2\frac{5}{9}$

B. Percentages, Fractions, Decimals and Square Models

Complete the table for the missing fractions and make square models for the fractions.

Percentages	Fractions	Decimal	Square Models
23%			
	$1\frac{1}{10}$		

Percentages	Fractions	Decimal	Square Models
☐	☐	0.78	
129%	☐	☐	

C. Common, decimal and percent equivalences

1. Work out common, decimal and percent equivalents of the benchmark fractions.

Common		A	$\frac{1}{4}$	$\frac{1}{3}$	B	C	$\frac{2}{3}$
Percent	10%	20%	D	E	50%	F	G
Decimal	0.1	H	I	J	K	0.4	L

2. **Compare the numbers using >, <, or =.**

1. $\frac{5}{8} \_\_ \frac{3}{10}$
2. $\frac{5}{11} \_\_ \frac{19}{44}$
3. $1\frac{5}{8} \_\_ 1\frac{8}{12}$
4. $\frac{2}{3} \_\_ \frac{4}{5}$
5. $\frac{5}{6} \_\_ \frac{3}{7}$
6. $\frac{7}{20} \_\_ \frac{11}{15}$

3. **List the numbers from least to greatest.**

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

ii. $1\frac{11}{18}\ 1\frac{12}{24}\ 1\frac{1}{3}$

iii. $\frac{7}{10}\ \frac{1}{2}\ \frac{3}{5}$

iv. $\frac{2}{7}$, 0.4, 30%

v. $\frac{5}{6}\ \frac{7}{12}\ \frac{2}{2}$

vi. $\frac{2}{7}\ \frac{1}{9}\ \frac{1}{3}$

vii. $\frac{7}{10}\ \frac{1}{2}\ \frac{3}{5}$

viii. 0.58, $\frac{3}{5}$, 49%

Learning Resources

Square grid sheet or Geodot paper for shading fractions.

Insert Assessment Task

i. Find which fraction is greater: $\frac{7}{12}$ and $\frac{8}{10}$.

ii. Arrange in descending order, the following fractions: $\frac{5}{6}$, $\frac{3}{4}$ and $\frac{7}{8}$.

iii. Arrange 0.832, $\frac{3}{8}$ and 38% from biggest to smallest.

Homework Task

- Investigate fractions of colours in a flag, (limit to flags of African countries, state the fractions in the Ghanaian language, and express them in common, percent and decimal forms); use Atlases or the internet.
- Identify benchmark fractions used in the media and describe the context in which they are used.
- Create patterns with Geodot paper, e.g. shading half of a rectangle in multiple ways.

Lesson B7.7 Number – Addition and Subtraction of Fractions

Content standard	B7.1.3.2 Explain the process of adding two or three common fractions and apply this in solving problems; and explain the process of subtracting two or three common fractions and apply this in solving problems
What you should know already	Can find least common denominator (LCD). Can compare and order common fractions.
What will you learn? What skills will you develop?	You will learn to: • Write equivalent fractions using the LCD. • Adding and subtracting fractions expressed with a common denominator.
Language and vocabulary, you will need to use	numerator, denominator, equivalent fractions, lowest common denominator
Ways to extend your understanding	Add decimal numbers by expressing them as fractions.
Things you will need to remember for future lessons	Only fractions with common denominators (i.e. which are of the same unit) can be added or subtracted.

Worksheet B7.7 Number – Addition and Subtraction of Fractions

A. Add or subtract the fractions below:

1. $\frac{3}{8}+\frac{7}{8}=$ **2.** $\frac{2}{3}+\frac{3}{4}=$ **3.** $\frac{3}{32}+\frac{1}{8}=$ **4.** $\frac{3}{5}+\frac{5}{6}=$

5. $\frac{5}{8}+\frac{1}{10}=$ **6.** $\frac{3}{8}+1\frac{1}{4}=$ **7.** $\frac{1}{4}+\frac{1}{5}=$ **8.** $2\frac{1}{8}+1\frac{1}{4}=$

9. $1\frac{5}{8}+\frac{13}{16}=$ **10.** $2\frac{2}{3}+\frac{4}{9}=$ **11.** $\frac{9}{10}-\frac{3}{16}=$ **12.** $\frac{7}{8}-\frac{1}{2}=$

13. $\frac{11}{16}-\frac{1}{4}=$ **14.** $\frac{5}{6}-\frac{1}{5}=$ **15.** $\frac{7}{8}-\frac{3}{10}=$ **16.** $1\frac{1}{2}-\frac{3}{32}=$

17. $5\frac{5}{6}-2\frac{3}{9}=$ **18.** $3\frac{2}{3}-1\frac{7}{8}=$ **19.** $2\frac{1}{4}-\frac{5}{6}=$ **20.** $4\frac{5}{6}-1\frac{1}{2}=$

B. Solve the word problems below using fractions.

1. The Mensah family decided to hike to Lake Bosomtwe from Kuntenase, approximately $8\frac{5}{8}$ kilometres away. After an hour the lake was still $5\frac{1}{3}$ kilometres away. How far did they hike so far?
2. Akosua purchased a packet of biscuits at the store. On his way home he ate ¼ of the biscuits in the box. At dinner later that night he and his friends took twice what he took on his way home. What fraction of the biscuits in the box was left?

Assessment Task

A. Work out answers to the following:

a) $\frac{3}{11}+\frac{7}{11}=$ **b)** $\frac{3}{4}+\frac{7}{8}=$ **c)** $\frac{4}{5}-\frac{1}{6}=$

d) For a family party, Baaba made $\frac{2}{5}$ of the desserts and her mother made half of the desserts served at the party. Who made more of the desserts? How much more or less dessert did Baaba's mother make?

e) $3\frac{1}{3}$ feet are cut off a board that is $12\frac{1}{4}$ feet long. How long is the remaining part of the board?

Homework Task

If you add 2 fractions and the sum is greater than ½, what can you say about the fractions. Investigate.

Lesson B7.8 Number – Multiplication and Division of Fractions

Content standard	B7.1.3.3: • Explain the process of multiplying a whole number by a fraction (and vice versa) and apply this in solving problems. • Explain the process of dividing a whole number by a fraction (and vice versa) and apply this in solving problems.
What you should know already	Can determine common factors Can find HCF
What will you learn? What skills will you develop?	You will learn to: • Multiply a whole number by a fraction and how to multiply a fraction by a whole number and explain the process. • Divide a whole number by a fraction and how to divide a fraction by a whole number and explain the process.
Language and vocabulary, you will need to use	numerator, denominator, highest common factor (HCF), simplify
Ways to extend your understanding	Determining fractions in circle graphs. Finding a fraction of given quantity and the result of dividing a quantity by a fraction.
Things you will need to remember for future lessons	Divide through the numerator and denominator by a common factor to simplify the fraction.

Worksheet B7.8 Number – Multiplication and Division of Fractions

A Write in lowest terms.

1. $\frac{6}{32}$
2. $\frac{21}{35}$
3. $\frac{18}{24}$
4. $\frac{12}{15}$
5. $\frac{5}{30}$
6. $\frac{9}{27}$
7. $\frac{14}{49}$
8. $\frac{8}{32}$
9. $1\frac{12}{21}$
10. $2\frac{16}{20}$
11. $5\frac{8}{14}$
12. $3\frac{10}{25}$

B. Multiply.

1. $\frac{1}{9} \times \frac{1}{2} =$
2. $\frac{7}{10} \times \frac{2}{5} =$
3. $\frac{3}{8} \times \frac{3}{7} =$
4. $\frac{1}{2} \times \frac{3}{16} =$
5. $\frac{3}{4} \times \frac{2}{3} =$
6. $\frac{7}{16} \times \frac{4}{3} =$
7. $\frac{15}{64} \times \frac{1}{12} =$
8. $\frac{2}{9} \times \frac{5}{9} =$
9. $\frac{3}{4} \times 10 =$
10. $1\frac{1}{2} \times \frac{5}{6} =$
11. $\frac{3}{16} \times \frac{5}{12} =$
12. $14 \times \frac{3}{8} =$
13. $\frac{1}{2} \times 1\frac{1}{3} =$
14. $3\frac{1}{16} \times \frac{1}{5} =$
15. $18 \times 1\frac{1}{2} =$
16. $16 \times 2\frac{1}{8} =$
17. $6\frac{3}{8} \times 1\frac{3}{5} =$
18. $2\frac{2}{3} \times 4\frac{3}{8} =$
19. $4\frac{4}{9} \times 4\frac{2}{4} =$
20. $3\frac{1}{8} \times 2\frac{2}{5} =$

C. Divide.

1. $\frac{1}{2} \div \frac{1}{4} =$
2. $\frac{2}{5} \div \frac{1}{2} =$
3. $\frac{8}{3} \div \frac{2}{3} =$
4. $\frac{2}{9} \div \frac{1}{3} =$
5. $4 \div \frac{1}{8} =$
6. $8 \div \frac{4}{5} =$
7. $9 \div \frac{3}{4} =$
8. $\frac{6}{5} \div \frac{4}{5} =$
9. $\frac{4}{11} \div \frac{1}{11} =$
10. $\frac{2}{7} \div \frac{5}{9} =$
11. $\frac{2}{3} \div 4 =$
12. $14 \div \frac{7}{8} =$

13. $15 \div \frac{5}{6} =$ **14.** $8 \div \frac{3}{4} =$ **15.** $1\frac{1}{4} \div 1\frac{1}{2} =$ **16.** $3\frac{1}{2} \div 5 =$

17. $6\frac{1}{4} \div 2\frac{1}{2} =$ **18.** $5\frac{1}{3} \div 2\frac{2}{3} =$ **19.** $3\frac{3}{4} \div 1\frac{1}{8} =$ **20.** $3\frac{1}{5} \div 1\frac{5}{7} =$

D. Solve the word problems below using fractions.

A. Calculate the following (when necessary, round your answer to the nearest tenth):

a. 28% of 40

b. 234% of 8

c. 3½ % of 50

d. 0.2% of 15000

e. 8.25% of 62

B. There are 132 pupils in a class. If $\frac{2}{3}$ of the pupils are girls, how many boys are in the class?

Assessment Task

B. Work out answers to the following:

Find

1. $15 \times \frac{2}{3}$

2. $12 \times \frac{3}{8}$

Homework Task

- A rectangle is $1\frac{1}{3}$ cm by $3\frac{3}{4}$ cm. Find its perimeter and its area.

Lesson B7.9 Number – Ratio and Proportion

Content standard	B7.1.4.1 Demonstrate an understanding of the concept of ratios and its relationship to fractions and use it to solve problems that involve rates, ratios, and proportional reasoning.
What you should know already	Even though ratios and rates are not concepts that are taught in the early years until B6, learners need to experience and gain proficiency with multiplication and division, which are later, used to solve ratio and rate problems. Examples of experiences should include: • "Equipartitioning": "producing equal sized groups (from collections) or pieces (from continuous wholes) as 'fair shares' for each of a set of individuals". • Multiplicative Comparisons: E.g. The coconut tree is *3 times as tall as* the guava tree. • Perform division facts. • Learners should know that a "part" is a piece of something or one thing in a particular group. • Learners should know that a "whole" represents all the combined pieces of something or all the items belonging to a particular group.
What will you learn? What skills will you develop?	You will learn to: • Describe the relationship between two quantities using ratio language. • Make tables of equivalent ratios. • Use concept of proportional reasoning to find missing values in tables. • Plot pairs of values on the coordinate plane. • Find a percent of a quantity as a rate per 100.
Language and vocabulary, you will need to use	Ratio, rate, percent, proportional, equivalent, unit, reasoning

Ways to extend your understanding	• Review your knowledge on skip counting forwards and backwards, multiplication and division facts, etc. • Review your knowledge on unit conversion.
Things you will need to remember for future lessons	• Find the ratio of quantities. • Make tables of equivalent ratios and use proportional reasoning to find missing values in the tables. • Plot pairs of values on the coordinate plane.

Worksheet B7.9 Number – Ratio and Proportion

Mathematics B7 Lesson … Learner Resources

Answer the following questions:

1. Simplify the following ratios

a) $\frac{1}{4}:\frac{1}{6}:\frac{1}{8}$

b) 3.6 : 4.5

2. Compare the following ratios:

a) 2. 5 : 7 and 4 : 3

b) 1/3 : 1/4 and 1/5 : 1/4

3. Find the value of x in each of the following:

a) 15, x, 27, 63

b) x, 30, 60

4. If 2 litres of coca cola cost GH¢18, find the cost of

a) 1.5 litres

b) 3 litres

c) 7 litres

5. The table shows the weight and cost of meat at Salaga Market. If 3kg of meat costs Gh¢ 60, use the information to complete the table.

Meat (kg)	2	3	5	12
Cost (Gh¢)		60		

Learning Resources

Index cards (one for each learner), pencils, red and yellow counters, Math set

Activity Instructions

1. A ratio is the comparison between two values: The comparison can be part-to-whole (ratio of apples to total amount of fruit in a bowl), or part-to-part (ratio of apples to bananas). Ratios can be expressed in the following forms: 3/5, 3 to 5, or 3:5.

2. Determining the ratio of given quantities:

   To determine the ratio of given quantities, you can write it as a fraction and find a common factor to reduce the numbers to the simplest form. For example, there are 60 boys and 120 girls in a school. So the ratio of boys to girls in the school is $\frac{60}{120} = \frac{1}{2}$ = 1:2 or 1 to 2.

   Note, however, that to express any two quantities as a ratio, they must be in the same unit.

