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SETS

OUTCOMES

- ✚ Interpret the set builder notation; $\{x: x > 2, x \in \mathbb{Z}\}$.
- ✚ Find the intersection set involving up to 3 sets.
- ✚ Interpret the set complement including its symbol (i.e. A' , B')
- ✚ Use single set operation symbols (e.g. $A \cap B \cap C$ or $A \cup B \cup C$).
- ✚ Use combined set operation symbols
[e.g. $(A \cap B') \cap C$, $(A' \cap B) \cap C$, $A' \cap (B' \cap C)$]
- ✚ Use and interpret Venn diagrams
- ✚ Apply simple operations on sets.

KEY POINTS

- A **set** is a collection of well-defined objects or elements.
- A **proper subset** contains only some of the members of the given set.
- An **improper subset** contains all or none of the members of the set.
- The operations on sets are; **intersection**, **union** and **compliment**.
- Intersection of two sets A and B is the set of elements **common to both** A and B.
- Union of two sets A and B is the set that contains elements that **belong to either** A or B or to both.
- **Compliment** of set A is the set of all elements that are in the universal set but not in A.
- Venn diagrams are used to illustrate sets in a pictorial way.
- Given set P and Q, the set difference of set P from set Q is the set of all elements in Q but not in P.

1) State whether the following statements are either true or false?

- $6 \in \{2, 4, 6\}$
- $q \in \{p, q, r\}$
- $\{a, b, c\} \cap \{p, q, r\} = \emptyset$

2) $E = \{1, 2, 3, 4, \dots, 15\}$

$B = \{\text{Prime numbers less than 15}\}$

$Q = \{\text{Factors of 12}\}$

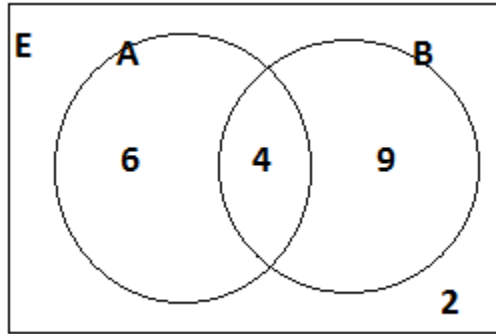
Find (i) $P \cap Q$

(ii) $n(Q')$

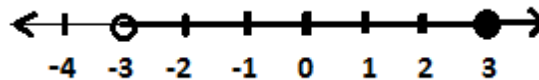
3) The diagram below shows $n(A) = 10$, $n(B) = 13$ and $n(A \cup B)' = 2$.

Find (i) $n(E)$

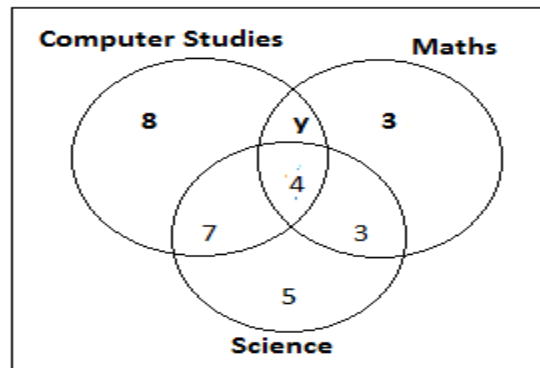
(ii) $n(A')$



- 4) Interpret the number line below using set builder notation.

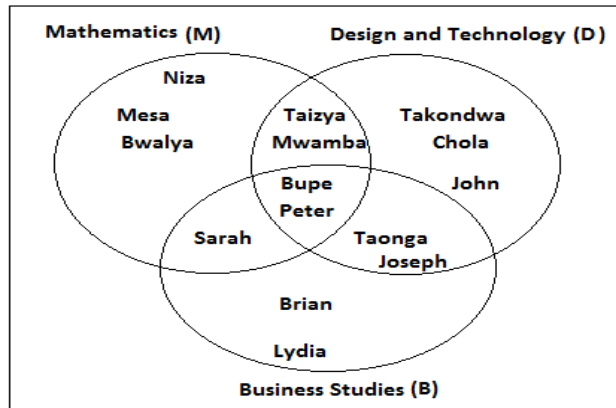


- 5) The Venn diagram shows the number of candidates who wrote examinations in one or two or all three subjects.



- How many candidates wrote one subject only?
- Find the number of candidates who did not write Computer studies or Maths.
- Given that those who wrote two subjects only are 12, find the value of y ?

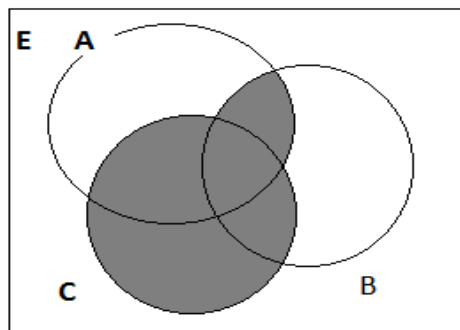
6)



The Venn diagram shows the names of pupils taking at least one of the three subjects in a class. The class only has 15 pupils.

- (i) Find $n(M)$
- (ii) Find $n(M \cup B)$
- (iii) List the elements in $M \cap (D \cup B)$
- (iv) Find the number of subsets in the set of pupils taking Mathematics only.

7) In the figure below, use set notation to describe the shaded region.



- 8) Given that $E = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$, $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6, 8\}$ and $C = \{2, 3, 5, 7, 11\}$
 - i) Illustrate the information in a Venn diagram
 - ii) List down the following sets
 - a) A'
 - b) $(A \cup B \cup C)'$
 - c) $(A \cap B) \cup C$
 - d) $C' \cap B'$

- 9) If $n(E) = 15$, $n(P) = 10$, $n(S) = 9$ and $n(P \cup S) = 15$. Find $n(P \cap S)$.

INTEGERS

OUTCOMES

- ✚ Add and subtract integers without using the number line.
- ✚ Multiply and divide integers.

KEY POINTS

- **Integers** are positive and negative whole numbers including zero.
- To add integers having the **same sign**, maintain the same sign and add the numbers together
- To add integers having **different signs**, subtract the smaller number from the bigger number and maintain the sign of the bigger number.
- When two integers of the same sign are multiplied the product is always positive.
- When two integers with different sign are multiplied the product is always negative.
- The above two principles apply for division as well.

10) Write down the integer value of x in $-4 \leq x < 3$

11) Evaluate the following;

- $5 - 13$
- $-20 - (-12)$
- $14 + 10 - (-11)$
- $-8 - (+5)$
- $-10 \times (-7)$
- $-58 \div 18$
- $2 \times (-3) \times 4 \times 6$
- $3 \times 0 \times (-7)$
- $-45 \div 9 + (-2)$
- $-154 \div (-14) - 20$

12) Simplify the following

- $$\frac{-4 \times (-3)}{+4}$$
- $$\frac{36}{-3 \times 4}$$
- $$\frac{-5 \times (-5) \times (-4)}{-2 \times (-5)}$$
- $$\frac{49 \times (-20) \times 48 \times 24}{+14 \times (-32) \times (-10)}$$
- $$\frac{720 \times (-9) \times 16}{-8 \times (+90) \times (-6)}$$

APPROXIMATION AND ESTIMATION

OUTCOMES

- ✚ Express numbers to given significant figure.
- ✚ Estimate measures or quantities.
- ✚ Round-off numbers to specified degree of accuracy.
- ✚ Express numbers in scientific notation or standard form.
- ✚ Approximate numbers in scientific notation to given degree of accuracy.
- ✚ Apply the concept of approximation in real life.

KEY POINTS

- **Approximation** of a number is way of estimating numbers to the nearest exact values.
- The three common ways used to estimate numbers are use of **significant figures**, **rounding off numbers** and **use of decimal** places.
- A significant figure is any digit from 1 to 9 appearing in a number. Zero is significant only when it appears between the digits 1 to 9 in a number.
- In decimals, zero is significant when it appears between the digits 1 to 9 of a decimal part and when it appears after the digits 1 to 9 to the right of the decimal point
- This is an estimate of numbers to the nearest whole number value using the place value system.
- If the digit to the right of the number to be rounded off is 5,6,7,8 or 9, add one to the preceding digit and replace all the digits to the right of the rounding off digit with zeros.
- If the digit to the right is either 0,1,2,3, or 4, do not add one to the preceding digit, but replace the subsequent digits to the right of the rounding off digit with zeros.
- Multiplication by 10 can be affected by moving the decimal point one place to the right of its original position (so that the number is 10 times greater). Similarly, to multiply by 100, move the point two places to the right; and so on.

13) State the number of decimal places in each of the following

- 2.05
- 612.35
- 24.00
- 240
- 13.3452

14) Express the following in standard form;

- i. 7 340
- ii. 74.1
- iii. 0.004×0.00012
- iv. $82.5 - 0.025$
- v. $0.282 \div 0.47$
- vi. $(9.3 \times 10^5) \times (3 \times 10^{-2})$

15) Express 4 530kg to the nearest 100kg.

16) The area of Zambia is 939 703 square kilometres. Approximate this figure correct to;

- i) 2 significant figures
- ii) 3 significant figures
- iii) to the nearest thousand

17) A city has a population of five hundred and six thousand. Write the size of the population

- a) In figures
- b) In standard form.

18) 5 660 in standard form correct to 1 decimal place.

19) According to the electoral commission of Zambia, the population of the newly registered voters in 2016 was 1, 593, 840. Express this number in standard form correct to 2 significant figures.

20) Express 84.64cm to the nearest millimeter.

- 21) Express
- (i) 339.83 correct to 3 significant figures.
 - (ii) 58.234 correct to one significant figure.
 - (iii) 23 914 correct to 3 significant figures.

22) Estimate the given measurements:

- a) How many km are in 10m.
- b) If 10 people take 5 days to complete a piece of work, how long will 2 people take to complete the same job?

23) The populations of five towns are 15 600, 17 300, 62 800, 74 000 and 34 400, each to the nearest 100. Find the total population of the five towns to the nearest 1 000.

RATIO AND PROPORTION

OUTCOMES

- ✚ Solve problems that involve ratio and proportion.

KEY POINTS

- A **ratio** is a comparison of two similar quantities
- If a and b ($b \neq 0$) are two quantities, then the ratio of a and b is written as a:b or $\frac{a}{b}$
- The terms of the ratio may be multiplied or divided by the same number without changing the value of the ratio.
- If two ratios are equal to each other, they form a **proportion**.
- A proportion is a statement of equality between two ratios.
- Two quantities are in direct proportion if they both increase or decrease in the same ratio.
- Two quantities are in inverse proportion if when one increases the other decreases in the inverse ratio.

24) Express the following ratios in their simplest terms:

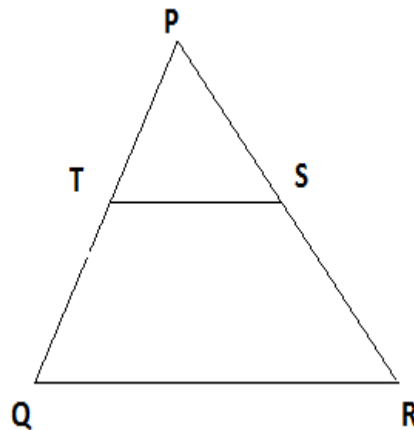
- 4:16
- 27:63
- 15:20:40
- 77cm:121cm
- 5kg:50g
- 400m²:1 Hectare
- 45minutes : $2\frac{1}{4}$ hours

25) The sum of K6, 400 is to be shared between two partners A and B in the ratio 3:5 respectively. Find how much each one receives.

26) The population of a town is 35 280 of whom 18 900 are females. What is the ratio of males to females?

27) A poultry farmer estimates that he has enough food to feed 2000 chickens for 14 days. If he gets 800 chickens more, for how long can his chicken be fed on the same food?