3. Simplifying ratios:

   Ratios may be simplified by dividing each part by the same number. In some problems the given ratio is not in its simplest form so change it to the simplest form first. For example, 4:16 is the same 2:8 which is also the same as 1:4.

4. Generating Equivalent ratios:

   To generate equivalent ratios, multiply each part of the ratio by the same number. For example, 2:5 is equivalent to 4:10 or 10:25.

5. As we learned in previous lessons, tables can be used to show equivalent ratios. As a review, look at the example below. With a partner, complete the table.

Example: Find the missing values in a table of equivalent ratios A : B.

A : B	
3	10
6	x
9	30
y	40

$$\frac{x}{6} = \frac{10}{3}\ x = \frac{10}{3} \times 6 = \frac{60}{3} = 20$$

6. Plotting pairs of values on the coordinate plane:

Ratios can be plotted as ordered pairs. Using the example below, we can find the points to plot by using the ratio [number of shirts : cost]. The number of shirts will be the x-coordinate and the cost will be the y-coordinate in the ordered pair. We found that 1 shirt costs Gh¢9, or 1:9, so our first ordered pair is (1,9). We can find the remaining ordered pairs by multiplying both numerals in the ratio pair by the same number.

Assessment Task

Answer the following questions:

1. The length and width of a rectangle is in the ratio 3 : 5. If its perimeter is 48 cm, find its length and width.

2. Use ratio language to describe the statements below:

i. Alhassan is 50 years old and his son, Musa is 25 years old.

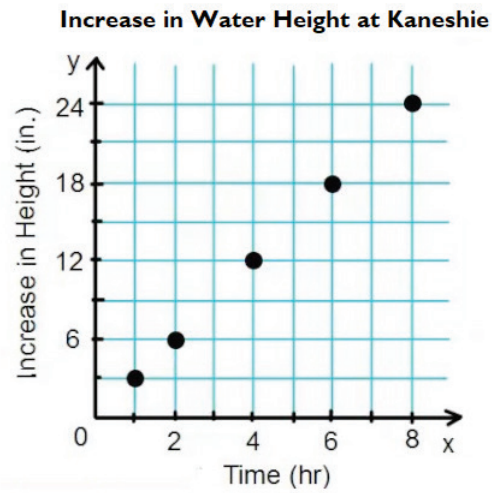
ii. In a B7 class, there are 12 boys and 36 girls.

3. Kafui, Adoley and Jantuah shared an amount of money in the ratio of their ages. Kafui is 36 years old, Adoley is 48 years and Jantuah is 24 years old. Complete the table with the equivalent ratios.

Names	**Equivalent Ratios**			
Kafui	36			
Adoley	48			
Jantuah	24			

4. During a heavy rainstorm in Accra, the waters of Kaneshie rose at a steady rate for 8 hours. The graph shows the increase of the water in height over time. Use the graph to complete the table of equivalent ratios. How many inches did the water rise in 8 hours?

Time (hrs)	1	2	4	6	8
Increase in height (in.)	3				



Homework Task

Answer the following questions

A. Investigate and write five activities in your community that make use of the concept of ratio.

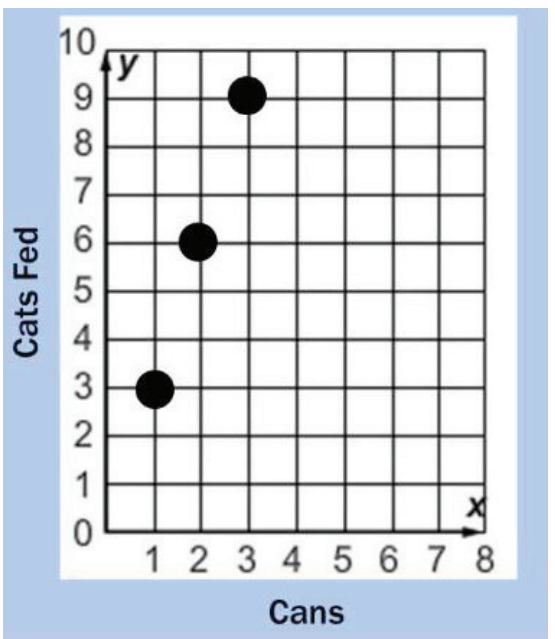
B. Mr. Kuma uses 15% of his monthly salary on firewood every month. If he spends Gh¢ 120 in buying the firewood, how much is his salary for the month?

C. Mr. Kuma uses 15% of his monthly salary on firewood every month. If he receives Gh¢ 1200 every month, how much does he spend on firewood?

D. The table shows the weight and cost of meat at Wrawra Market. If 2kg of meat costs Gh¢ 40. Use the information to complete the table.

Meat (kg)	0.5	2	4	8	20
Cost (Gh¢)			80		

E. The graph shows the number of cats that can be fed with each large can of food. Use the information in the graph to complete the table.



Lesson B7.10 Algebra – Pattern and Relations

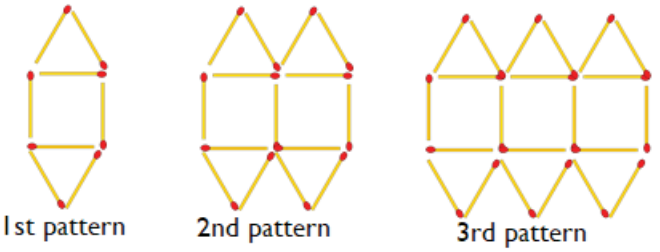
Content standard	B7.2.1.1 Derive the rule for a set of points of a relation, draw a table of values to graph the relation in a number plane, and make predictions about subsequent elements of the relation.
What you should know already	• Continue simple symbolic and numerical patterns. • Identify missing elements in a given pattern. • Create simple symbolic and numeric patterns. • Form algebraic expressions.
What will you learn? What skills will you develop?	You will learn to: • Extend a given relation and explain how each element differs from the preceding one. • Describe the rule for a given relation. • Identify the relation or rule in a pattern/mapping and predict subsequent elements. • Locate points on the number plane, draw tables/ graphs of values of a given relation and use it to solve problems.
Language and vocabulary, you will need to use	Relation, mapping, pattern, domain, co-domain, range, rule, corresponding, numerical, Cartesian, symbolically
Ways to extend your understanding	Review your knowledge on skip counting forwards and backwards, multiplication and division facts, square and triangular numbers and use of simple mathematical language such as one more, one less, twice as many as, etc.

Things you will need to remember for future lessons	• You will need to remember identifying and plotting graphs to solve problems. • Remembering how to create patterns will help you to analyse and interpret data, and solve complex mathematical problems. • We find patterns in math, but we also find patterns in nature, art, music and literature.

Worksheet B7.10 Algebra – Pattern and Relations

Answer the following questions

1. Draw the fifth pattern.



2. Use the pattern in question 1 above to complete the table below.

Pattern No.	1	2	3	4	5	6	7
Number of sticks	8	15	22				

3. How does each pattern in Q1 differ from the pattern that comes before it?

Domain	Co-domain
1	4
2	7
3	10
4	
5	16

4. Study the table carefully.

i. What is the missing number in the co-domain?

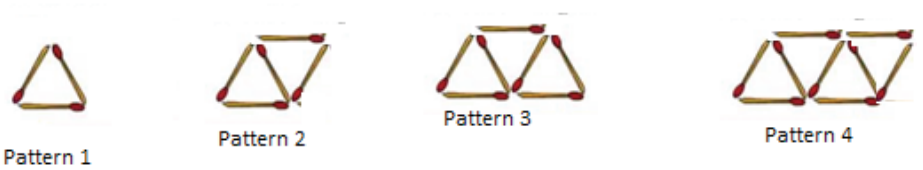
ii. What is the corresponding number to 10 in the domain?

Activity Instructions

Read the following activities carefully.

1) **Review previous work on patterns.**

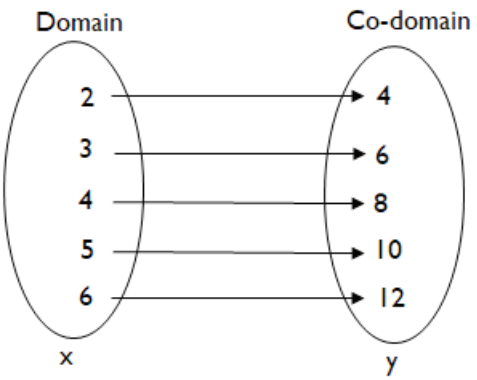
   i. Complete the table below for the number of match sticks used in the geometric patterns.



Number of triangles	1	2	3	4	5	6	7		*n*
Match sticks	3	5	7						

2) **Describing the rule for a given relation.**

To get the rule for a given relation, first identify how each pattern differs from the other. For example, in the relation above, each term in the domain **is one less half of** the number in the co-domain. Or members in the co-domain are doubles of the numbers in the domain. Therefore, we can describe the rule for this relation as "x is half of….".

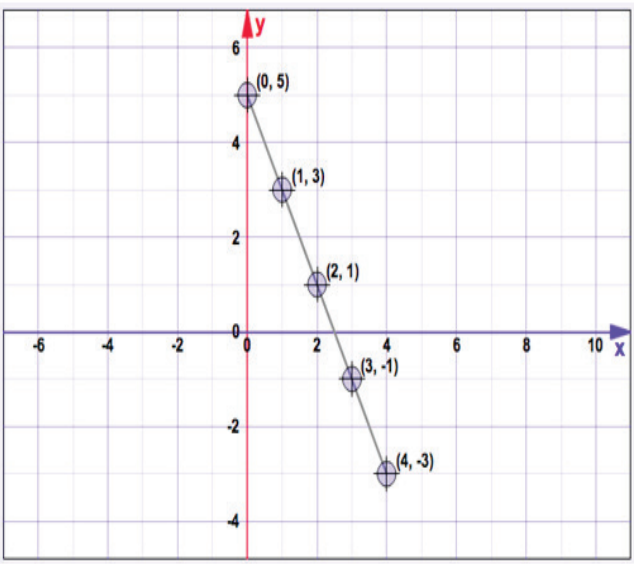


3. Constructing tables of values of a given relation and locating points on the number plane.

To complete a table of values for a given relation, use the rule for the relation to solve for the other values.

x	y
0	5
1	3
2	1
3	-1
4	-3

E.g. Complete the table of values for the relation Rule: $y \rightarrow -2x + 5$



{0, 1, 2, 3,4}

You can then use the values in the table to draw a graph.

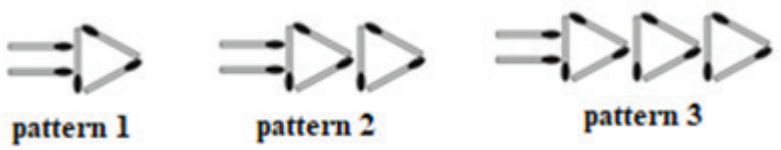
Assessment Task

A. Study the table carefully. Find the numbers missing under Column 4; and the missing rules under Column 5. with rule in words.

Term/Input	**1**	**2**	**3**	**4**	**Rule for the relation (*n*) in words**
Result/Output A	5	10	15		A is 5 times n
Result/Output B	0	4	8	12	B is
Result/Output C	4	7	10		C is 1 more than 3 times n
Result/Output D	5	9	13		D is
Result/Output E	5	11	17		E is
Result/Output F	0	6	12	18	F is

B. Patterns with match sticks.

i. The patterns below have been made with match sticks. Study the number of match sticks in each pattern and complete the table.



Pattern Number (n)	1	2	3	4	5	6	7	8	9	10		50	*n*
Number of match sticks	5	8	11										

ii. What is the rule for determining the match sticks in a pattern?

C. Patterns with tiles.

The pattern below shows the arrangement of tiles on a wall.

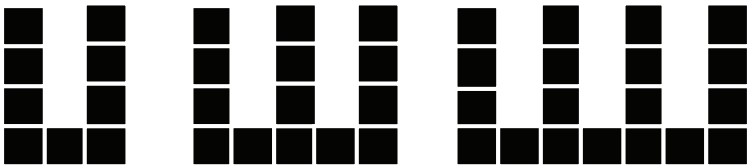


Figure 1 Figure 2 Figure 3

Study the patterns carefully and use it to find the number of tiles that will be needed to make the Figures:

i. Figure 6

ii. Figure 10

iii. Figure 50

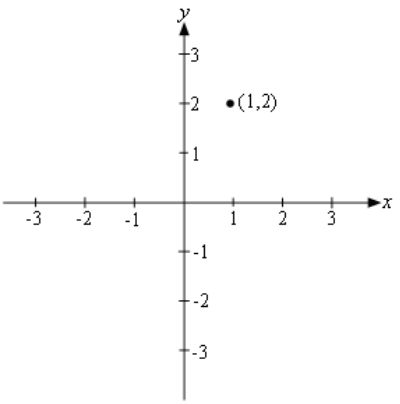
iv. What is the rule for determining the match sticks in a figure?

D. Graph the relation.

i. Draw a table for the mapping defined by the rule on the domain {-2, -1, 0, 1, 2, 3}
Rule: $x \rightarrow 2x + 1$

Homework Task

A. Draw the number plane and locate the following points on it.



E.g. (x , y) (1, 2)

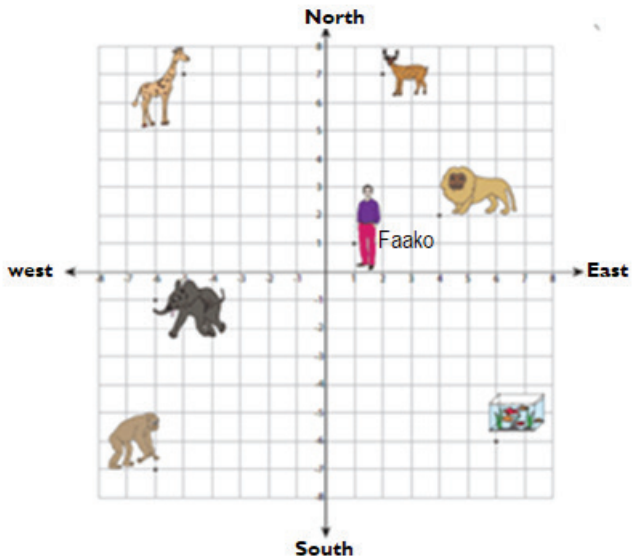
i. (-2, 4)

ii. (5, 3)

iii. (-3, -6)

iv. (7, -2)

B. The Cartesian plane shows the location of animals.



Use the Cartesian plane to answer the following questions:

i. If Faako walks 7 units West and 8 units South, which animal does he see?

ii. Which animal is closest to Faako?

iii. Which animal is located at the point (2, 7)?

iv. What is the point at which the giraffe is located?

C. Plotting points on the Cartesian plane

a. On a Cartesian plane, plot the points in the table and join the points.

x	y
2	5
1	3
0	1
-1	-1
-2	-3

b. What do you observe?

Lesson B7.11 Algebra – Algebraic Expressions

Content standard	B7.2.2.1 Simplify algebraic expressions involving the four basic operations and substitute values to evaluate algebraic expressions.
What you should know already	• Powers of numbers. • Know addition, subtraction, multiplication and division facts. • Find an unknown in a mathematical problem.
What will you learn? What skills will you develop?	You will learn to: • Form simple algebraic expressions. • Add, subtract, divide and multiply algebraic expressions with rational coefficients. • Substitute values to evaluate algebraic expressions. • solve multi-step problems of algebraic expressions with and without rational coefficients.
Language and vocabulary you will need to use	Coefficients, algebraic, expressions, evaluate, simplify, substitute
Ways to extend your understanding	• Try a lot of examples on powers of numbers to make sure you have a good understanding of it. • Have more practise in writing or describing rules for mappings or relations in words
Things you will need to remember for future lessons	• You will need to remember addition, subtraction, division and multiplication of algebraic expressions with rational coefficients. • Substituting values to evaluate algebraic expressions this will help you in solving most mathematics problems that involves formulae.

Worksheet B7.11 Algebra – Algebraic Expressions

Answer the following questions

A. Write each of these expressions in its simplest form.

i. $y + y + y = \square$

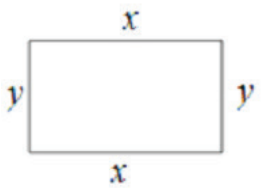
ii. $s + s + s + t + t + k + k + k = \square$

B. Simplify the following expressions.

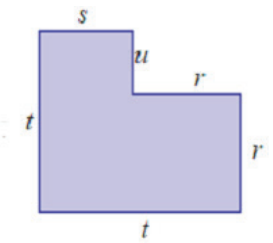
i. $5x + 4x + 2x + 3x = \square$

ii. $5zbc + 4zbc + 7zbc = \square$

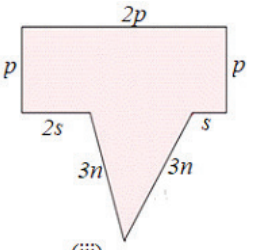
C. Write an expression for the perimeter of each of the following shapes:



(i)

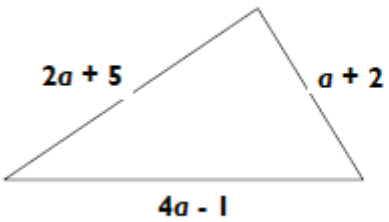


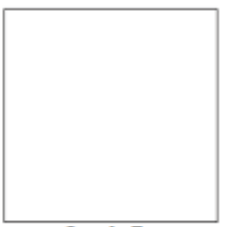
(ii)



(iii)

D. Write an expression for the perimeter of the triangle and square below.





E. Simplify the following expressions

i. $4p \times 8p^2$

ii. $5xy^2 \times 4x^4y^3$

iii. $\frac{12x^2y^2}{16xy^4}$

iv. $\frac{-30abc}{6ab^2c^{-2}}$

Activity Instructions

Read the following instructions carefully

1. Note the meaning of the following terms when forming algebraic expressions.
   - i. "more than" means addition
   - ii. "less than" means subtraction
   - iii. "times" means multiplication

E.g. If x represents an unknown number, then

- i. 10 more than the number $x + 10$
- ii. 5 less than the number is $x-5$
- iii. 3 times the number $\rightarrow 3x$

2. Consider the following when adding and subtracting algebraic expressions:
   - i. Add and subtract only like terms. Also, consider mainly the coefficient.

     E.g.1: $2x + 3x + x = 6x$

     [Hint: because all the terms have like variables, consider adding the numbers 2+3+1 = 6, then write the variable (6x).]

     E.g.2: $5x - 2x = 3x$

     [Hint: because there are like terms, consider mainly the numbers, then write the variable with the answer.]

   Note: the following cannot be simplified because we only add or subtract like terms.

   - i. $2x + 3b = 6x^2$
   - ii. $5x - 2y$

3. Consider the following when multiplying and dividing algebraic expressions:

   i. When multiplying algebraic expressions, first, multiply the numbers (coefficients), then use your knowledge in powers of numbers to simplify the variables.

   E.g.

   i. $3x \times 2x = 6x^2$

   ii. $4ab^2 \times 4ab = 16a^2b^3$

   ii. When dividing algebraic expressions, first, divide the numbers (coefficients), then use your knowledge in powers of numbers to simplify the variables.

   E.g.

   i. $8x \div 4x = 2$

   ii. $14a^3b^2 \div 7ab = 2a^2b$

Assessment Task

Answer the following questions:

A. Form algebraic expressions for the following statements:
If n represents an unknown number, then

   i. One-third of the number

   ii. 2 more than 5 times the number

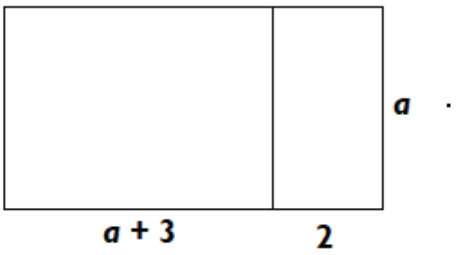
   iii. 8 times the number is subtracted from 5 and the result is multiplied by 2.

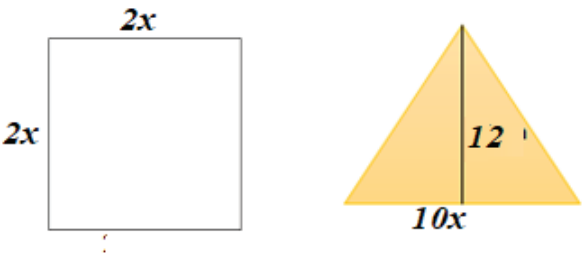
B. Simplify the following expressions:

   i. $4x + 7 - 2x - 4$

   ii. $7xy + 5x - 4x + 5x + 2xy - 3$

C. Write an expression for the area of the following shapes:





D. If $x = 2$, $y = 4$, $a = 3$, $b = 2$, $z = 1$ and $c = -1$
Simplify the following expressions and substitute the values to evaluate them.

i. $\frac{16x^3y^2}{16xy^4}$

ii. $\frac{-30abc}{6ab^3c^{-2}}$

iii. $\frac{18x^5y^2}{24x^3y^2}$

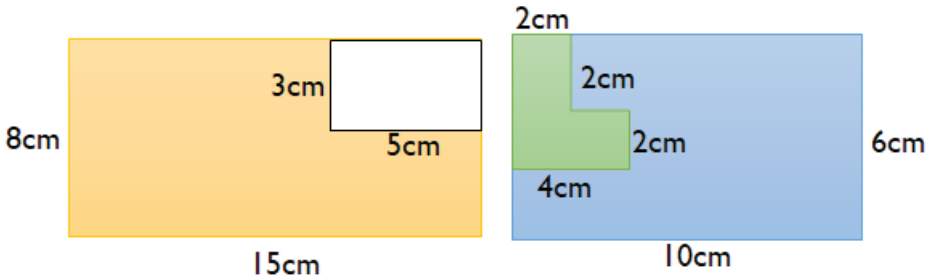
Homework Tasks

Task 1: Identifying constants and variables in real life:

Imagine you are at a market place like Makola; make a list of items/ elements/people that you consider to be variables (quantities that vary) and constants (quantities that stay the same) playing a role in the market.

Some examples could be the car park, the hawkers or the number of shops on the first floor.

Task 2: Write an expression for finding the perimeter of the bigger shape



Task 3 Simplify the following expressions

i. $15p^3q^2 \times 12x^5y^3 \div 36pq \times 45xy$

ii. $\frac{7x^2 + 2x^2}{3x^3}$

iii. $7a - 7a^3 + 14a^4$

Task 4

i. If $x = 2$, $y = 4$, $p = 3$ and $z = -1$
simplify the following expressions and substitute the values to evaluate them.

a. $3xy \times 5y$

b. $7xy + 5x - 4x + 2xy - 3$

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

d. $5x + 4 - 9y + 3x + 2y - 7$

Lesson B7.12 Algebra – Equations

Content standard	B7.2.3.1 Demonstrate an understanding of linear equations of the form x + a = b (where a and b are integers) by modelling problems as a linear equation and solving the problems concretely, pictorially, and symbolically.
What you should know already	• Compute (add, subtract, multiply and divide) fluently with integers, fractions, decimals, per cents, and numbers written in scientific notation and exponential form. • Determine the greatest common factor, least common multiple and prime factorisation of numbers. • Compute integers involving the four operations. • Locate points on a number plane and draw graphs.
What will you learn? What skills will you develop?	You will learn to: • Change word problems to linear equations in one variable and vice versa. • Use concrete materials such as counters to represent linear equations. • Describe orally, given linear equations. • Solve linear equations using concrete materials. • Write mathematical expression for linear equation. • Solve linear equations in one variable and describe the process of solving the equation.
Language and vocabulary, you will need to use	Linear, equations, variable

Ways to extend your understanding	In order to understand your understanding on this concept: • review your knowledge on addition, subtraction, multiplication and division facts. • also, review your knowledge of finding the unknown from primary school.
Things you will need to remember for future lessons	• You will need to remember using concrete materials such as counters to represent linear equations and describe the process orally. • Then, solve linear equations in one variable and describe the process of solving the equation.

Worksheet B7.12 Algebra – Equations

Answer the following questions

1. The sum of the ages of two friends is 25, and the elder one is 4 times older than the younger one. Write this as a mathematical sentence?

2. The length of a rectangle is 3cm greater than its width. The perimeter of the rectangle is 34 cm. Find its length.

3. Musa is 7 years older than his wife, Adoley. The sum of their ages is 63. Find Musa's age.

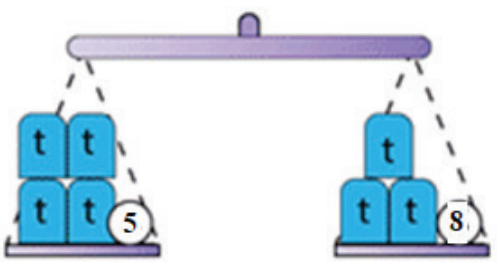
4. Write word problems for the following linear equations

   i. $x + x = 15$

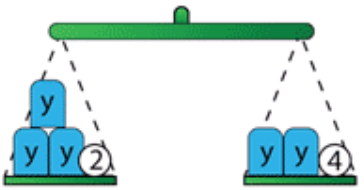
   ii. $\frac{1}{2}x = 20$

   iii. $2x + 5 = 11$

5. Write an equation for the balancing problem and solve.



6. Write an equation for the balancing problem and solve.



Activity Instructions

1. Changing word problems to linear equations:

   To change word problems to mathematical statements, read the problem carefully. Then choose a letter to represent the unknown you have to find.

   For example, when a certain number is subtracted from 10 and the result is multiplied by 2, the final result is 4.

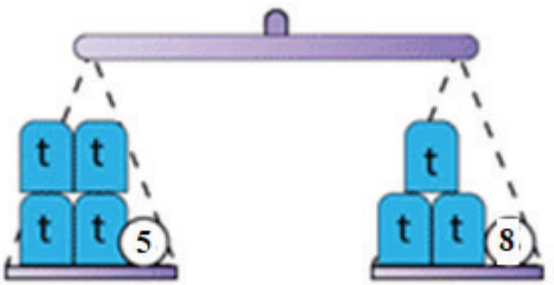
Solution:

Let the number be x, then we have (10-x) and when this is multiplied by 2 we have 2(10 – x). this final result is equal to 4.

2. Use concrete materials to represent linear equations:

   To represent linear equations concretely, we can use the balance method.

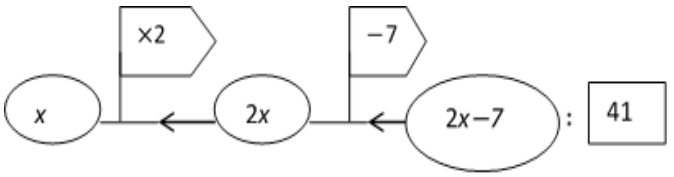
   For example: $4t + 5 = 3t + 8$ can be represented as shown below.