- 28) A string is cut into two parts in the ratio 7: 5. If the longer part is 21m long, find the total length of the string before it was cut.
- 29) Increase each of the following by the given ratios:
- i) K12,100 (12:11)
 - ii) 120km (3:5)
- 30)



- In the figure $PQ = 3PT$ and TS is parallel to QR , what is the ratio of TS to TR .
- 31) Mr. Kunda and Mr. Mbewe are to share their profits in the ratio 4:3 respectively according to their investment. If their profit is K4, 200 how much will Mr. Kunda get?
- 32) In how many days could 30 men do a piece of work which 24 men can do in 40 days?
- 33) The perimeter of a rectangular field is 192 metres. The ratio of its length and breadth is 5:3. Calculate its area.
- 34) In a book store 100 books occupy 1.80m of shelf. What length of shelf is required for 540 similar books?
- 35) If a school of 400 pupils has enough food to last 3 months, how long will the same food last for 300 pupils at the same rate of consumption?
- 36) If one United State dollar is equivalent to 11.50 Zambian Kwacha (US \$1=K11.50), how many United States dollars will Mapenzi get from K 1, 207.50.

- 37) A certain amount of money is shared amongst three sisters as follows: the first share is twice the second; the second share is twice the third. If the total amount to be shared is K 1050, how much is the first share?
- 38) A, B and C share a sum of money in the ratios 7: 8: 16. C receives K270 more than A. Find the amount of money that was shared.

ALGEBRAIC EXPRESSIONS AND FORMULAE

OUTCOMES

- ✚ Formulate algebraic expressions.
- ✚ Simplify algebraic expressions.
- ✚ Apply the distributive law in simplifying algebraic expressions.
- ✚ Evaluate algebraic expressions.
- ✚ Solve simple equations using the additive and multiplicative inverse.
- ✚ Construct formula from given statement.

KEY POINTS

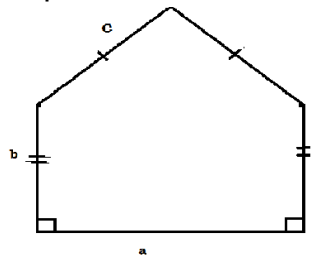
- Algebra involves the use of letters to represent numbers whose exact values are not known.
- Expressions like $4a - 3$ and $5y + 2$ are **algebraic expressions**. $5y$ and 2 are called terms.
- Like terms in an expression have the same variables. Unlike terms have no common variables.
- Like terms can be added together.
- Coefficients** are multiplied together and variables together.
- Only expressions with like terms can be simplified.
- Replacement of a given variable by a given number is called substitution.
- Finding the value of an algebraic expression by substitution is called evaluation of the expression.
- An algebraic expression can be expanded by using the distributive law of multiplication.
- Expand an expression by removing the brackets. Multiply every term outside the brackets by every term inside the
- An algebraic expression is factorized when it is expressed as a product of its factors.

- 39) Simplify the following:
- a) $7x - 7y + 6x - y$
 - b) $3x^2y^3x^4y$
 - c) $5(3x-y) - 2(7x+4y)$

- 40) Factorise completely
- a) $6xy^2 + 3xy$
 - b) $4a^2 - b^2$
 - c) $15a^3 - 5ab$

d) $9cx + 6cy$

- 41) Find the formula for the perimeter of the shape on the right.



- 42) Given that $p = -4$, $q = 3$ and $r = \frac{1}{6}$.

Find the value of

- qr , giving your answer as decimal.
- $P + q - r$, giving your answer as a mixed number.

- 43) Given that $x = 3$, $y = 4$ and $z = -2$, evaluate

- $2x^2 - y$
- $y(x - z)$

44) $Z = \frac{2}{X} - \frac{Y}{72}$

Find the value of z when $x = 12$ and $y = -6$.

Give your answer as a fraction in simplest form.

- 45) Translate each of the following phrases into an algebraic expression. (use any brackets of your choice)

- The sum of any two numbers.
- The sum of two consecutive odd numbers.
- Six years younger than Maimbo's age.
- Half as much as Lilian's marks.
- Twice the number of goals for Kantayeni football club less thrice the number of goals for Kwada football club.
- The difference between x and y divided by 5.

- 46) Express $\frac{3}{2a} + \frac{1}{b}$ as a single fractions.

- 47) Solve the following equations;

a) $\frac{n-8}{2} = 11$

b) $8x + 9 = 3(x + 8)$

c) $2m - 2 = 4m - 6$

c) $2(3x - 6) + 9 = -3(x - 5)$

- 48) A certain cultured bacteria bears an average of x offsprings per day and an average of y bacteria die each day. If there are N bacteria initially, find
- The number B of bacteria born in n days.
 - The number D of dead bacteria after n days.
 - The total number P of bacteria after n days.
- 49) A farmer has 250 goats and buys x more goats at the market. He now has 320 goats. Find x .
- 50) The area of a rectangle is 28cm^2 . How long is the rectangle if it is 4 cm wide.
- 51) The distance from Kitwe to Chingola is 51 km. How far from Kitwe have I travelled if I still have 17 km to go?

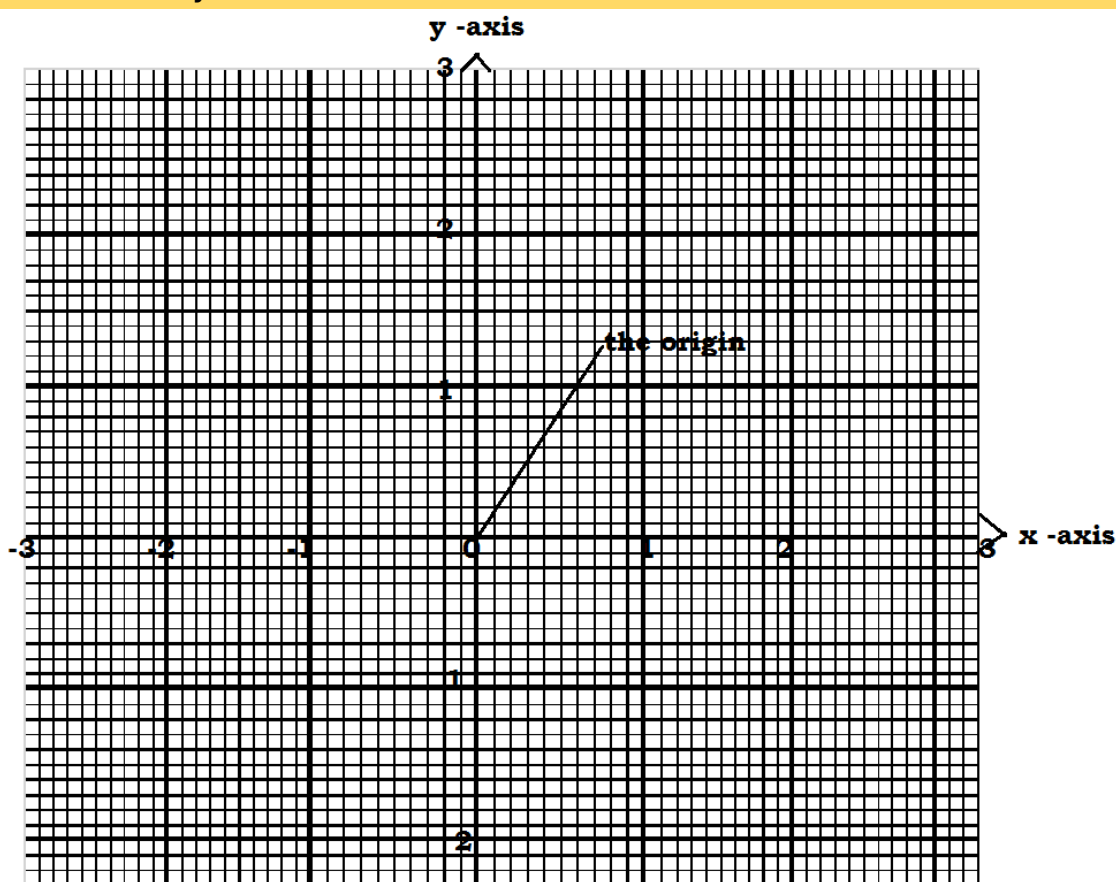
CARTESIAN PLANE

OUTCOMES

- ✚ Draw the XOY plane.
- ✚ Plot and read the ordered pair (x, y) on the XOY plane.
- ✚ Join different points on the Cartesian plane.
- ✚ Graph straight lines.

KEY POINTS

- The ordered pair (x, y) gives the coordinates of a point.
- The ordered pair $(3, -2)$ for example describes the position of a point with reference to the x -axis and y -axis. The first number 3 is called the x -coordinate (sometimes called the first reference) and the second number -2 is called the y -coordinate (the second reference).



- The axes OX and OY are often called Cartesian axes after the seventeenth-century French Mathematician Descartes who introduced the idea of coordinates.

- 52) Given the points S $(9, 2)$, T $(1, 0)$, V $(4, 4)$ give.
- a) the x -coordinates of S, T and V.
 - b) the y -coordinates of S, T and V.

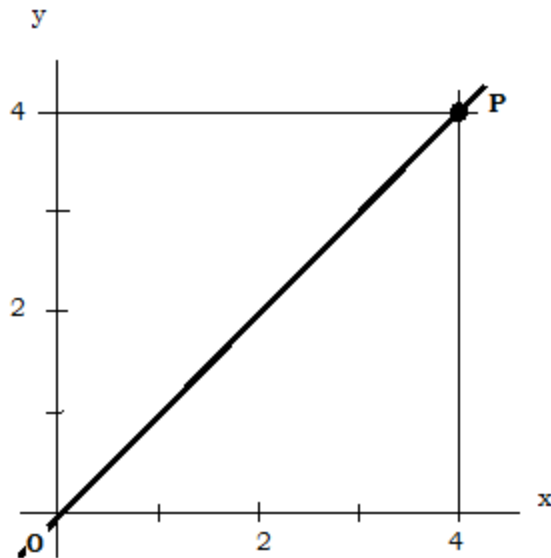
c) the point whose x coordinates is equal to its y-coordinates.

53) Plot the following sets of points. Join up the points in each set and set in the order given, and also join the last point to the first in each set.

a) A(2, 6), B(2, 2), C(6, 2) and D(6, 6)

b) M(12, 6), N(10, 6), P(14, 6)

54)

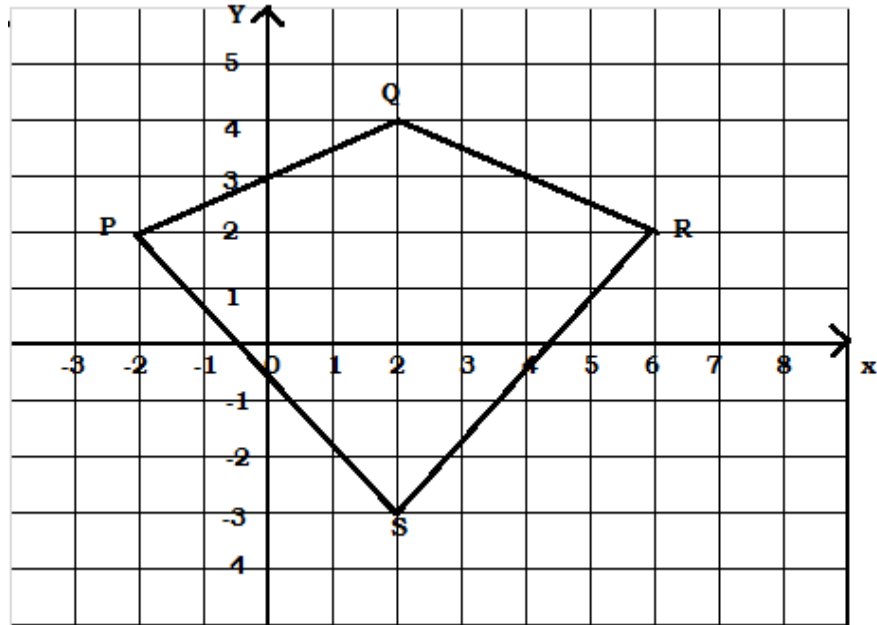


In the diagram OP is a straight line passing through the origin and point P (4, 4).

a) Find the equation of the line OP.