In the left pan, there are 4t and 5. Then in the other pan there are 3t and 5. So we equate the two and solve for t.

3. Use a flag diagram for equations and their inverses to solve equations:

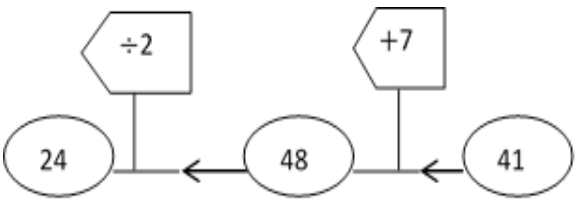
i. Think of a number, double it and subtract 7. The result is 41. What was the original number?
The flag diagram is:



i.e. $2x - 7 = 41$

To solve the equation, move in the opposite direction and do the inverse of the operations.

$2x - 7 = 41$



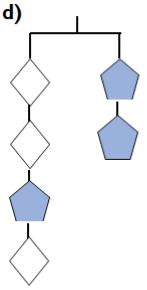
Use a flag diagram to solve the equations:

i. $3x + 5 = 26$

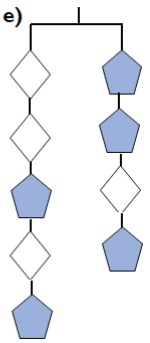
ii. $8n - 12 = 28$

4. In each balance, the mass of one rhombus is 12 grams. Find the mass of the pentagon.

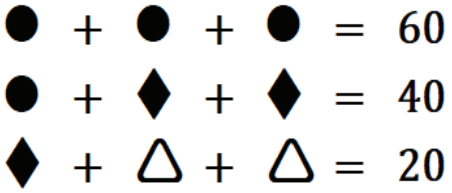
d)



e)



5. Use the three equations below to find the value of ● + ♦ × △



Learning Resources

- index cards,
- paper,
- mathematical sets,
- colour pencils

Assessment Task

Solve the following questions:

1. Using the balance method, sketch the following problems
   - i. $4x + 5 = 2x + 15$
   - ii. $3v = 33$
   - iii. $8n - 12 = 28$
2. Write mathematical expressions for the following word equations.
   - i. A certain number was divided by three; two was added to the result. The final answer is 8.
   - ii. When 1 is added to a certain number and the result is multiplied by 4, the final result is 20. Find the number.
3. Solve for x in the following equations.
   - i. $x + 5 = 10$
   - ii. $2x - 6 = 4x - 18$
   - iii. $20 - 3x = x + 12$
   - iv. $6x + 4 = 28$

Homework Task

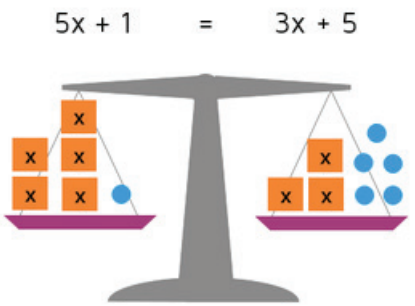
A. Solve the following equations

1. $2x - 6 = 0$
2. $7x - 2 = 8 - x$
3. $8 - 2x = 5 - 4x$
4. $4 + 3x = 2 - 2x$
5. $2(x - 1) + 2(3x - 1) = 0$
6. $4(x-1) - (2x - 5) = 4$

B. Solve the following equations

1. Ten added to thrice a whole number gives 40. Find the number.
2. Four-fifths of a number is greater than three-fourths of a number by 8. Find the number.
3. The sum of two consecutive multiples of 4 is 60. Find the number.

C. Write three linear equations on your own and sketch the equations. Look at the example below



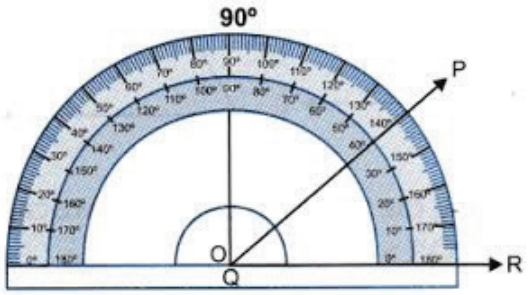
Lesson B7.13 Geometry and Measurement – Angles

Content standard	Demonstrate understanding of angles including adjacent, vertically opposite, complementary, supplementary and use them to solve problems
What you should know already	• Describe an angle. • Draw angles. • Draw lines and divide into parts.
What will you learn? What skills will you develop?	You will learn to: • compare the sizes of angles. • measure angles. • classify angles and • label by type. • show in real life some examples of angles and their applications. • solve problems involving the different types of angles.
Language and vocabulary, you will need to use	Angles (acute, right, obtuse, reflex, supplementary, complementary), vertex, horizontal, vertical
Ways to extend your understanding	Find how, who and where you can apply the concepts of angles. Identify the types of angles in physical structures like buildings, pylons, bridges.
Things you will need to remember for future lessons	Different categories of angles

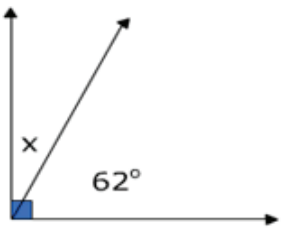
Worksheet B7.13 Geometry and Measurement – Angles

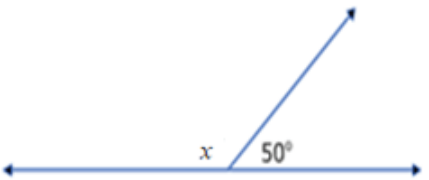
Worksheet

A. Use a protractor to draw various angles such as 30°, 45°, 60°, 75°, 90°, 120°, 150°, 270°, 300°, etc.

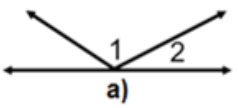


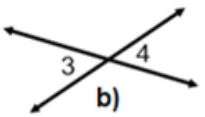
B. Determine the missing angle marked x

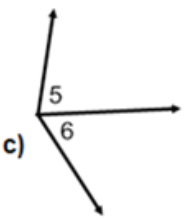


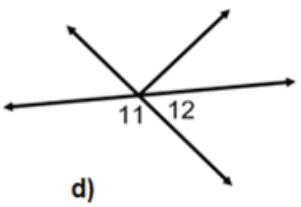


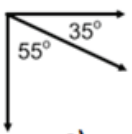
C. Identify each pair of angles as adjacent, vertically opposite, complementary or supplementary.

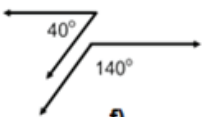












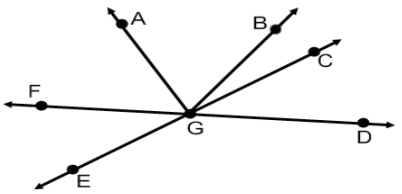
D. Use the figure at the right to identify and label the following angles

i. two acute vertical angles.

ii. two obtuse vertical angles.

iii. a pair of adjacent angles

iv. a pair of complementary angles.

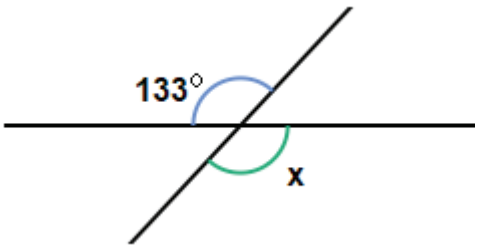


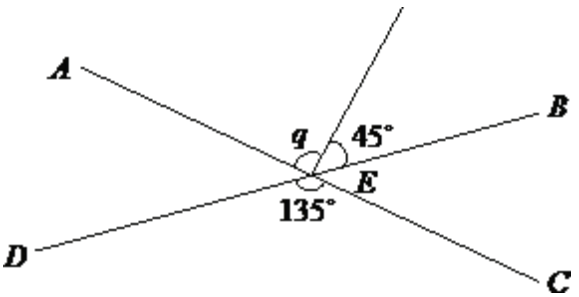
Learning Resources

Protector, ruler, worksheet, geometric and isometric grid

Assessment Task

Use adjacent, vertically opposite, complementary or supplementary to solve problems. Determine the angle(s) marked with letters.





Homework Task

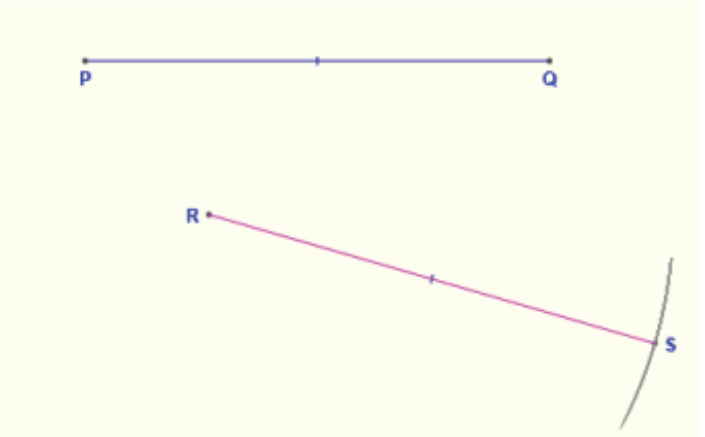
Measure the missing angle in each diagram.

Lesson B7.14 &15 Geometry and Measurement - Construction 1& 2

Content standard	B7.3.1.2: Demonstrate how to construct a perpendicular to a line from a given point. Bisect a line, bisect angles, and construct angles of the following sizes: 30˚, 45˚, 60˚, 75˚ and 90˚
Indicators	• Construct a line segment perpendicular to another line segment. • Construct the perpendicular bisector of a line segment
What you should know already	• Draw and measure lines. • Divide lines into given parts with a ruler.
What will you learn? What skills will you develop?	You will learn to: • draw and measure line in different orientations. • construct lines, perpendicular • bisectors of line in different orientation. • apply geometric construction skills in other subject areas.
Language and vocabulary, you will need to use	Draw, construct, midpoint, perpendicular, line segment
Ways to extend your understanding	Architects use construction instruments to work with their designs. Explore ways in which carpenters use construction principles in crafting their products.
Things you will need to remember for future lessons	Construction and application of perpendicular bisectors.

Worksheet B7.14 & 15 Geometry and Measurement Construction 1& 2

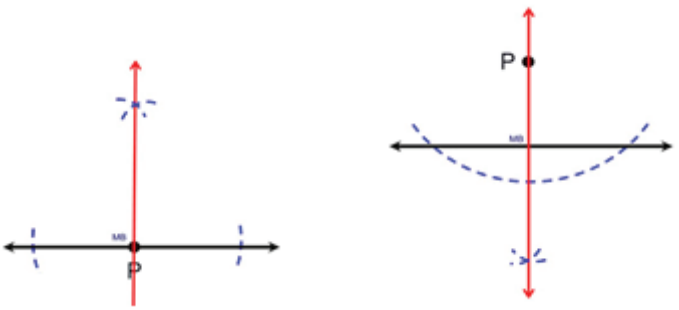
1. Use a pair of compasses and a ruler to construct a copy of a given line segment. RS is a copy of PQ.



2. Use a pair of compasses and ruler to construct a perpendicular at a point on a line segment; and drop a perpendicular from a given point outside a line segment.

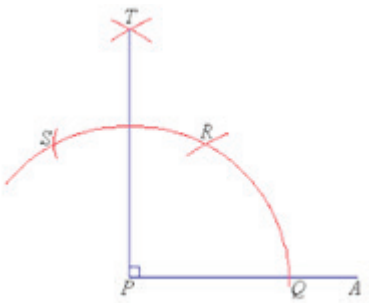
   (i) A perpendicular at a point on a line segment:

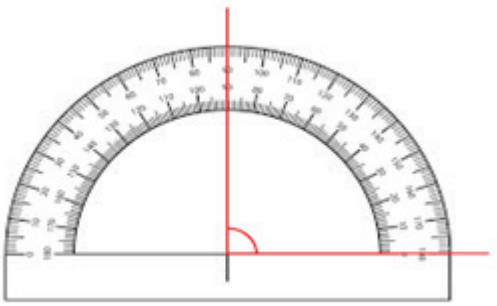
   (ii) A perpendicular from a given point outside a line segment:



3. Use a pair of compasses and a ruler to:

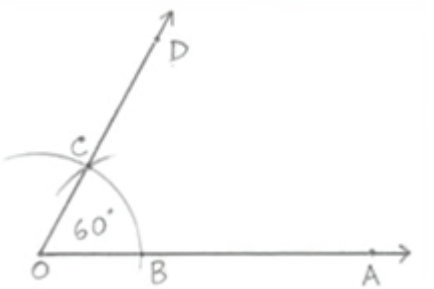
   a) Construct an angle of 90° (raise perpendicular at a point) on a given line segment and verify using the protractor. (The line segment *PT* is perpendicular to *PA* therefore ($\angle APT = 90°$)

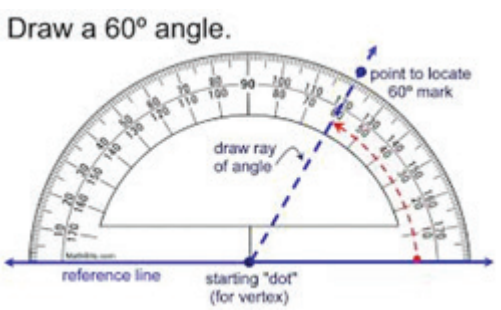




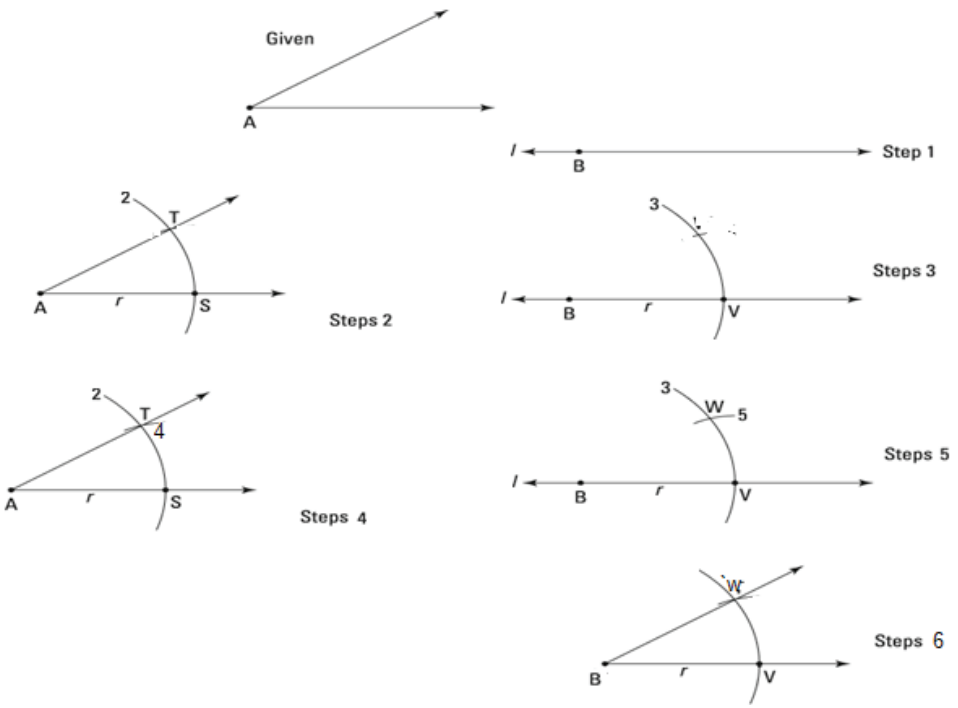
4. Use a pair of compasses and a ruler to:

a) Construct an angle of 60˚ at a point on a given line segment $\angle AOD = 60^{O}$) and verify with the protractor.





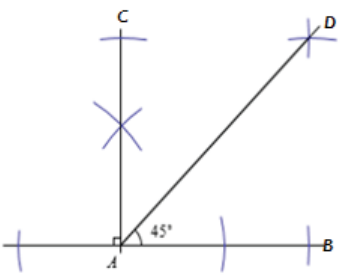
5. Use a pair of compasses and a ruler to copy a given angle *A:* i.e. draw a line and locate point B; copy the arc *ST* and transfer using B as the centre to obtain *VW*; join *B and W* to obtain the copied angle.



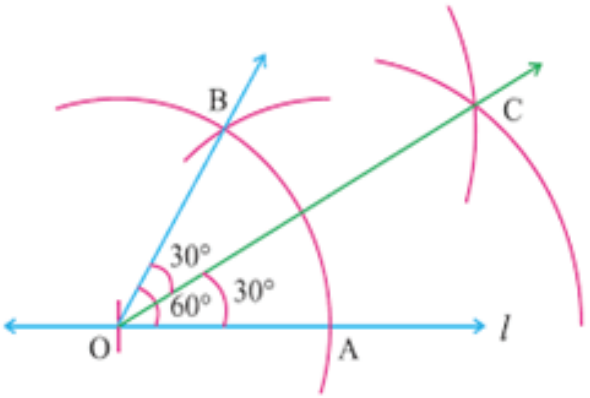
a) Construct an angle of 45˚ by bisecting an angle of 90˚ (i.e. bisect $\angle BAC = 90^{\circ}$ to obtain $\angle BAD = 45^{\circ}$, Line $|AD|$ is the angle bisector of the right angle).

b) Construct $\angle ABC = 45^{\circ}$ such that |AB| = 5cm and |BC| = 6cm. Bisect $\angle ABC = 45^{\circ}$.

[Hint: Construct $\angle ABC = 90^{\circ}$ and bisect it]

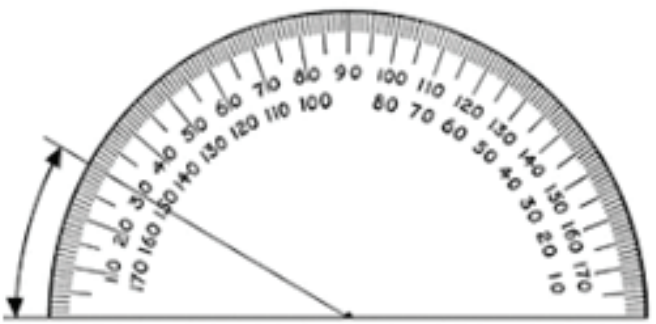


c) Construct an angle of 30˚ by bisecting an angle 60˚ (i.e. bisect $\angle AOB$= 60˚ to obtain $\angle AOC = \angle COB$ =30˚ Line |OC| is the angle bisector).



d) Find the combinations of angles that make 75˚:

- Construct 90˚ and 60˚ and a point
- Bisect angle between 90˚ and 60˚ (that is 30˚)
- Add 15° to 60˚ to make 75˚

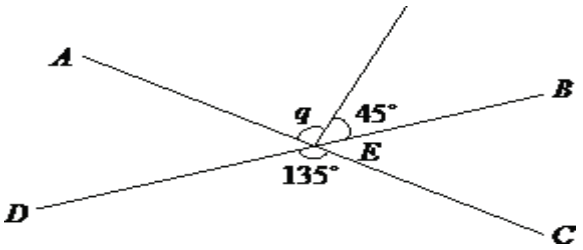


Learning Resources

Protector, Ruler

Assessment Task

Use adjacent, vertically opposite, complementary or supplementary to solve problems. Determine the angle(s) marked with letters.



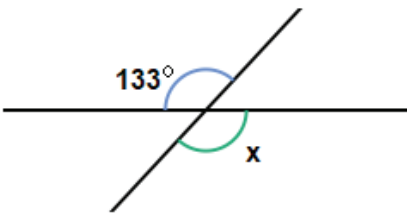
Homework Task

A. Describe how you will do the following:

1. Copy a given angle.

2. Construct an angle of size $90°$.

3. Construct an angle of size $60°$.



B. Draw and bisect the following lines

i. $\overrightarrow{AB}$ = 8cm

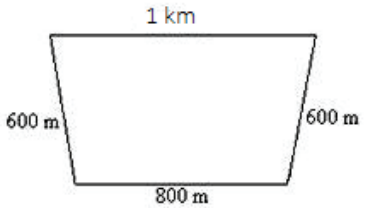
ii. $\overrightarrow{AB}$ =5.5cm

Lesson B7.16 Geometry and Measurement - Perimeter

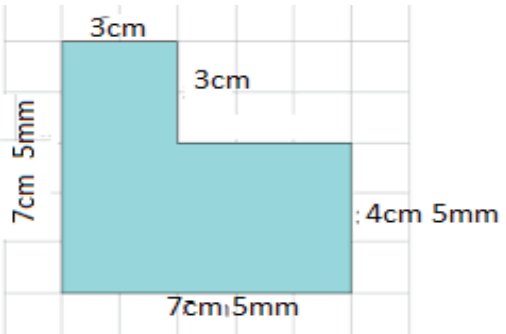
Content standard	B.7.3.2.1 Demonstrate the ability to find the perimeter of plane shapes including circles using the concept of pi (**π**) to find the circumference a circle.
Indicators	B.7.3.2.1.1 Calculate the perimeter of given shapes whose dimensions are in two units (i.e. cm and mm, m and cm, or km and m)
What you should know already	• Describe basic shapes • Draw basic shape • How to find the perimeter of a square and a rectangle
What will you learn? What skills will you develop?	You will learn to: • Convert units from one to the other. • Trace the perimeter around given shapes. • Calculate the perimeter of given shapes (polygons)
Language and vocabulary, you will need to use	Perimeter, convert
Ways to extend your understanding	Find the amount of fencing material needed to build a fence. E.g. the fence wall of your parents' plots of land.
Things you will need to remember for future lessons	Combinations of angles to construct angle 75˚ in different orientations.

Worksheet B7.16 Geometry and Measurement – Perimeter

1. Calculate the perimeter of a shape with dimensions given in km and m, by converting to the smaller unit and adding the distance around the shapes.

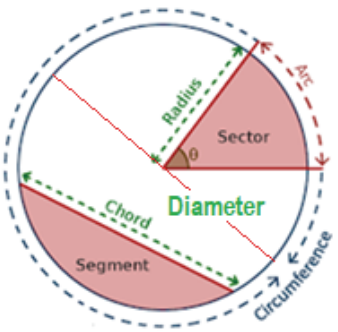


2. Calculate the perimeter of a shape with dimensions given in cm and mm by converting to decimal fractions in the larger unit (i.e.7cm 5mm = 7.5cm).



3. Identify and name the parts of a circle – radius, diameter, circumference, arc, sector, etc.

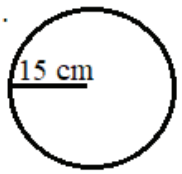
4. Find the radius or diameter of a circle.



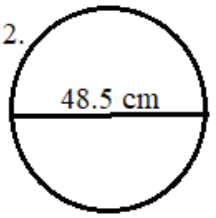
If you are given the radius, find the diameter. If you are given diameter find the radius.

1. r = 15 cm
2. r = 9.5 m
3. d = 12 cm
4. d = 9.5 m
5. d = 13.2 m
6. d = 14 cm
7. r = 8.5 m
8. r =70 cm
9. d = 8.5 cm
10. d = 70 m

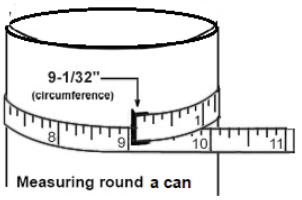
11.

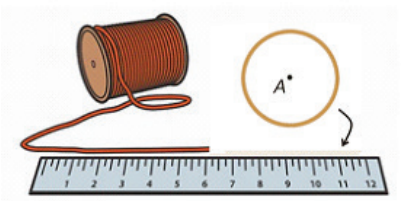


12.



5. Measure the radius, diameter and circumference of circular objects, and the base or cross section of cylindrical objects like cans, tyres, bowls, etc., roundabouts, etc., and describe the measuring tools used.





6. Measure and record the perimeter of the circular sections (or circumference) and diameter of various circles in the table below.

7. Complete the table for the results of C ÷ D.

8. Use your observations on C ÷ D to explain the relationship between the diameter and circumference of a circle.

Circle	Circumference(C)	Diameter(D)	C ÷ D
Tin A	13	4	13 ÷ 4 =
Tin B	38	12	38 ÷ 12 =

The letter π, used as the symbol for the ratio of the circumference of a circle to its diameter. The ratio itself is approximately 3.141592+.

An approximation to π

π≈3.141592653589793238462643383279502884
197169399375105820974944592307816406286
208998628034825342117067982148086513282
306647093844609550582231725359408128
481117450284102701938521105559644622948
9549303819644288109756659334461284756482
33786783165271201909145648566923460348
610454326648213393607260249141273724587
0066063155881748815209209628292540917153
64367892590360011330530548820466521384
146951941511609................forever....

[Read more about pi on the internet]

9. How to find the circumference of a circle:

   i. The circumference of a circle can be found by multiplying the given value of pi (i.e. π = 3.14) by the diameter of the circle.

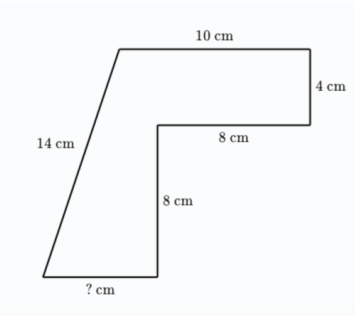
   ii. If a circle has a diameter of 4, and the given pi or π is 3.14, its circumference is 3.14×4=12.56

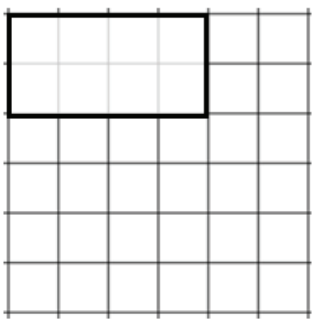
   iii. If you know the radius, the diameter is twice as long.

https://www.homeschoolmath.net/worksheets/table-circle.php?col=2&row=3&space=3&metric=1&customary=1&pi=3.14&round=2&image=1&c1=1&c2=1&font=Arial&FontSize=11pt&pad=5&ptitle=&Submit=Submit

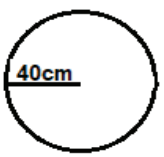
Assessment Task

1. Convert 5cm to mm.
2. Which the biggest 20m, 200mm, 20cm?
3. The perimeter of the shape below is 60cm. Find the length of the missing side.
4. Draw a rectangle whose perimeter is twice as large as the one in the grid.