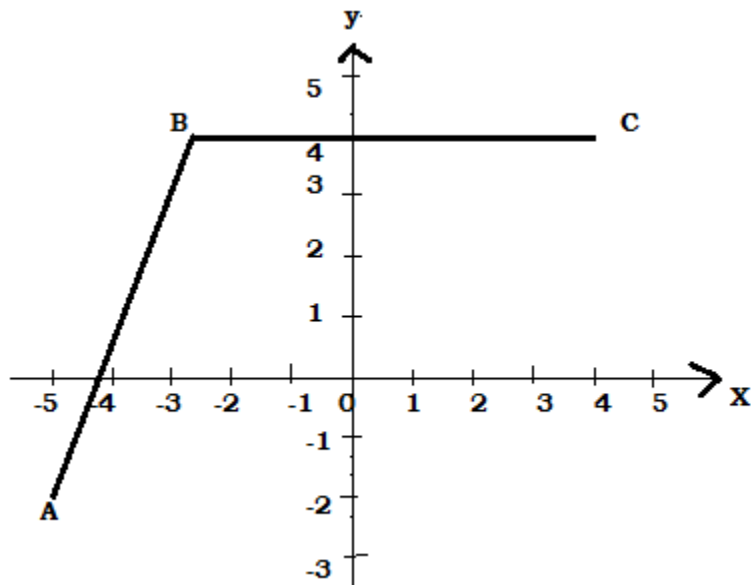
b) Write down the coordinates of the image of (0, 4) when reflected in the line OP.

55) The XOY plane below shows a quadrilateral PQRS.



- What is the name of the quadrilateral PQRS?
- Write the coordinates of the points P, Q and R

56) Three of the vertices of a quadrilateral are A(-5, -2), B(-3, 4) and C(4, 4). If the shape is a parallelogram, write down the coordinates of the fourth vertex D and complete the parallelogram.



FUNCTIONS

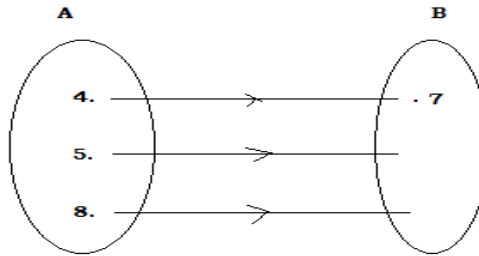
OUTCOMES

- ✚ Describe different types of relationships.
- ✚ Map functions to show relationship.
- ✚ Identify mappings from arrow diagrams.
- ✚ Find the range of the function when domain is given.
- ✚ Find a function given a set of ordered pairs.
- ✚ Draw graphs of linear functions.
- ✚ Solve problems involving functions.

KEY POINTS

- A **Relation** from set A to a set B is a pairing of elements of A with elements of B. It is a set of ordered pairs. It may be denoted by a capital letter Y or the small letter y.
- Types of relations;
 - I. In a **one-to-one relation**, every element of one set is connected to exactly one unique element of a second set.
 - II. In a **many-to-one relation**, more than one element of one set is connected to the same element of a second set.
 - III. In a **one-to-many relation**, the same element of one set is connected to more than one element of a second set.
 - IV. In a **many-to-many relation**, an element of one set is connected to more than one element of a second set.
- A **mapping** is the matching of elements of one set to the elements of another set by a rule. For example, $y = x + 2$.
- A **function** is a rule which gives an output number in terms of an input number. NB. A one-to-one and a many-to-one relation is a function.
- A function is a mathematical instruction such as “think of a number, multiply it by 2 and 3 to the results”
- The set of input values in a function is known as the **domain** and the set of the output value is known as the **range**.
- The elements of the domain are called **objects** and the elements of the range are called **images**.
- A value of a function [$f(x) = 2x - 5$ for example] can be found by substituting the value of x in the function definition.

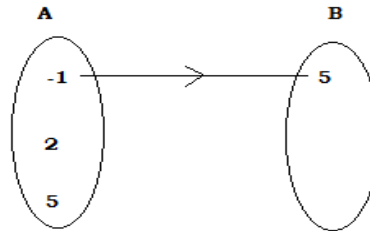
57) A mapping from A and B is such that $x \rightarrow x + 3$, as shown in the arrow diagram below.



Find the image of

- a) 5
- b) 8

58) A relation from set A to set B is given as $x \rightarrow 4 - x$. Complete the arrow diagram below.



- 59) i) Draw the graph of the mapping $x \rightarrow x + 1$ from set $D = \{-3, -2, -1, 0, 1, 2, 3\}$ to the set of integers.
 ii) Draw the graph of $x \rightarrow x + 1$ on the set of positive and negative numbers and zero.

60) If $f(x) = \frac{x-5}{x+5}$, find the value of x for which $f(x) = 2$.

61) If $f: x \rightarrow 2x + 3$, find $f(2)$.

62) A function is defined by $f(x) = 10x + 9$. Find $f(-2)$

63) If $f: x \rightarrow 3x + 4$ and $g: x \rightarrow \frac{x-4}{3}$, find $f(1)$ and $g(7)$.
 What can you say about the functions f and g ?

64) If $f: x \rightarrow \frac{x}{3}$, find:

- a) $f(\frac{1}{2})$
- b) $f(-1)$

SOLID SHAPES

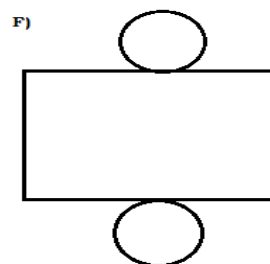
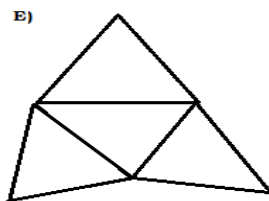
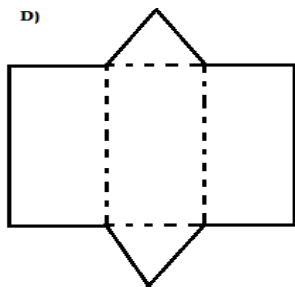
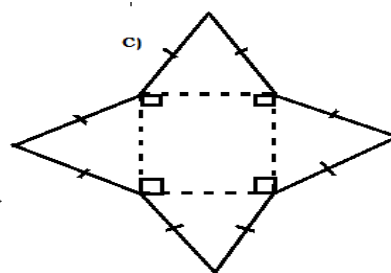
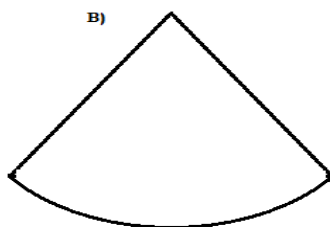
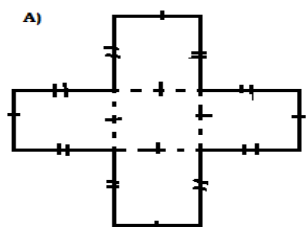
OUTCOMES

- ✚ Identify cones and pyramids.
- ✚ Draw nets of cones and pyramids.
- ✚ Draw/sketch of cones and pyramids.

KEY POINTS

- Three-dimensional shapes are also called **solids**.
- A **pyramid** is a solid whose base is a polygon and whose faces are triangles. The triangular faces meet at a point called the **apex** or **vertex**. NB: A pyramid is named after its base. E.g. if the base is a square, the pyramid will be called a square-based pyramid.
- (the most famous man-made objects that have the shape of a pyramid are the Great Pyramid of Giza, in Egypt)
- The **height** of a pyramid is a perpendicular distance of the apex from the base.
- A pyramid is called a **regular** or **right pyramid** if the apex is exactly above the center of the base. Otherwise the pyramid will be known as a **slanting pyramid**.
- A **cone** is a pyramid such that the base and every normal cross-section is a circle. It has one curved face and one circular edge/base.
- A **net** is a pattern made when the surface of three-dimensional figure is laid out showing each face of the figure. NB: A solid may have different nets.

65) Name the solid figure that can be formed from the nets below



- 66)** Construct a cone of radii 5 cm and height of 12 cm and draw the net of that cone in two different ways.
- 67)** Draw a net of a tetrahedron with edges of 6cm.
- 68)** Draw a net of a cylinder of radius 5cm and length 10 cm on a manila paper. Use the net to make a cylinder with both ends closed.
- 69)** Draw a net of pentagonal pyramid of sides 6cm and slant height 8cm on a manila (plane paper).

MENSURATIONS

OUTCOME

- ✚ Find the total surface area of cylinder and triangular prism.
- ✚ Calculate the volume of cylinder and triangular prism.
- ✚ Describe density.
- ✚ Calculate density of regular objects.
- ✚ Describe properties of interior and exterior angles of regular polygons.

- ✚ Calculate interior and exterior angles of regular polygons.
- ✚ Describe irregular polygons.

KEY POINTS

- **Surface area**; If you want to know how much cardboard is needed to make a box or how much paper is needed to cover a tin, you have to know the **surface area** of the box or the tin.
- A **prism** has a uniform cross section which is either polygonal or circular. In finding the surface area of a prism, it is advisable to sketch their nets.
- Volume of a prism is given by;

Volume = Base area x perpendicular height

The base is also considered to be the cross section

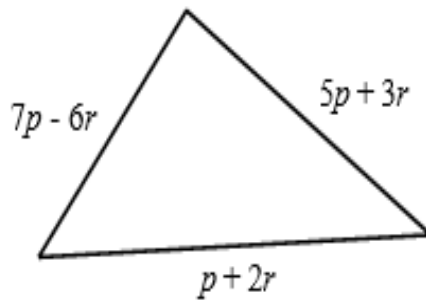
Hence **volume** = (**area of cross section**) x (**height**)

- **Density** can be described as a measure of how much matter is in a unit volume or unit area or unit length. The density of a substance is defined as its mass per unit volume and the **SI (International System of Units)** is kg/m^3 .

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

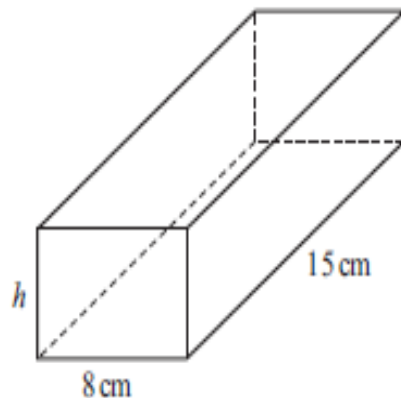
- A **polygon** is a plane shape bounded by straight lines. Polygons are named according to the number of sides they possess.
- A **regular polygon** is a polygon whose sides are equal and whose interior angles are all equal
- An **irregular polygon** is one whose sides and angles are not equal to each other. It can have sides of any length and angles of any size.
- The sum of ALL interior angles of an **n-sided** regular polygon is given by **$(2n - 4)$ right angles = $(2n - 4) \times 90^\circ$**

70) Write an expression for the perimeter of this triangle. Give your answer in its simplest form.



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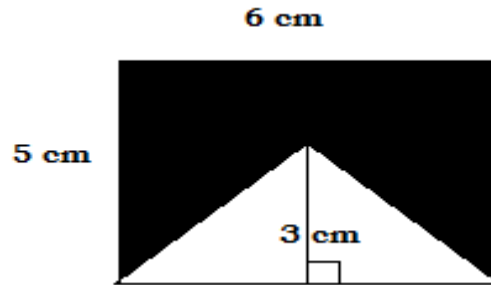
- 71) The diagram shows a rectangular prism.



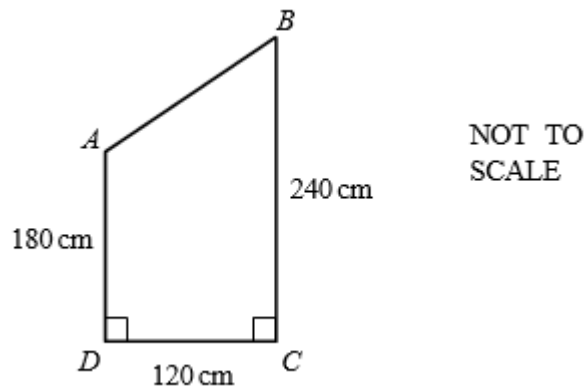
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The volume of this rectangular prism is 720cm^3 . The width is 8 cm and the length is 15 cm.
Work out the height, h .

- 72) The density of mercury is 13.6g/cm^3 . Find the volume of 5 440g of mercury in cubic centimeter.
- 73) Kitwe village has an area of 10km^2 and a population of 30 000 people. Find the population density of the village in people per square kilometer.
- 74) A closed cylinder of radius 21cm has height of 32 cm. If the cylinder has a density of 20g/cm^3 . Calculate;
a) the volume of the cylinder
b) the mass of the cylinder
c) surface area of the cylinder.
- 75) The figure below shows a rectangle 6cm long and 5cm broad, with a triangle of height 3cm cut out of one side. Calculate the area of the shaded part.



76)

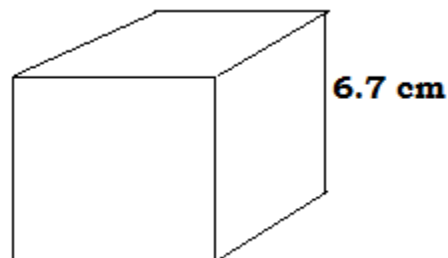


The diagram shows the cross section ABCD of a shed. $AD = 180$ cm, $DC = 120$ cm and $BC = 240$ cm.

- i) Write down the mathematical name of the cross section ABCD.
- ii) Calculate the area of the cross section ABCD. Give the units of your answer

77)

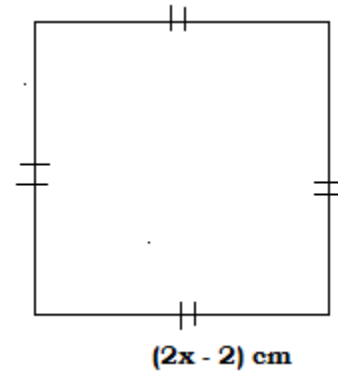
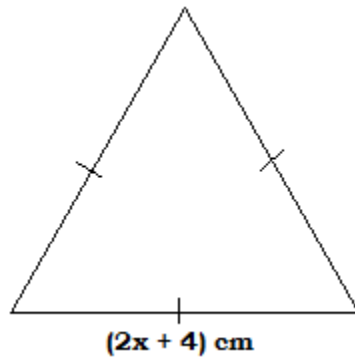
not to scale



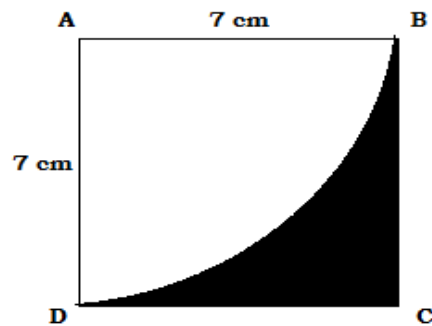
Each edge of this cube is 6.7 cm long. Work out;

- a) the volume
- b) the surface area

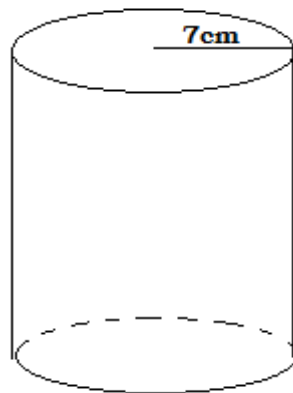
78) The diagram below represent an equilateral triangle of side $(2x + 4)$ cm and a square of side $(2x - 2)$ cm. If their perimeters are equal, find the value of x .



- 79) The figure below shows a square of side 7 cm. Inside the square is a quarter of a circle of radius 7 cm. Using $\pi = \frac{22}{7}$, calculate the area of the shaded part.



80)



The diagram shows a cylinder of radius 7cm. Taking π to be $\frac{22}{7}$,

- Calculate the circumference of the base of the cylinder.
- Given that the volume of the cylinder is 1540cm^3 , calculate the height of the cylinder. (Volume of cylinder = $\pi r^2 h$)

ANGLES

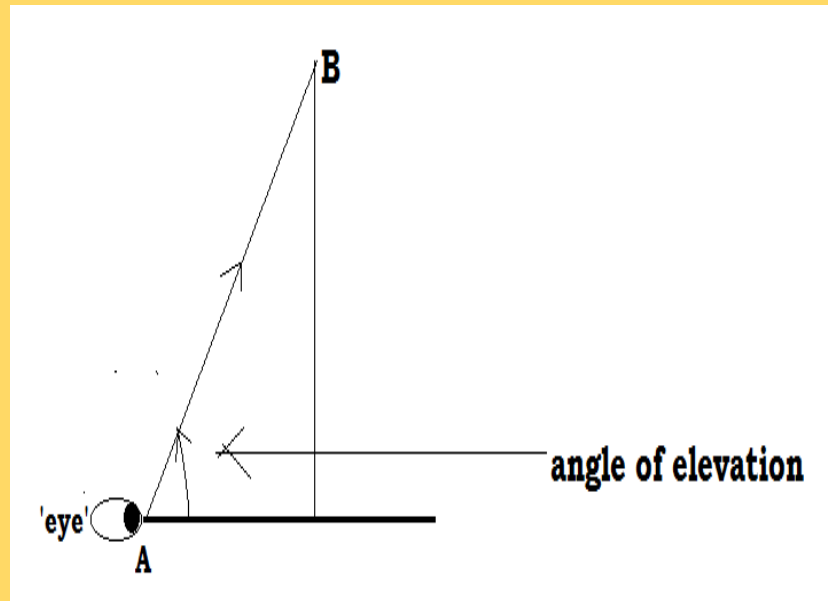
OUTCOME

- ✚ Identify related angles.
- ✚ Find angles associated with straight lines.
- ✚ Find angles of elevation and depression.
- ✚ Solve problems related to real life.

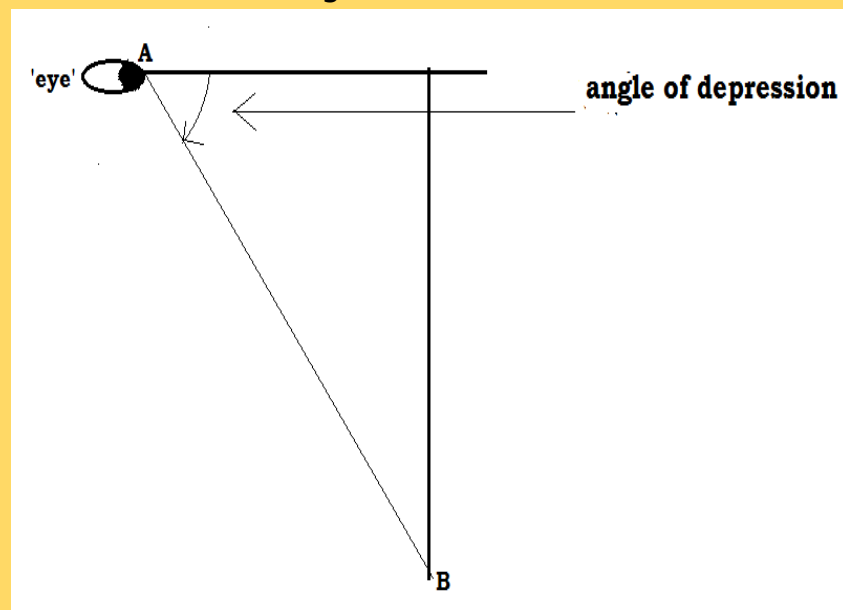
KEY POINTS

- An **angle** can be defined as an amount of turning.
- A **complete turn** is divided into 360degrees, written 360° . This unit was chosen a long time ago by the Babylonians.
- A **complete turn** = 360° , a **straight angle** = 180° , a **right angle** = 90°
- The size of an **acute angle** is between 0° and 90° , and the size of an **obtuseangle** is between 90° and 180° .
- The size of a **reflex** angle is between 180° and 360° .
- Two angles which add up to 180° are called **supplementary angles**. Each angle is the supplement of the other.
- Two angles which add up to 90° are called **complementary angles**. Each is the complement of the other.
- The sum of angles **x**, **y** and **z** and a point is 360° .
- When two straight lines intersect, two angles on opposite sides of the common vertex are said to be vertically opposite. **Vertically opposite** angles are equal.
- Angles associated with parallel lines
 - Angles on a transversal**
 - Corresponding (F) angles**
 - Alternate (Z) angles**
 - Allied (co-interior) angles**
- Angles properties of a **triangle**.
- An observer at O defines the **bearing** of an object P by giving the angle between north and the direction OP measured in the clockwise direction.
- The bearing is given by **three figures**, starting from (north) 000° , up to but not including 360° .

- The angle of **elevation** of a point B from a lower point A is the acute angle between the horizontal through A and the direction AB.



- The **angle of depression** of a point B from an upper point A is the acute angle between the horizontal through A and in the direction AB.

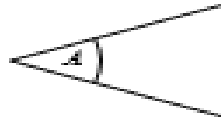


81)

similar	acute	line	perpendicular	radius
reflex	obtuse	parallel	congruent	isosceles

Choose the correct word from this box to complete each of these statements.

(a)



Angle A is ...

(b)



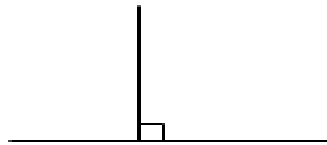
Angle B is ...

(c)



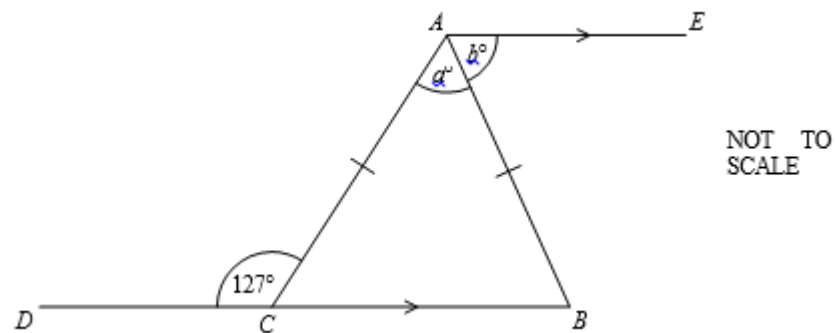
These lines are ...

(d)



These lines are ...

82)

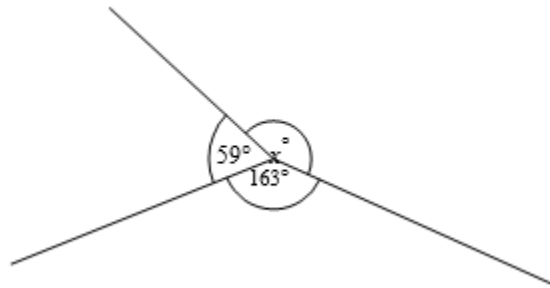


The diagram shows an isosceles triangle ABC .
 DCB is a straight line and is parallel to AE .
Angle $DCA = 127^\circ$.
Find the value of

(a) a ,

(b) b .

83)

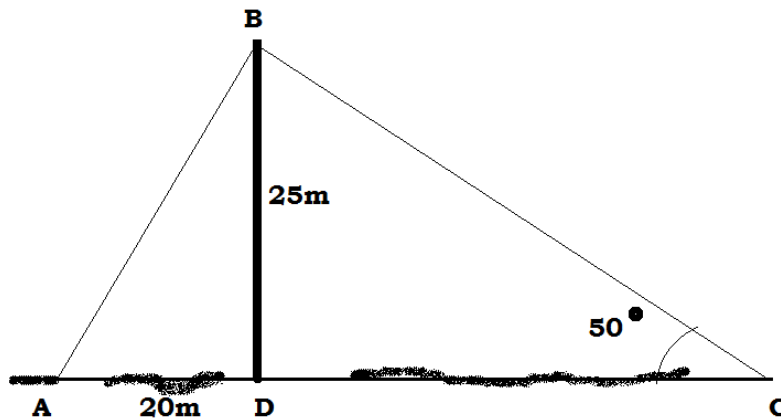


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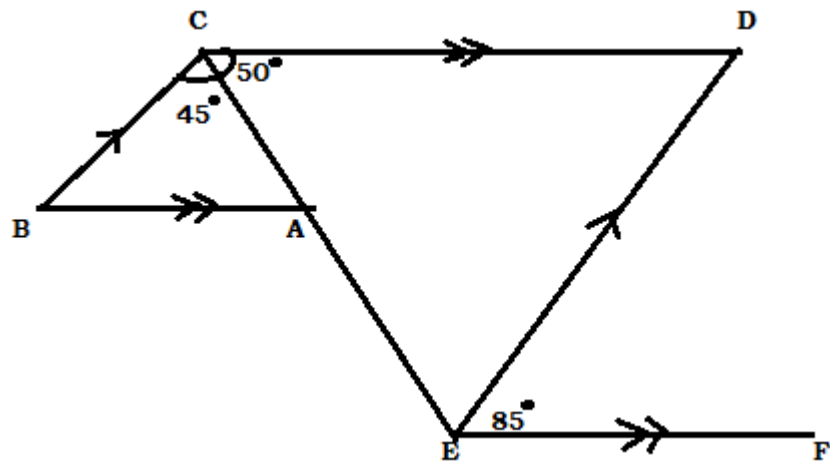
- (a) Find the value of x .
 (b) One of the angles is 163° .
 What type of angle is this?