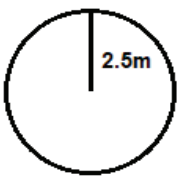




5. Use the relationship between the diameter and circumference of a circle (i.e. $\pi = \frac{C}{D} = \frac{C}{2r}$) to solve the following:
   1. The radius of a circle is 140cm. What is the (a) diameter (b) circumference? [Take $\pi = \frac{22}{7}$]
   2. Find the circumference of the circles below whose radii are given and round to the nearest tenth [take $\pi = 3.142$]:



a)



b)

Homework Task

i. Calculate the circumference of a washing basin in the house. Explain how you did it.

Lesson B7.17 Geometry and Measurement - Area of A Triangle

Content standard	B.7.3.2.2 Derive the formula for determining the area of a triangle and use it to solve problems.
Indicators	B7.3.2.2.1 Use the relationships between a triangle and a rectangle (or parallelogram) to deduce the formula for determining the area of a triangle.
What you should know already	Draw rectangles and triangles. Tell the differences and similarities between rectangles and triangles.
What will you learn? What skills will you develop?	You will learn to: • Establish the relationship between rectangles and triangles.
Language and vocabulary, you will need to use	Base area, equal halves, parallelogram Find the area of combined triangles and parallelograms.
Ways to extend your understanding	
Things you will need to remember for future lessons	Formulae for finding the areas of triangles and parallelograms.

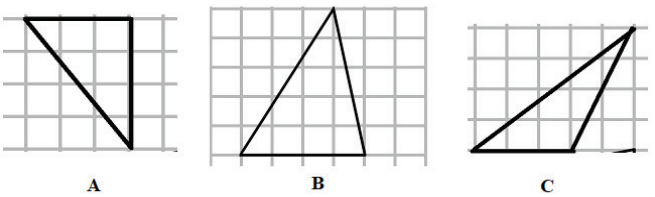
Worksheet B7.17 Geometry and Measurement - Area of A Triangle

1. Determine the number of unit squares enclosed by the triangles below.

i. What is the perpendicular height of each triangle?

ii. What is the area?

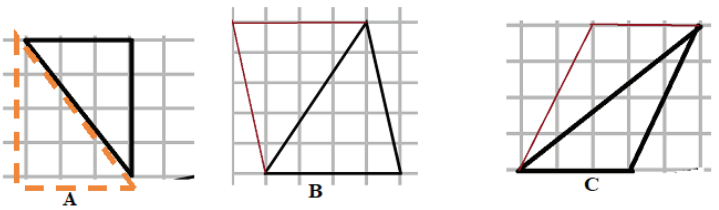
iii. How does the perpendicular help in calculating the area?



2. (i) Spot the rectangle enclosing the triangles to find the unit squares in each triangle. Notice the base and height of the triangle.

Triangle Area = $\frac{1}{2}$ Rectangle Area = $\frac{1}{2}$ base × height

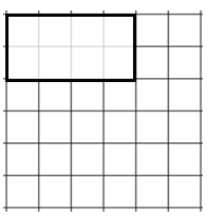
(ii) Spot the *Parallelogram* from which the triangle was formed.



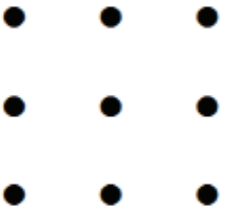
Triangle Area = $\frac{1}{2}$ Parallelogram Area

= $\frac{1}{2}$ (base of parallelogram) × height = $\frac{1}{2}$ b × h

3. Draw a rectangle whose perimeter is twice as large as the one in the grid.

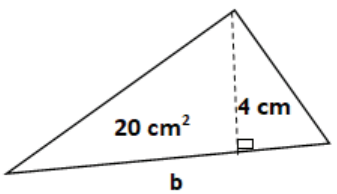


4. How many different triangles can be drawn in the 3x3 Geodot or square grid using the points as vertices?

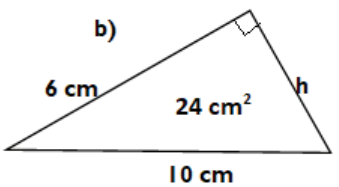


5. How many of the triangles you have drawn in Question 4 above are:
   a. right angled triangles?
   b. isosceles triangles?
   c. equilateral triangles?
   d. scalene triangles?
6. Which triangle has the least area?
7. Which triangle has the largest perimeter?
8. The area of each triangle is given. Find the unknown measure.

a)

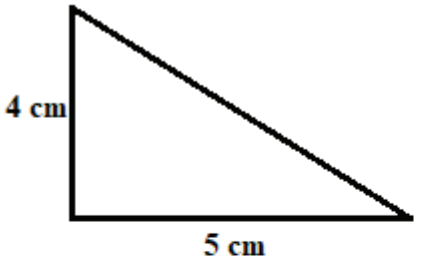


b)



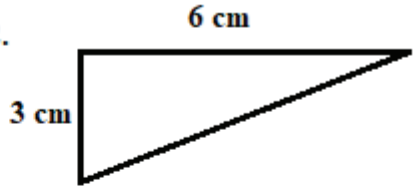
Work out the area and complete the worksheet.

1.



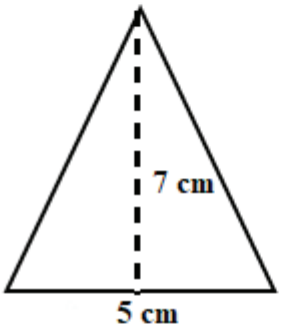
Area _____

2.



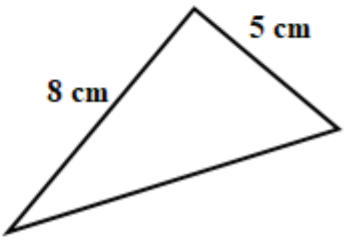
Area _____

3.



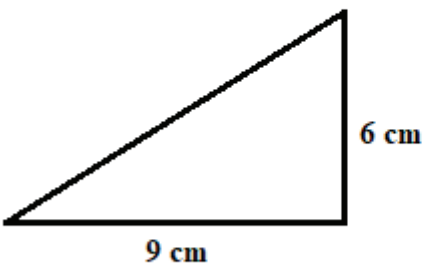
Area _____

4.



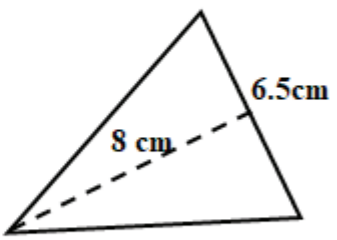
Area _____

5.



Area _____

6.



Area _____

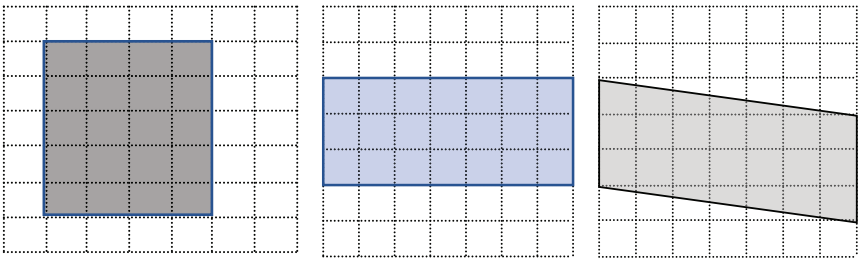
Learning Resources

Ruler, grid paper or geodot paper

Assessment Task

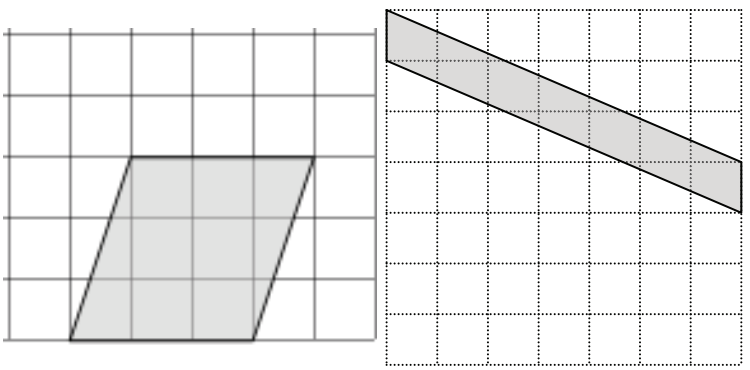
i. Draw a line to divide each of the parallelograms into two equal triangles. Mark out or shade the two equal triangles.

ii. What is the relationship between the two equal triangles and the parallelogram?

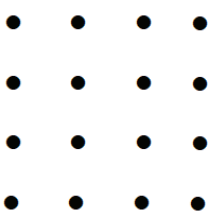


Homework Task

A. Find the area of the parallelogram, taking the area of a square as 1 square unit.



B. How many different rectangles can be drawn in the 4x4 geodot or square grid using the points as vertices?



C. Which rectangle has the least area?

D. Which rectangle has the largest perimeter?

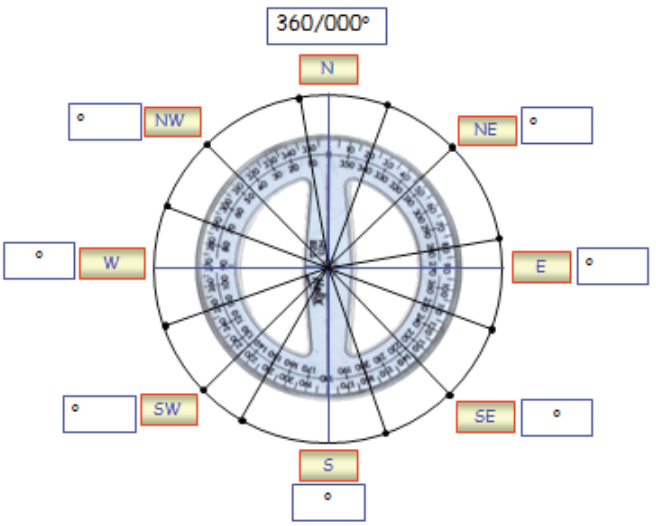
Lesson B7.18 Geometry and Measurement - Bearings and Vectors

Content standard	B7.3.3.1 Understanding bearings, vectors and their use in real life.
What you should know already	Measure angles with a protractor. Read directions – main cardinal points and the eighths or half angles between these.
What will you learn? What skills will you develop?	Giving directions; locating given destinations. Reading maps, compasses using mobile apps.
Language and vocabulary, you will need to use	bearing of, cardinal points
Ways to extend your understanding	Reading direction of locations with compass apps
Things you will need to remember for future lessons	It is easy to get the accurate direction by finding or facing the true North.

Worksheet B7.18 Geometry and Measurement – Bearings and Vectors

A. Finding bearings and back bearings of one point from another

1. A 360° protractor is used to measure bearings. In the figure below use your protractor to measure the bearing of each point from the centre of the circle and complete the boxes.



B. Work out the answer to each of these questions.

i. On what bearing is a ship sailing if it is heading:

(a) West?

(b) North-East?

(c) South-West?

ii. What is the back bearing or reciprocal bearing to each of the bearings below?

(a) 045°

(b) 200°

(c) 180°

iii. What angle do you turn through if you turn clockwise from:

(a) N to S?

(b) E to W?

(c) N to NE?

(d) S to NE?

(e) E to NW?

iv. What is the bearing of:

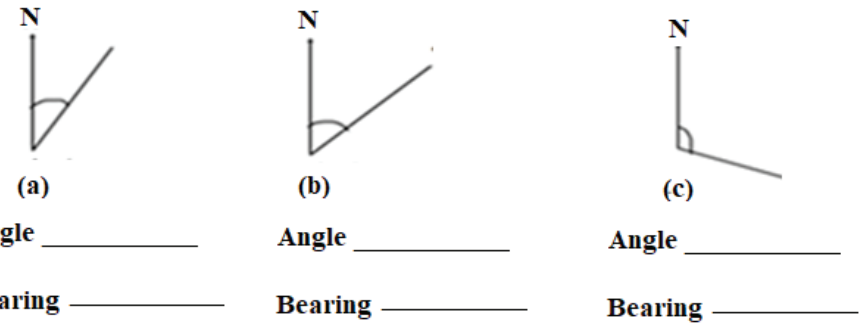
(a) N?

(b) NE?

(c) W?

(d) SW?

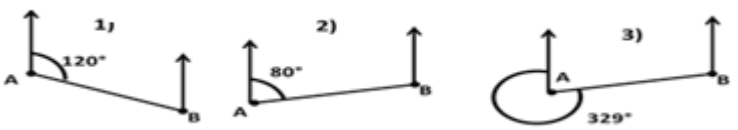
C. Use a protractor to measure the marked angle and describe the bearing of the object from point N.



D. Finding the bearings and back bearings of one point from another.
In each diagram, what is the bearing of

(i) B from A?

(ii) A from B?