84) From the ground level, a girl observes that the angle of elevation of the top of a tree is 45° . Find the height of the tree if the distance between her and the tree is 40 m.

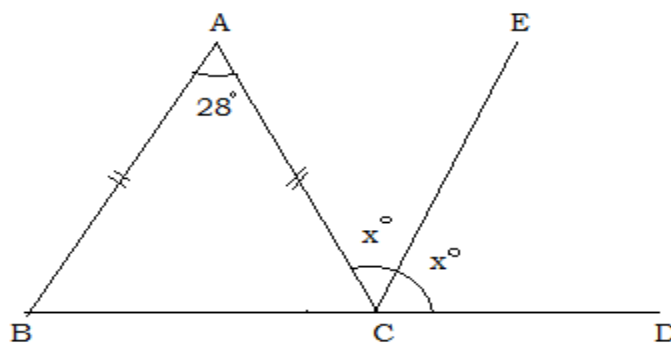
85) Two wires, AB and BC are attached to a pole BD, as shown in the diagram below. Find; (**use a scale of 1cm = 10m**)



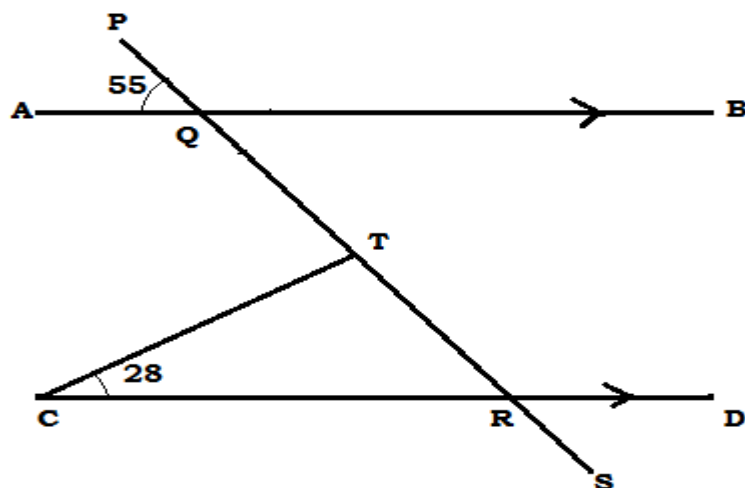
- a) The lengths of wires.
 b) The distance DC.
 c) The angle of elevation of B and A.
- 86) In the figure below CD is parallel to BA and EF. BC is parallel to ED.
 Given that angle $ACB = 45^\circ$ and angle $DEF = 85^\circ$.
 Calculate
 i) angle ABC
 ii) angle CED



- 87) In the figure, ABC is a triangle in which $AB = AC$, and angle $BAC = 28^\circ$. If angle $ACE = \text{angle } ECD$, calculate angle DCE

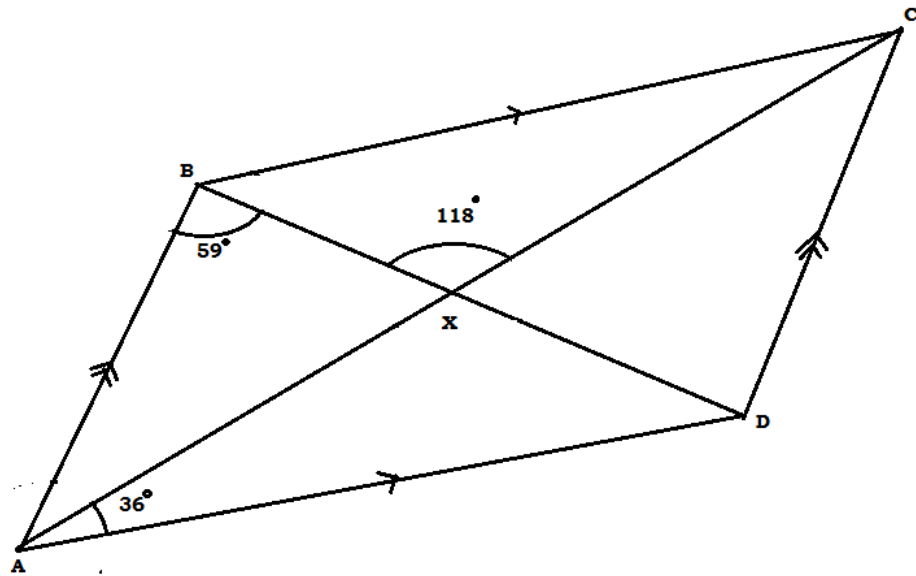


88)



In the diagram, AB is parallel to CD. PTS is a straight line cutting AB at Q and CD at R. Angle $AQP = 55^\circ$ and angle $DCT = 28^\circ$. Calculate angle QTC .

89)



The figure ABCD is a parallelogram. Diagonals AC and BD intersect at X. Angle $BXC = 118^\circ$, angle $XAD = 36^\circ$ and angle $ABX = 59^\circ$. Find

- i) angle CXD
- ii) angle XBC

OUTCOMES

- ✚ Construct 60° , 90° angles using ruler and compass.
- ✚ Construct angle Bisectors using ruler and compass.
- ✚ Use ruler and compass to construct parallel lines.
- ✚ Construct perpendiculars using ruler and compass.
- ✚ Relate geometrical construction to real life problems.
- ✚ Construct triangles, circumscribed circles and inscribed circles
- ✚ Design patterns.

KEY POINTS

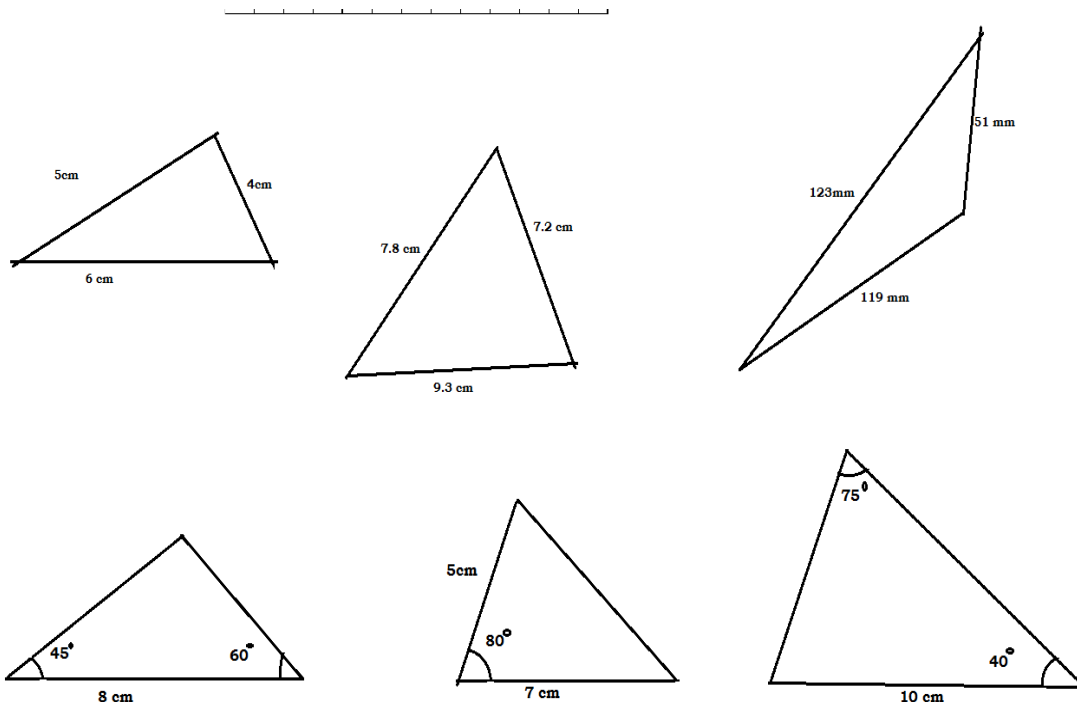
- In **geometry** to construct a figure means to draw it accurately.
- Should be able to **construct a triangle** using;
 - i. Given the lengths of all three sides.
 - ii. Given two angles and a side.
 - iii. Given two sides and angle between them.
- When two lines meet at right angles we say that they are **perpendicular** to each other.
- When **constructing (designing)** buildings, roads, bridges and so on (even building plans), the knowledge of geometrical construction is used especially when partitioning the building, erecting wall which requires high level of accuracy.
- When drawing arcs of a circle, take a suitable radius to avoid making lines and arcs which cut at very small angles. Do not rub out any construction lines or arcs.

90) Draw lines of length indicated and construct their perpendicular bisectors.
i) 10cm ii) 8mm iii) 9.5 cm iv) 12mm

91) Construct the following angles;

- i) 60°
- ii) 30°
- iii) 15°
- iv) 90°
- v) 45°
- vi) 120°

92) Use a ruler and compass to construct the triangles below with given sides of lengths given in the sketches.



- 93) i) Construct triangle ABC in which $AB = 10\text{cm}$, $AC = 6\text{ cm}$ and $BC = 7\text{cm}$.
 ii) Measure and write down the size of angle ACB.
 ii) Construct an angle bisector of angle A.
- 94) a) Use a **ruler** and **compass** only.
 i. Construct a triangle ABC with $AB = 10\text{ cm}$, $BC = 7\text{cm}$ and $AC = 5\text{cm}$.
 ii. Measure and write down the size of angle BAC
 iii. Construct a perpendicular line from C to meet AB at X.
 iv. Measure CX.
 v. Find the area of the triangle ABC.
- 95) i) Use geometrical instruments to construct triangle PQR in which $PQ = 11\text{cm}$, angle $PQR = 117^\circ$ and $QR = 6.5\text{ cm}$.
 ii) Measure and write the length of PR.
 iii) Construct the perpendicular bisector of PQ.
 iv) Bisect angle PRQ.
- 96) Construct a circumscribed circle of triangle PQR given that $PQ = 10.5\text{ cm}$, $QR = 9\text{ cm}$ and $PR = 7.4\text{ cm}$.

- 97) Construct an inscribed circle of triangle ABC given that $AB = 11$ cm, angle $ABC = 67^\circ$ and $AC = 10.5$ cm.
- 98) Construct triangle ABC in which $AC = 11.5$ cm, $BC = 7$ cm and $AB = 9.5$ cm. Measure and write down the size of angle ABC. On the same diagram, draw a parallel line PQ, 3 cm from AC.
- 99) Draw a circle of radius 6 cm. Mark a point P on the circle. With centre P and the same radius, draw an arc to cut the circle at Q and U. With centre at Q and the same radius, draw an arc to cut the circle at R and P. Continue drawing arcs with centres R, S, T and U.
- 100) Draw a line $AD = 9$ cm. Using a radius of 3 cm, construct circles with centres A, B, C and D. These circles intersect at points E, F, G, H, I and J. With these points as centres and the same radius, draw circles to get the pattern.

STATISTICS

OUTCOMES

- ✚ Identify methods of data collection.
- ✚ Present data on Histograms and frequency polygons.
- ✚ Draw frequency tables of grouped data.
- ✚ Construct and interpret graphs of given data.

- ✚ Find Mean for grouped and ungrouped data.
- ✚ Identify uses of statistics.

KEY POINTS

- Identify two types of data; Primary and secondary.
- Some methods of data collection are;
 - Questionnaires.
 - Interviews
 - Observation among others.
- Data presentation methods;
 - Pictogram
 - Bar Charts/graphs (including compound bar charts)
 - Histograms
 - Frequency polygons
 - Line graphs
 - Pie Chart (circle graphs)
 - Frequency tables
- Mean, mode and median.
- The **mean** is the sum of all the measures divided by the number of the measures.
- The **mode** is the measure with the highest frequency.
- The **median** is the number in the middle of a set of ordered data.

101) Find three numbers which have a mode of 4 and a mean of 6.

102) Express 2, 3, 4, 6, x, 10, 12, 14 are scores arranged in the increasing order. These scores have a median of 7. Find x.

103) Michael sales ice cream. The table shows how many of the different flavours she sales in one hour.

Flavour	Vanilla	Strawberry	Chocolate	Mango
Number sold	6	8	9	7

Michael wants to show this information in a pie chart.
Calculate the sector angle for mango.

104) The table shows the average monthly temperature (°C) for Fairbanks, Alaska.

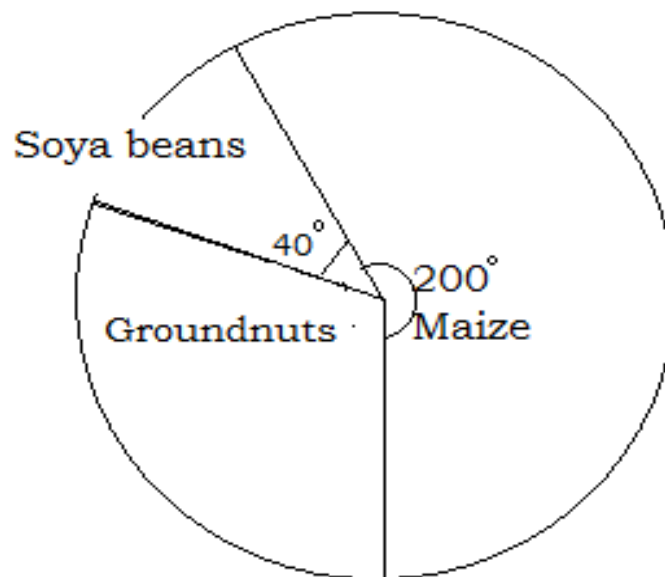
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	-23.4	-19.8	-11.7	-0.8	9.2	15.4	16.9	13.8	7.5	-5.8	-21.4	-21.8

- (a) (i) Find the difference between the highest and the lowest temperatures.
- (ii) Which month's average temperature is 14.6°C warmer than April?
- (b) A month is chosen at random from the table.
- Find the probability that its average temperature is below zero.

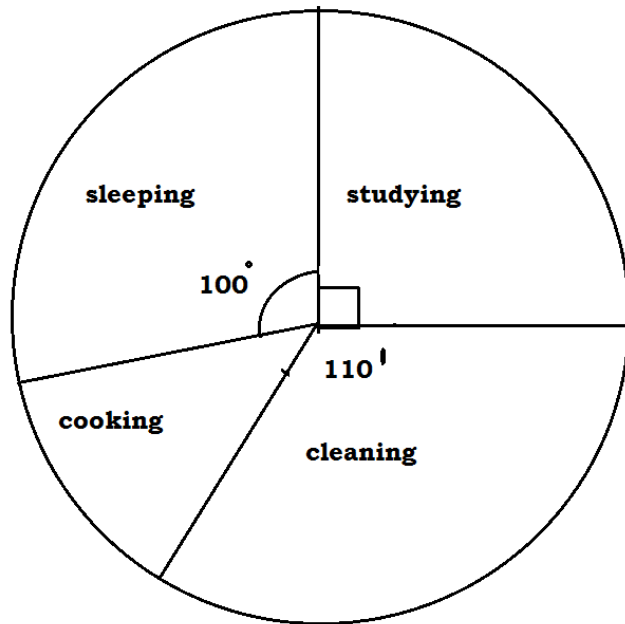
105) The pie-chart shown represents a farmer's crop harvest for 2014-2015

Season. If 6000 bags of maize were produced, calculate

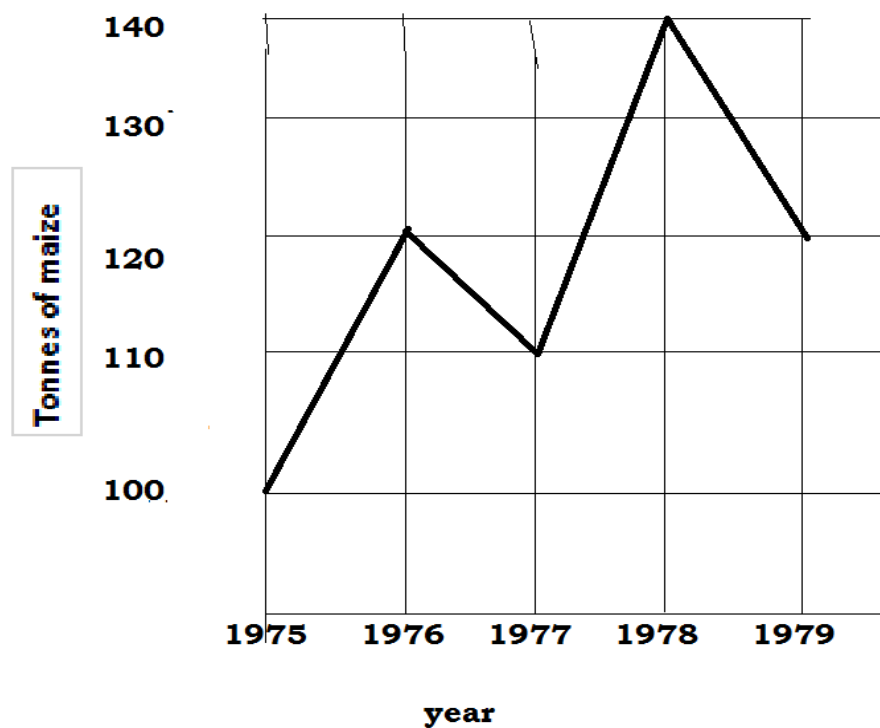
- a) the number of bags of groundnuts produced.
- b) the number of bags of Soya beans seed produced.



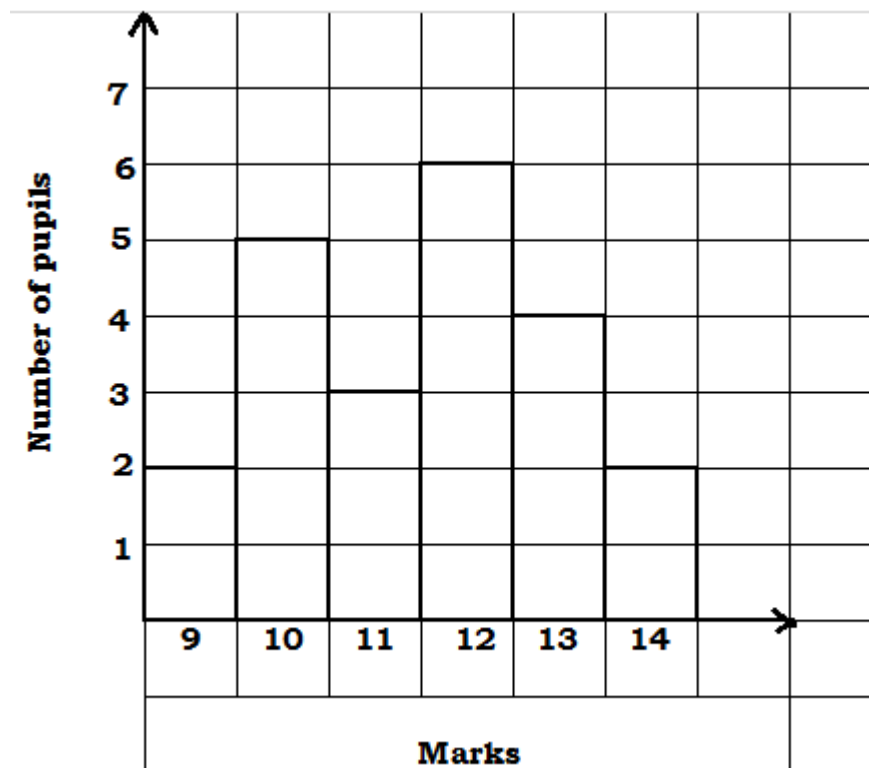
106) The pie chart above shows how Mwape spent her time one Saturday. How many hours did she spend on cooking?



- 107) The line graph above shows the production of maize in tonnes in the Eastern Province for the year 1975 to 1979. What was the average production per year?



- 108) The bar chart below shows the results in a Mathematics test for a Grade 9 class at Lwimbo Secondary School.



- How many pupils wrote the test?
- If the pass mark was 12, how many pupils failed?

NUMBER BASES

OUTCOMES

- ✚ Convert from denary to bicimal numbers of the form 1110.1, up to 3 bicimal places.
- ✚ Convert number in bicimal to base 10.

- ✚ Multiply and Divide numbers in base 2 and base 5.

KEY NOTES

- Computers work in base 2 while computer programmers use base 16. Special names have been given to different number bases as shown below;
 - Base 2-the binary system
Base 10-the denary
 - Base 8-the octal system
 - Base 12-the duodecimal system
 - Base 16-the hexadecimal system.
- In binary system, a point separates numbers of 1 and above from numbers less than 1. In base 2, numbers less than 1 are called bicimal.

109) Find $3032_{\text{five}} - 1004_{\text{five}}$, giving your answer in base 5.

110) Find the value of $24_{\text{five}} + 133_{\text{five}}$ in base 10.

111) Divide 11110_{two} by 101_{two} , giving your answer in base 2.

112) Find the difference between 4312_{five} and 52_{eight} in base ten.

113) Given that $a = 25_{\text{eight}}$, $b = 1011_{\text{two}}$ and $c = 3a + b$. Find the value of c in base ten.

114) Find the difference between 4312_{five} and 52_{eight} in base ten.

115) Convert the following to base 10

- 110.11_2
- 1001.10_2
- 111.11_2

SQUARE ROOTS AND CUBE ROOTS

OUTCOMES

- ✚ Describe the meaning of square root and its symbol.
- ✚ Describe the meaning of cube root and its symbol.
- ✚ Find roots of Squares and Cubes.

KEY POINTS

- The positive **square root** of a positive number **N** is that number $\sqrt{N}$ which, when multiplied by itself, gives N. The square root of 0 is 0.
- Squaring, and taking the square root, are inverse operations.

- When a number is multiplied by itself two times, the product is called the **square of** the number. E.g. 4×4 is $4^2 = 16$, read as 4 **squared**. The 4 is the base, 2 is the power and 16 is known as a perfect square.
- The **square root** of a number is a value that can be multiplied by itself to give the original number. The symbol for square root is $\sqrt{\square}$ or $\sqrt[2]{\square}$
- The first six perfect squares are: 0, 1, 4, 9, 16 and 25.
- When a number is multiplied by itself three times, the product is called the **cube of** the number. E.g. $2 \times 2 \times 2$ is $2^3 = 8$, read as 2 **cubed**.
- The **cube root** of a number is a special value that when cubed gives the original number. The symbol for cube root is $\sqrt[3]{\square}$

116) Calculate $\frac{\sqrt[3]{27}}{1.3^2}$

117) Calculate

- $\sqrt[3]{64}$
- $\sqrt[3]{125}$
- $\sqrt{256}$
- $\sqrt[3]{216}$
- $\sqrt{49} + \sqrt[3]{64}$

118) Simplify

- $(-\sqrt{9})^2$
- $\sqrt{16} + \sqrt[3]{64}$

INDEX NOTATION

OUTCOMES

- ✚ Interpret the positive and zero indices.
- ✚ Apply laws of indices.

KEY POINTS

- A number expressed as a^n is said to be expressed in **index form**.
- In the expression a^n , “a” is the base and “n” is the **index** or **power** of a. The plural for index is indices.
- Generally the following apply;

i. $a^m \times a^n = a^{m+n}$

ii. $\frac{a^m}{a^n} = a^{m-n}$

- iii. $a^1 = a$
- iv. $a^0 = 1$
- v. $(a^m)^n = a^{m \times n}$

119) Simplify the expressions.