E. Drawing vectors and measuring angles.

1. Draw the following vectors and measure each angle:

   (I) $\overrightarrow{AB}$ = (3km, 060)

   (ii) $\overrightarrow{QR}$ = (5km, 120)

2. The bearing of P from Q is 060°.What is the bearing of Q from P?

3. Write each of the following as a column vector using graph.

   (I) $\overrightarrow{AB}$ = (5km, 030°), $\overrightarrow{CD}$ = (25km,150°)

4. Find the magnitude and the direction of the following vectors:

   (I) $\overrightarrow{AB} = \begin{pmatrix} 12 \\ 15 \end{pmatrix}$

   (ii) $\overrightarrow{PQ} = \begin{pmatrix} 15 \\ 9 \end{pmatrix}$

Assessment Task

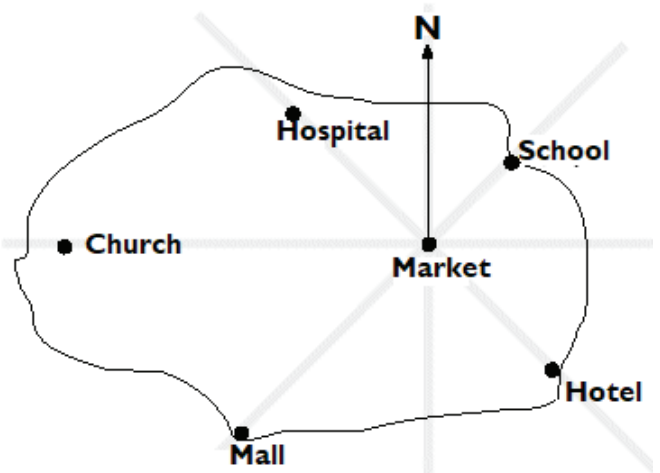
i. What angle do you turn through if you turn clockwise from SW to SE?

ii. The bearing of P from Q is 145°.What is the bearing of Q from P

iii. Draw a vector given its length and bearing E.g. $\overrightarrow{TS}$ = (6km, 245°).

Homework Task

The map of an island has been shown below. A faint set of compass points has been put on the map to help you.



What is the bearing of,

(a) the hotel from the market?

(b) the market from the church?

(c) the hospital from the market?

(d) the school from the mall?

(e) the hospital from the hotel?

(f) the hotel from the hospital?

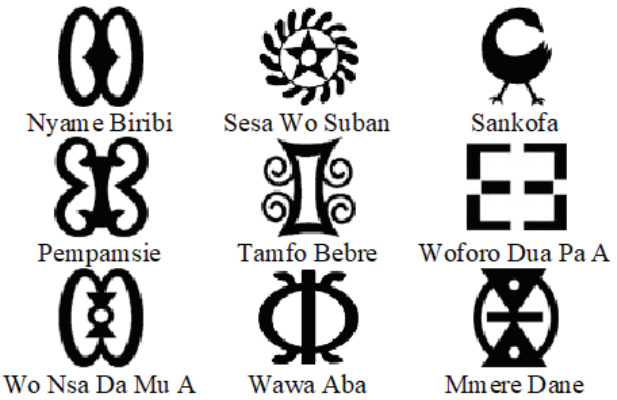
Lesson B7.19 Geometry and Measurement - Transformation (i.e. Reflection and Translation)

Content standard	B7.3.3.2 Perform a single transformation (i.e. reflection and translation) on a 2D shape using graph paper (including technology) and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.).
What you should know already	Plot point in the coordinate plane. Properties of reflection in a given major axis.
What will you learn? What skills will you develop?	You will learn to: • Identify some shapes in real life that have reflectional (or fold) symmetries, e.g., in fabrics, buildings, nature, etc. • Names of the major horizontal grid lines and major vertical grid lines in a coordinate plane. • Draw the images of shapes under reflection in given major lines on the coordinate plane.
Language and vocabulary, you will need to use	symmetry, symmetries, reflectional symmetry, vertical grid lines -*x=0*, *x=1*, *x=2* , major horizontal grid lines - *y=0*, *y=1*, *y=2 etc.*, adinkra fabrics,
Ways to extend your understanding	Using geodot to explore the relationship between the x- and y- coordinates of an object and its image (i) under reflection in different lines; (ii) translation by different vectors.
Things you will need to remember for future lessons	Names of the major horizontal grid lines and major vertical grid lines in a coordinate plane. Properties of a symmetrical shape

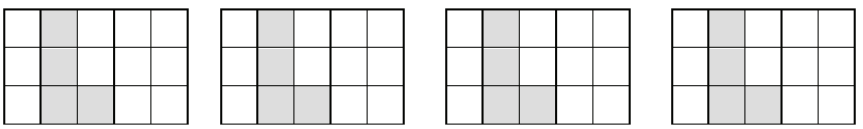
Worksheet B7.19 Geometry and Measurement – Transformation (i.e. Reflection and Translation)

A. Symmetries in adinkra symbols

Identify the number of symmetries in these adinkra symbols:

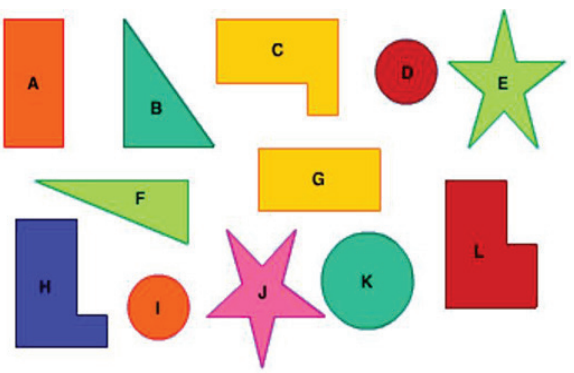


B. How many different ways can one more square be shaded in this shape so that it can have a line of symmetry?

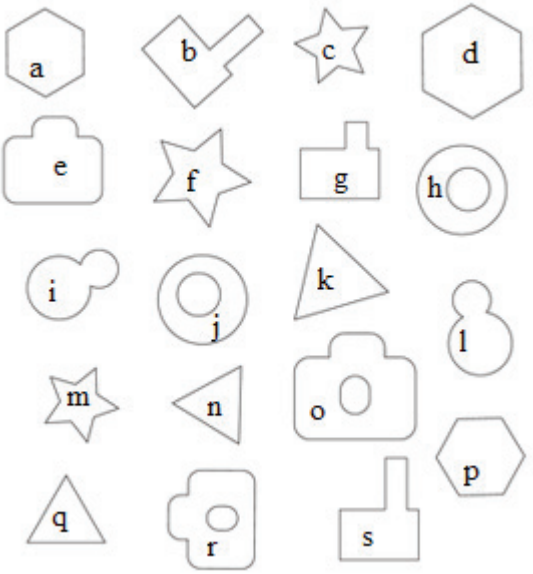


C. Congruent and similar shapes

a) Which of the shapes are congruent and which are similar?

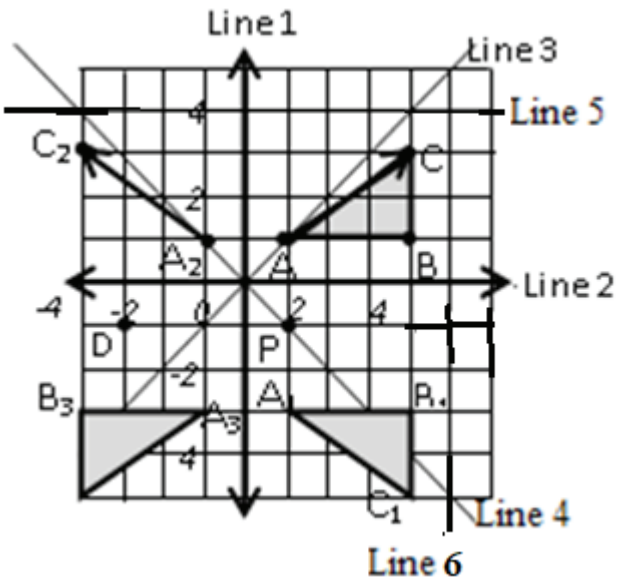


b) Which shapes are similar and which are congruent?



D. Major vertical grid lines and major horizontal grid lines

Identify points with given coordinates and lines (i.e. lines parallel to the x-axis or y-axis) in the number plane.



E. Points and Lines in the coordinate plane

Use graph sheet or geodot sheet to copy the figure and

a) Write down the coordinates of the points a A, A_1 and A_2' and

b) State the equations of the following lines in the coordinate plane:

i. Line 1 is .....

ii. Line 2 is .....

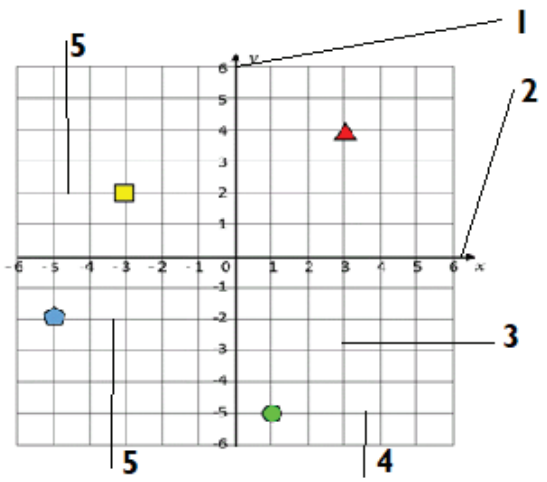
iii. Line 3 is .....

iv. Line 4 is .....

v. Line 5 is .....

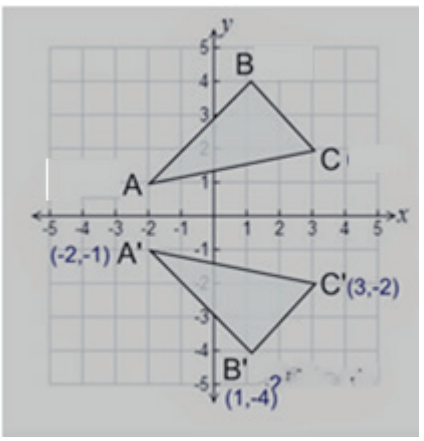
vi. Line 5 is .....

c) The shapes are at points where two lines meet. Six lines are marked 1, 2, 3, … 6, in the plane, write down their equations. State which of the marked lines passing through each shape. [e.g. the line y= –1 passes through the pentagon]



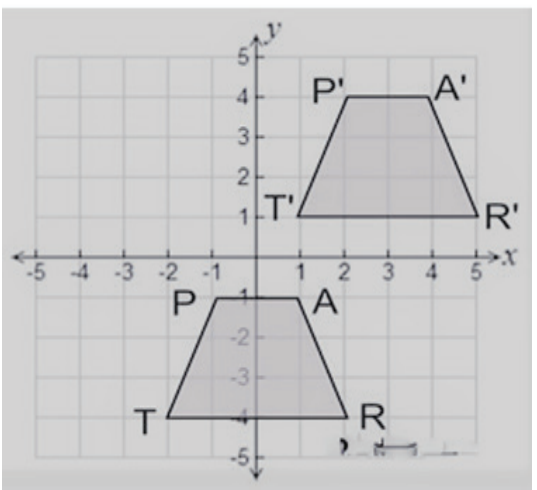
F. Reflection in the x-axis

a) Use a graph sheet or geodot to draw a triangle ABC with points A (-2, 1), B (1, 4) and C (3, 2). Then draw its image A'B'C' under a reflection in the x-axis and find the coordinates of the vertices.



G. Translation by a given vector

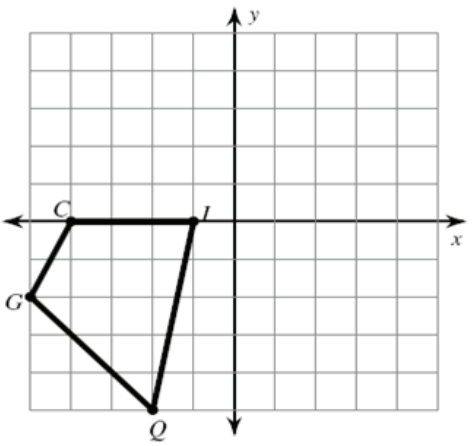
Use graph sheet or geodot to draw a trapezium PTRA with points P(-1, -1), T(-2, -4), R(2, -4) and A(1, -1). Then draw it image P'T'R'A' under a translation by the vector $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and find the coordinates of the vertices.



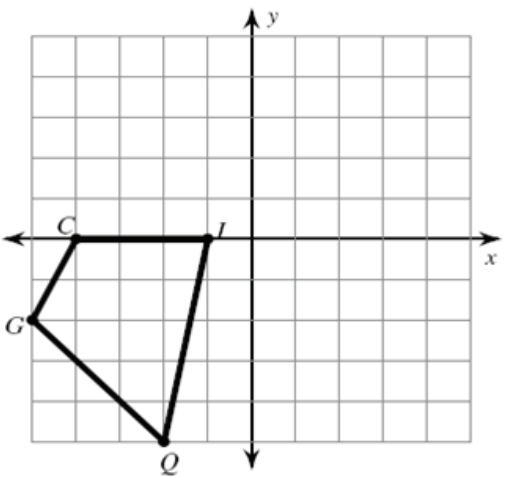
H. Copy onto a geodot or graph sheet and draw the image under a reflection in the lines

(i) $y = 0$

(ii) $x = {}^{-}1$.