- a) $p^3 \times p^7$
- b) $t^5 \div t^8$
- c) $\frac{20x^8}{-4x^4}$
- d) $\frac{p^2q \times 2pq^3}{4p^3q^2}$
- e) $24p^2q \div 12pq$
- f) $\frac{20r^3t \times 5r^2t^2}{25r^4t^3}$

120) Given $(h^3)^k = h^{12}$, find the value of k.

121) Write each expression in its simplest form.

- i) $3q^4 \times 5q^2$
- ii) $t^8 \div t^2$

122) Evaluate

- i) $-4^2 + 4^3$
- ii) $2^3 \times 3^2 + 5^1$

123) Find the value of $2m^2 - mn + n^2$, when $m = 2$, $n = -1$

REAL NUMBERS

OUTCOMES

- ✚ Identify Rational numbers
- ✚ Identify Irrational numbers.

KEY POINTS

- **Rational numbers** are numbers which can be expressed as exact or recurring fractions. They can be expressed in the form $\frac{a}{b}$, where **a** and **b** are integers and $b \neq 0$. (These are numbers which can be expressed as exact or recurring fractions).
- Every **integer** is a rational number since all integers can be written in the form $n/1$.

- **Irrational numbers** are sets of fractions that neither terminates nor recur. These numbers cannot be expressed in the form $\frac{a}{b}$. This set of numbers includes numbers such as π and $\sqrt{2}$.
- **Some** decimals are irrational such as $\frac{7}{13} = 5.3846153846$

124) Arrange the following numbers in ascending order.

-25, 0.5, $\frac{1}{3}$, 2.

125) From the following set of numbers, copy and complete the table below;

$\sqrt{7}$, 3, 5, $\frac{3}{4}$, 0.1, 0. $\dot{3}$, 3.2, 4, 0.4 $\ddot{5}$, 13, $\frac{4}{5}$, 25, 23, $\sqrt{4}$, 1, 16, 41, π , 81, 29, 0.5

Square Numbers	Prime numbers	Odd numbers	Irrational numbers
4	29		

126) State whether the following statements are **true** or **false**.

- The set of natural numbers and the set of positive integers are identical.
- 14 is a rational number.
- There are less than 10 rational numbers between 0 and 1.
- All prime numbers are odd.
- 1 is a rational number.
- $\sqrt{10}$ is not a rational number.
- $\sqrt[3]{27}$ is not a rational number
- 5 is an irrational number
- 1.666...is not an irrational number.
- We cannot tell if $\frac{n}{7}$ is rational or irrational.
- 1.2 is a rational number.
- $\frac{41}{3}$ is an irrational fraction.

127) Consider the following numbers; 0.02, 2, $\frac{3}{4}$, π , 45, 36, $\sqrt{2}$, 5, 17. Write down;

- a) prime numbers
- b) the squares numbers
- c) rational numbers and
- d) irrational numbers.

128) Express 1764 as a product of prime factors leaving your answer in index form. Hence find $\sqrt{1764}$.

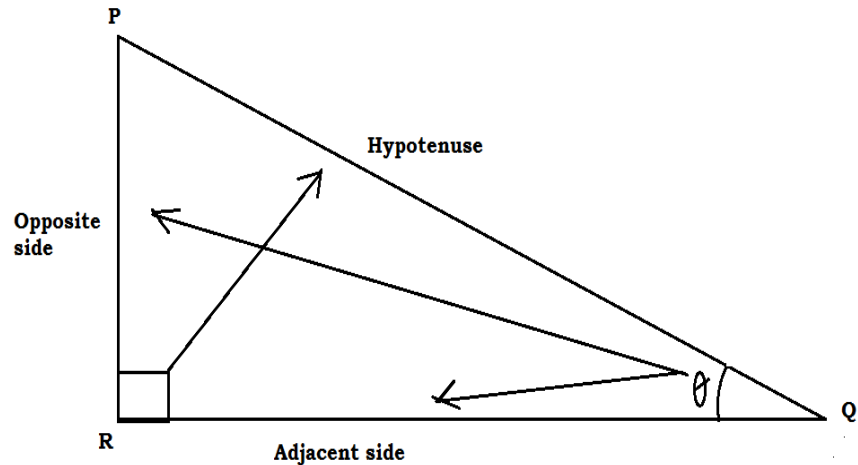
129) Prove that all repeating decimals are rational.

PYTHAGORAS THEOREM

OUTCOMES

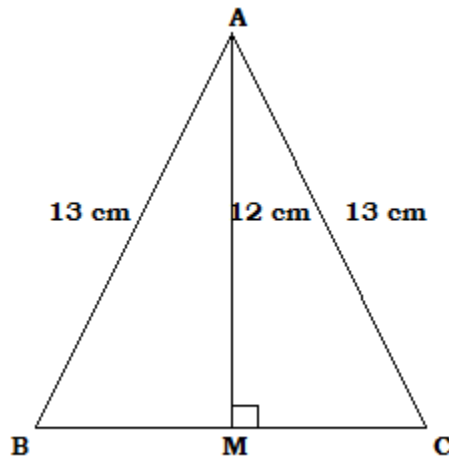
- ✚ Identify sides in the Right angled triangle.
- ✚ State the Pythagoras' theorem.
- ✚ Solve real life problems involving Pythagoras' theorem.

KEY POINTS

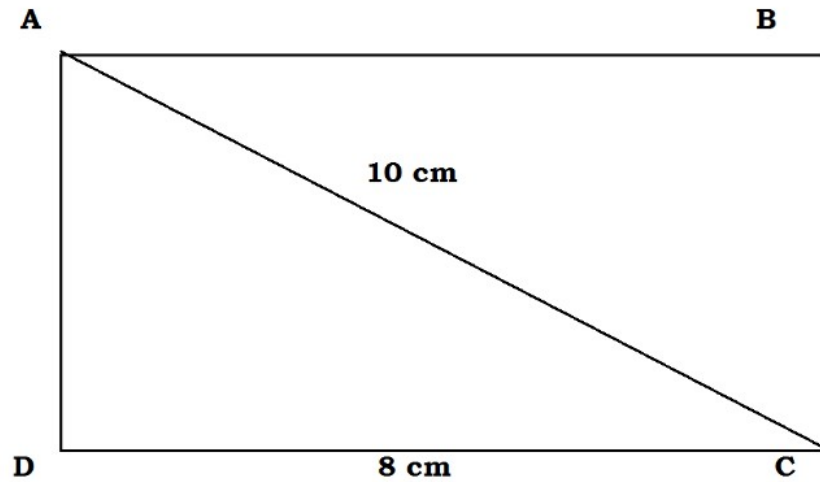


- The adjacent and the opposite sides depend on the angle θ .
- The Pythagoras' theorem states that; In any right-angled triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs of the right triangle (adjacent sides).

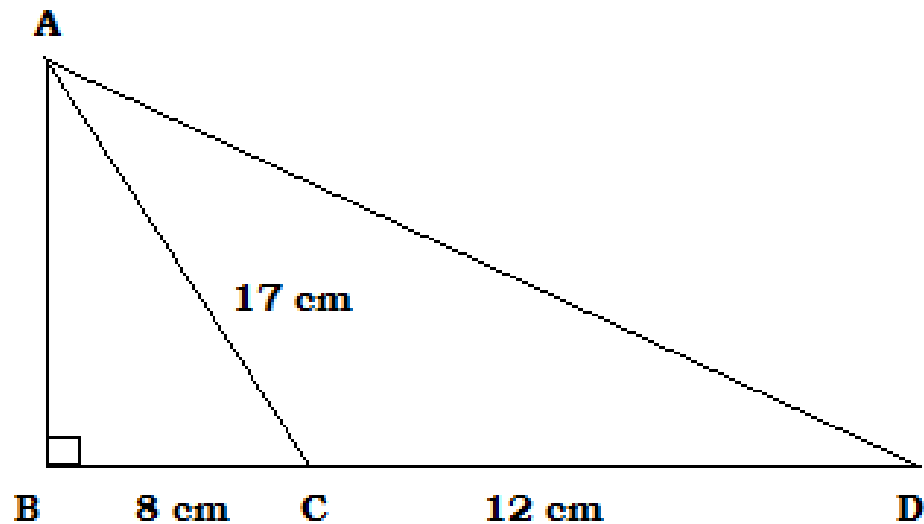
130) In the triangle below $AB = AC = 13\text{cm}$, and $AM = 12\text{ cm}$. Calculate the length of BC .



131) A rectangle below is 8 cm long and its diagonal is 10 cm. Calculate the length of the breadth BC of the rectangle.



132) In the figure below, angle $ABC = 90^\circ$, $BC = 8\text{cm}$, $AC = 17\text{cm}$ and $CD = 12\text{cm}$. Calculate the length of AD .



DIRECTION AND BEARINGS

OUTCOMES

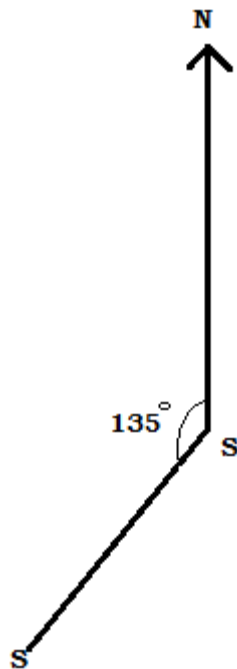
- ✚ Identify the cardinal points on the compass

- ✚ Find three figure bearings of one point from another

KEY POINTS

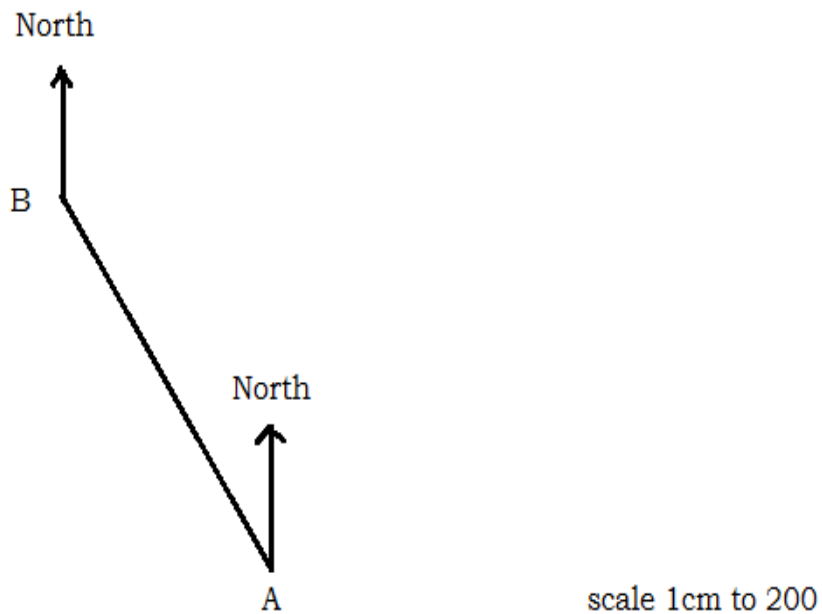
- **Bearings** are a measure of direction, with the north taken as a reference. If you are travelling north, your bearing is 000° , and this is usually represented as straight line up on the page.
- If you are travelling in any direction, your bearing is measured clockwise from north.
- NB. Bearings are always measured clockwise from north and given as 3 digits.

- 133) A boat sailing on a course of 120° turns through 90° anticlockwise. Find its new direction.
- 134) A map is drawn to a scale of 1: 100 000. Calculate the length of a road which is 9.5 cm on the map, giving your answer in kilometers.
- 135) In the figure, the bearing of S from R.



- 136) An aircraft flies from a point A, 400km on a bearing of 030° to a point B. From B it flies 300km on a bearing of 100° to a point C. Find by scale drawing the distance and bearing of A and C. (Use a scale of 1cm to represent 50 km)

- 137) The scale drawing shows the positions of two villages, A and B. The scale is 1 centimeter represents 200 meters.



- a) Measure the bearing of B from A.
b) Work out the actual distance from A and B.

EQUATIONS AND INEQUATIONS

OUTCOMES

- ✚ Change subject of the formula.
- ✚ Solve equations and in-equations in one variable.
- ✚ Solve equations and in-equations in two variables.
- ✚ Sketch the graph of in-equations and shade the wanted region.
- ✚ Solve simultaneous linear equations in two variables.
- ✚ Apply equations and in-equations in real life.