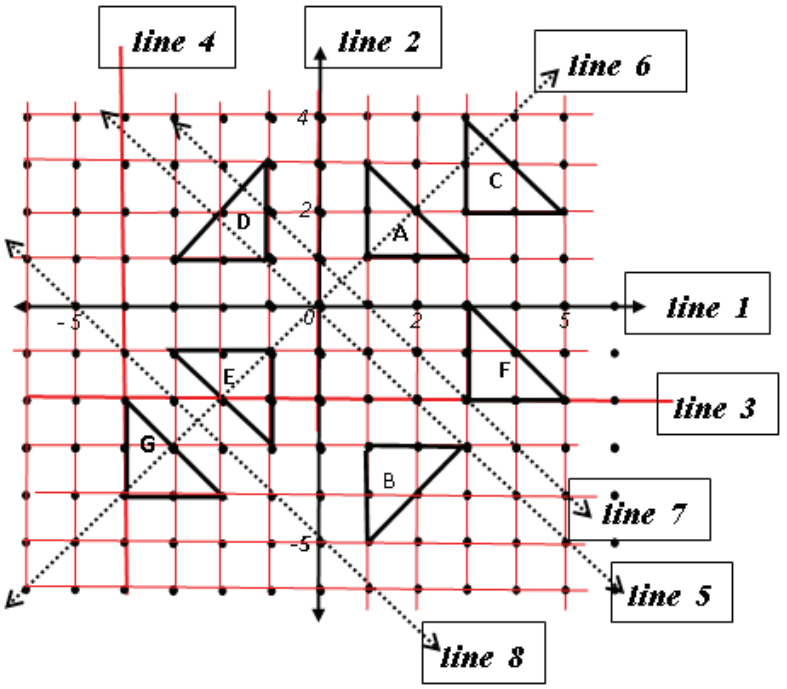


I. Copy onto a geodot or graph sheet and draw the image under a by the vector (2,1)



Assessment Task

E. In the figure below are triangles labelled A, B, C., …, G. Study the coordinates of their locations and do the exercises that follow.



F. Describe the single transformation in the figure that maps

i. ΔA onto ΔC

ii. ΔA onto ΔB

iii. ΔA onto ΔD

iv. ΔA onto ΔF

Homework Task

Identify five objects at home that have symmetries.

Lesson B7.20 Data And Probability - Data

Content standard	B7.4.1.1 Select, justify, and use appropriate methods to collect, display and analyse data and use these to solve and/or pose problems.
What you should know already	Collecting first-hand and second-hand data. Displaying data (ungrouped) presented in frequency tables, line graphs, pie graphs, and bar charts and answering questions on them.
What will you learn? What skills will you develop?	You will learn: • Some methods of data collection and display information collected to solve a given problem. • Choosing the most appropriate method. • Finding out in detail issues from the organised data and using them to solve problems.
Language and vocabulary, you will need to use	Collect, data, record, design, administer, quantitative and qualitative, methods of collecting data (questionnaire, interview observation experiments, survey databases electronic media or internet)
Ways to extend your understanding	"How much money do B7 learners spend as bus fare to school every month?" What method will you use to collect data to solve this problem?
Things you will need to remember for future lessons	The appropriate methods for the collection of data to solve a given real life problem. Designing, administering a survey form and presenting data in an appropriate way and solving the given problem.

Worksheet B7.20 Handling Data - Data

A. Class Survey Question Form

1) Hello, What's your name? _____
2) How old are you? _____
3) What's your favourite school subject? _____
4) What's your worst subject? _____
5) What's the most important school subject? _____
6) What is your favourite hobby? _____
7) What's your favourite day of the week? _____
8) How much do you spend on bus fare to school every day? _____

B. Class Survey Data Summary Form

Use the table below to organise the data obtained from the class survey.

Name	Age	Favourite subject	Worst subject	Important subject	Favourite hobby	Favourite week day	Daily bus fare (cedis)

To what use can you put the findings of the class survey? State some of them.

_____

C. Planning my Survey

1. Identify a situation which requires data collection.
2. Design and administer the data collection tool, e.g. the questionnaire.
3. Display the data in a frequency table and draw the appropriate graph/ chart.
4. Write your conclusion as applicable.

Assessment Task

Collect marks (maximum 10) obtained in a mathematics test by learners in B7.

Complete the frequency table below for the data recorded.

Marks	Tally	Frequency
1		
2		
3		
4		
Total		

Draw a bar graph to illustrate the data in the frequency table.

Write your conclusion about the learners' performance in the test and/or pose questions on the graph.

Homework Task

- Design a survey form to collect data on the number of desks in each classroom of your school.
- Discuss with other learners residing in the same neigbourhood (in small groups) and write down:

1. how you would find out **the number of households in the neigbourhood.**
2. how you would find out the number of people living in the households identified.
3. the appropriate method to collect the data.
4. design the tool/questionnaire for the data collection.

Lesson B7.21 Data and Probability - Data

Content standard	B7.4.1.2 Calculate the mean, median and mode *(a representative value)* for a given ungrouped data and use it to solve problems.
What you should know already	Number and Number operations (ordering a set of numbers from the least to the greatest, addition, division).
What will you learn? What skills will you develop?	You will learn to: • Calculate/find the mean, median and mode of a given ungrouped data set and use it to solve problems. • identify when to use either the mean, median or mode in a given situation.
Language and vocabulary, you will need to use	mean/average, median, mode, ordered set of data (array), frequency
Ways to extend your understanding	i. Calculating the mean, the median and the mode: o of class members' heights; o of data skewed by two large marks obtained in a test; ii. Explore when the mean and median are the same. iii. Note that the mode is the value in the data set that occurs most often and **not the number of times it occurs.** iv. Practice - Solving grade appropriate real-life problems.

Things you will need to remember for future lessons	1. The **Mean** (also called Arithmetic Mean or Average), the **Median** and the **Mode** are known as Measures of Central Tendency (i.e. representatives of the values in a data set). 2. The Mean (average) of a data set is found by adding all numbers in the data set and then dividing by the number of values in the set. 3. The Median is the *middle* value when a data set (with an odd number of items) is ordered from least to greatest. 4. The Median is the **mean/average of the two middle** values when a data set (of an even number of items) is ordered from least to greatest. 5. The **Median** is preferred over the **Mean** to represent the given values when the data set has one or two **large values** as compared to the rest of the values. E.g., the parents of the PTA of your school decided to give the same amount of pocket money to their children per term. The data collected showed that two parents decided to give ten times more than most parents preferred to give their children. 6. The M**ode** is the technical word that is used for the value in a data set that **occurs most often**. Some data sets, for example, may not have a mode. It is also possible for a data set to hav**e more than one mode**.

Worksheet B7.21 Data and Probability - Data

A. Finding mean

i. Find the **mean** for the data set 8, 9, 7, 6, 8, and 10.

ii. Calculate the mean of the ages of children at a party presented in the frequency table below:

Ages (x):	1	3	5	6	7	8	9	10
Frequency (f):	2	5	6	10	8	5	3	10

iii. Find the mean for the data set 8, 9, 7, 6, 8, and 10.

B. Finding Median

i. Find the **median** for the data set 19, 29, 36, 15, and 20.

ii. Find the **median** for the data set 8, 9, 7, 6, 8, and 10.

III. Calculate the Mean and find the Median of the data presented in the following table:

iv. Compare the **mean** and the **median** calculated in (III) above and determine which one of them would be the best representative of the data set.

C. Finding Mode

i. Find the **mode** for data set {2, 1, 3, 2, 3, 3}.

ii. How may modes does this data set have? {0. 5, 7, 7, 10, 12, 15, 15, 32}.

D. Looking at the Mean, Median and Mode in single data set

Ayisha produces xylophone for sale. The following table shows the number of xylophones she sold every month in Year 2019:

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Xylophones Sold	5	8	10	8	7	9	3	11	10	10	12	15

I. Find the mean, median and the mode of the sales made in 2019.

II. Compare and explain/interpret the values calculated.

Notes

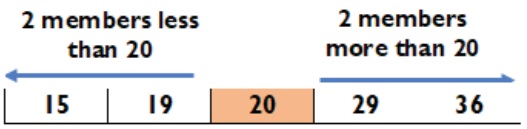
a) To calculate the mean, add all numbers in the data set and then divide the sum by the number of members of the data set.

b) In a data presented by a frequency table the frequencies must be considered when finding the sum of the values and the number of members of the data set.

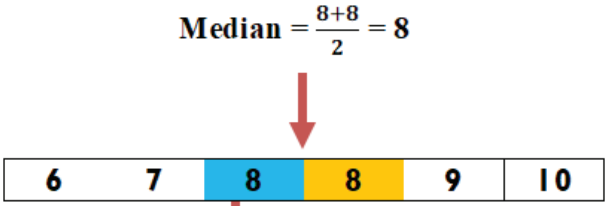
c) To find the median arrange the data set from least to greatest and select the middle value (for an odd number of items). If the data set has an even number of items calculate the **mean/average of the two middle** values.

d) In a data organised in a frequency table the frequencies must be considered in finding the median.

E.g. 1 For an odd number of members in a data set,



E.g.2 For an even number of members in a data set,



Assessment Tasks

1. A magazine listed fuel consumption rates for the following small cars:

Model	Fuel Consumption
Car 1	6.2 L/100 km
Car 2	6.6 L/100 km
Car 3	5.7 L/100 km

Calculate the mean or average fuel consumption of the three small cars.

2. Tickets for a football match have been sold at the following prices: 180 at Gh¢.30, 215 at Gh¢.40, and 124 at Gh¢.50

   a. What is the total amount of money received for the tickets?

   b. What is the mean price of tickets sold (to 3 significant figures)?

3. What is the mean/average of all possible five-digit numbers that can be formed by using each of the digits 6, 7, 5, 9, and 2 exactly once?

4. 160 electric light bulbs of a given brand were tested to find the lifespan of each bulb (i.e., the time it lasted before it failed). The results are given in the table below:

Life in hours	≤500	≤1000	≤1500	≤2000	≤2500	≤3000	≤3500	≤4000
Number of bulbs	2	6	19	87	138	156	159	160

Find the median lifespan of the bulbs tested.

Homework Task

Mean, Median, Mode of Ungrouped Data

1. The table below shows a data set presented in a frequency table.

Set members (x)	2	4	6	8	10
Frequency (f)	6	4	5	7	3

a. Find the mean/average of the data.

b. Find the median of the data.

c. Find the mode of the data.

2. The table below shows the cost of different makes of a new car imported by a motor company in the year 2019 and the number of cars sold.

Cost	GH¢48,000	GH¢64,000	GH¢80,000	GH¢96,000	GH¢105,000
Frequency	12	8	14	8	11

a. Find the mean amount spent on a new car.

b. Find the median amount spent on a new car.

c. Find the modal value.

Lesson B7.22 Data and Probability - Probability

Content standard	B7.4.2.1 Identify the sample space for a probability experiment involving single events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.
What you should know already	The difference and relationship between theoretical probability and experimental probability. Calculate the probability of simple events. Predict the probability of a given outcome occurring for a given probability experiment by using theoretical probability.
What will you learn? What skills will you develop?	You will learn to: • determine when an event is impossible, possible, or certain. • calculate simple probabilities and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.
Language and vocabulary, you will need to use	impossible, possible, certain events, sample space, probability experiments, random
Ways to extend your understanding	Solving more problems on probability and presenting/ expressing the results as fractions, decimals, percentages and/or ratios.
Things you will need to remember for future lessons	That experimental probability approaches the theoretical probability of a particular outcome as the number of trials in an experiment increase.

Worksheet B7.22 Data and Probability - Probability

A. Perform the following experiments:

i. Toss a coin 100 times.

ii. Throw a dice 100 times.

iii. Use tallies to record your results, and transfer them to the frequency tables below.

Throwing a dice 100 times

Outcome	Number of throws
1	
2	
3	
4	
5	
6	

Tossing a coin 100 times

Outcome	Number of throws
Head	
Tail	

Compare the experimental probabilities to the theoretical probabilities and record your findings.

B. What is the chance of having the outcomes (impossible, possible or certain) in the following experiments (tick the most appropriate)?

Outcome of rolling one dice		*Impossible*	*Possible*	*Certain*
	Obtaining the number 1			
	Obtaining the number 7			
	Obtaining the number 4			
	Obtaining the number 8			

Outcome of rolling two dice		*Impossible*	*Possible*	*Certain*
	Obtaining a total of 3			
	Obtaining a total of 1			
	Obtaining a total of 9			
	Obtaining a total of 12			
	Obtaining a total of 13			

C. Calculate the probabilities and complete the table

Name _____		Score _____		
Probability with a single die 				
Find the probability of rolling:	**Fraction**	**Decimal**	**Percentage**	**Ratio**
1. factors of 120	1			
2. a multiple of 3	$\frac{1}{3}$			
3. factors of 2	$\frac{1}{3}$			
4. divisors of 12	—	0.83		
5. a 3 or greater	$\frac{2}{3}$			
6. factors of 8	—			1:2
7. factors of 6	$\frac{2}{3}$			
8. divisors of 30	$\frac{5}{6}$			
9. a 3 or smaller	—		50	

Learner Resources

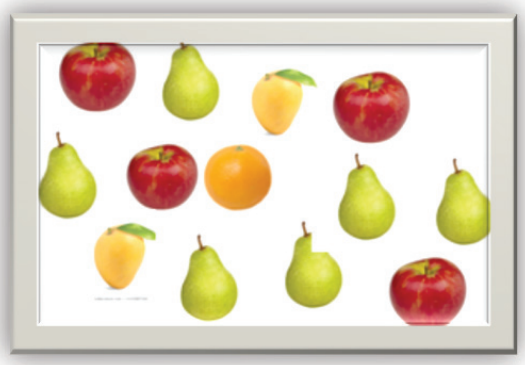
Dice, coins and a jotter

Assessment Tasks

1. A group of learners from a basic school in Koforidua are selected for a study. The colours of their shoes are noted as follows:

Colour of Shoes	Number of Learners
Black	12
Brown	6
Blue	7
Green	8
Grey	4

What is the probability that the colour of a learner's pair of shoes, chosen randomly (i.e. without specific pattern), starts with the letter 'G'?



2. The picture shows some fruits in a box. Abdul is getting late for school and just picks up a fruit from the box without looking at it.

Which fruit is *most likely* to be picked by Abdul?