KEY POINTS

- An equation is a **sentence**.
- Equations often involve unknown value called **variables** such as x, y, m among others.
- A linear equation is one that can be written in the form $ax + b = c$, where a, b and c are constants. (These can either be in one, two or more variables.)
- Systems of equations in two variables can be solved by;
 1. The substitution method
 2. The elimination method
 3. Graphical method
- When an inequation is either divided or multiplied by a negative number, the inequality sign **MUST** be reversed.

138) Solve the following equations

- i. $6x - 3 = 3x$
- ii. $3(x - 4) = 24$
- iii. $7 - 4x = 9 - 12x$
- iv. $2 + 7(2 - x) = 3x - 24$
- v. $4(x - 1) - 3(x - 2) = 6$
- vi. $\frac{3x-1}{5} = 4$
- vii. $\frac{2}{5}x - 3 = 1$
- viii. $\frac{x-2}{2} = \frac{5+x}{3}$
- ix. $\frac{x-3}{2} + 2x = 6$

139) Solve the following inequations

- i. $3(x + 2) - 4(x + 1) \geq 7.$
- ii. $4x + 5 < 6x + 2$
- iii. $M - 4 < 3m + 8$
- iv. $y - 4 \leq 5 + 3y$
- v. $\frac{1}{3}(2x - 3) \leq 5$
- vi. $\frac{2}{3}(y+1) > \frac{3}{4}$
- vii. $\frac{1}{3}(t+2) < t + \frac{1}{2}t$

140) $V = \frac{1}{3}Ah$

a) Find V when $A = 15$ and $h = 7$.

b) Make h the subject of the formula.

141) What is the solution set of $3 - 5x \leq -12$ where x is a member of the set $\{0, 1, 2, 3, 4, 5, 6\}$.

142) Solve the systems of equations given below;

$$5x + 3y = 1$$

$$4x + 5y = 6$$

$$5x + 3y = 16$$

$$11x + 7y = 34$$

$$x + y = -7 \text{ and } x - y = -3$$

$$2x - y = 6$$

$$2x - 2y = 2$$

$$2x - y = 7$$

$$3x + y = 3$$

SOCIAL AND COMMERCIAL ARITHMETICS

OUTCOMES

- ✚ Work out payments for piece work & work per hour.
- ✚ Compute deduction from salaries.
- ✚ Calculate over time.
- ✚ Differentiate & calculate income tax and value added tax.
- ✚ Calculate pension and compensation.

- ✚ Calculate depreciation and appreciation.
- ✚ Calculate simple and compound interest.
- ✚ Calculate utility bills, Bank and Postal charges.
- ✚ Generate simple budget.
- ✚ Calculate insurance, premium, policy cover.
- ✚ Calculate cost of goods bought on hire purchase.

KEY WORDS

- **Salary** is best associated with employee compensation quoted on an annual basis (usually paid monthly).
- **Wages** are best associated with employee compensation based on the number of hours worked multiplied by an hourly rate of pay. (the most common types of payments are payment by **piece work** and payment **by hour**.)
- People who are paid 'by hour' may be paid extra money if they work more than the agreed number of hours. The extra number of hours worked are called **overtime**.
- A **discount** is a reduction in price, often given at a sale, or a special purchase of goods. It is usually given in the form of a percentage, or 'K' discount.
- A **commission** is an agreed percentage of the total value of goods sold by a salesman or agents of commercial enterprise.
- A **tax** is an amount of money that individuals, companies and other organizations pay to the government.
- A **pension** is a regular payment made by the state to people of or above the official retirement age and to some widows and disabled people.
- When something goes up in value (e.g. a piece of land) as time goes on we say that its value **appreciates**.
- When the value of an item decreases with time (the value of a car), we say it **depreciates**.

143) Shupa is a newspaper boy. He sales 200 newspapers a day at K8 each. His commission rate is 15%. How much commission does he earn in a week?

144)

Basic wage	Overtime	Total Wages
K5 400		K7 800

This is Mrs. Chewe's payslip for November 2015. Overtime rate is paid at K64.00 per hour. Find

- How much he received for overtime.
- the number of hours he worked as overtime.

- Mrs. Banda, paid K429 to an electricity company to buy electricity units. The charge included K3 Television fee. If she bought 213 units, what was the cost of 1 unit?
- A radio can be bought for cash at K 265 or on hire purchase with a deposit of K 105 and a monthly instalment of K 65 for six months. How much money is saved when the radio is bought for cash?
- How much would Mr. Silumesi pay for a bed priced at K 240 if he is allowed $12\frac{1}{2}\%$ discount?
- A travelling bag was sold for K 420 at a discount of 25%. Find its actual price.
- Mrs. Mwikisa bought 3 packets of sugar at K 25 a packet, a 25kg bag of mealie meal at K 85, 2kg of beef at K 27 per kilogram, 2.5 liters of cooking oil at K 60 and a packet of salt at K 15. Work out her total bill.
- Calculate the simple interest on K 4 800 invested at 15% per annum for 5 years.
- Mr. Mutale got a loan from a bank at the rate of 30% per annum for 2 years. If the interest to be paid back was K 5 400, what was the value of the loan?
- A bicycle may be purchased by either a single cash payment of K 260 or by a deposit of K 60 followed by 8 monthly instalment of K 28.75 each. How much more expensive is it to buy a bicycle on hire-purchase than on cash payment?

153) Mr. Hankunku bought the following items from Shoprite Checkers in Lusaka.

9 rolls wall paper at K 700 per roll

4 rolls ceiling paper at K 400 per roll

3 tins of wall paint at K 700 per tin

He was allowed 5% discount on the total cash payment. How much did he pay for the items?

154) The customs duty on cigarettes is K 20 per kg plus 15% of the value for duty purposes. If Mr. Chilala imported 150kg of cigarettes valued at K 3, 000, calculate the total customs duty Mr. Chilala paid on the cigarettes.

MATRICES

OUTCOMES

- ✚ Present data from real life in matrix form.
- ✚ State order of matrices.
- ✚ Add and subtract matrices.

- ✚ Multiply a matrix by a scalar.
- ✚ Multiply matrices.
- ✚ Apply matrices in real life.

KEY POINTS

- A **matrix** is a rectangular array of number arranged in rows and columns. The numbers contained in a matrix are called elements (or members) of a matrix.
(these entries are arranged in rows and columns)
- The **order** of a matrix is an expression of the number of rows and columns of a matrix. Written in the form **a x b**
- There are different types of matrices and these include; **square** matrix, **column** matrix, **row** matrix, **zero** matrix and **identity** matrix.
- We add/subtract matrices of the **same order** and the addition/subtraction involves the corresponding elements.
- To multiply a matrix by a scalar (a number), we multiply each element of the matrix by the scalar (number).
- We can only multiply two matrices if the number of elements in the row of a multiplier (the first matrix) equals the number of elements of a column in the multiplicand (the second matrix).

155) Write the order of the following matrices

$$\text{i) } A = \begin{pmatrix} 1 & 2 & 4 & -1 \\ 0 & 2 & 1 & 1 \end{pmatrix}$$

$$\text{ii) } B = \begin{pmatrix} -1 & 0 & -1 & 0 \end{pmatrix}$$

$$\text{iii) } C = \begin{pmatrix} 4 & 3 \\ 2 & 1 \\ 1 & 0 \end{pmatrix}$$

$$\text{iv) } D = \begin{pmatrix} 1 \\ 10 \\ 12 \end{pmatrix}$$

156) Given that $A = \begin{pmatrix} 1 & -4 & 2 \\ 3 & 1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -2 & 1 \\ 6 & 8 & -7 \end{pmatrix}$, find

$$\text{i) } A - 2B$$

$$\text{ii) } -B$$

$$\text{iii) } \frac{1}{2}A + \frac{1}{2}B$$

157) Work out

$$\text{a) } \begin{pmatrix} 4 \\ -4 \end{pmatrix} + \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$\text{b) } 5 \begin{pmatrix} 2 \\ -3 \end{pmatrix}$$

$$\text{c) } \begin{pmatrix} 3 & 4 \end{pmatrix} \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

158) $\mathbf{a} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ 5 \end{pmatrix}$, work out $\mathbf{a} - 2\mathbf{b}$

SIMILARITY AND CONGRUENCY

OUTCOMES

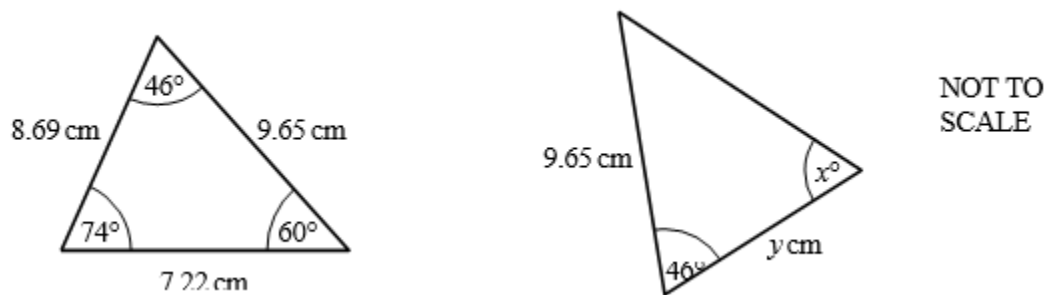
- ✚ Illustrate properties of different figures in order to determine similarity.
- ✚ Establish conditions of similarity.
- ✚ Solve problems involving similarity.
- ✚ Illustrate properties of different figures in order to determine congruency.

- ✚ Establish conditions of congruency.
- ✚ Solve problems involving congruency.
- ✚ Use similarity and congruency to solve problems in real life.

KEY POINTS

- Need a sound background of ratios and proportions
- Two triangles are congruent if their corresponding angles and corresponding sides are equal.
- Two triangles are similar if the corresponding angles are equal and the corresponding sides are proportional.
- When taking the ratios of the sides involved in calculations, sides of the same triangle should appear either in the numerator or in the denominator.

159)

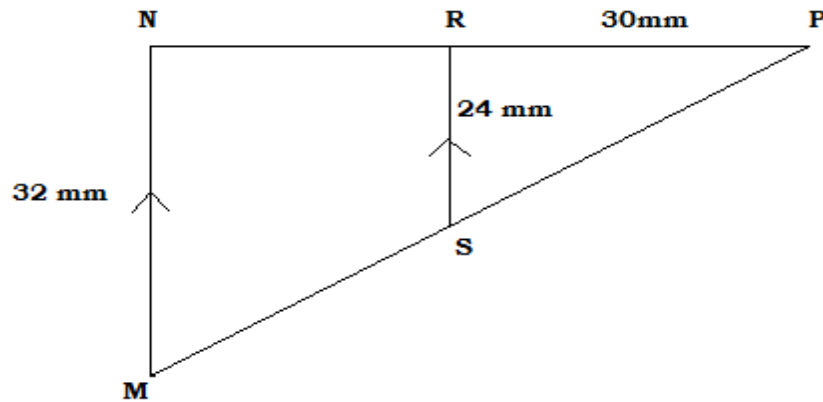


These two triangles are congruent.

Write down the value of

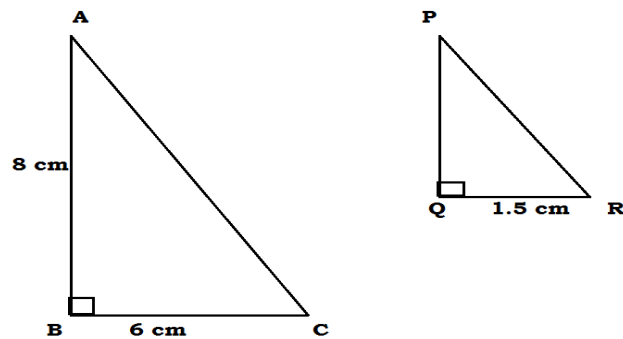
- x
- y

- 160) The perimeter of a rectangular field is 192 metres. The ratio of its length and breadth is 5:3. Calculate its area.
- 161) Write all the conditions for congruency of triangles.
- 162) In the figure $PR = 30\text{ mm}$, $RS = 24\text{ mm}$ and $MN = 32\text{ mm}$. Calculate RN .

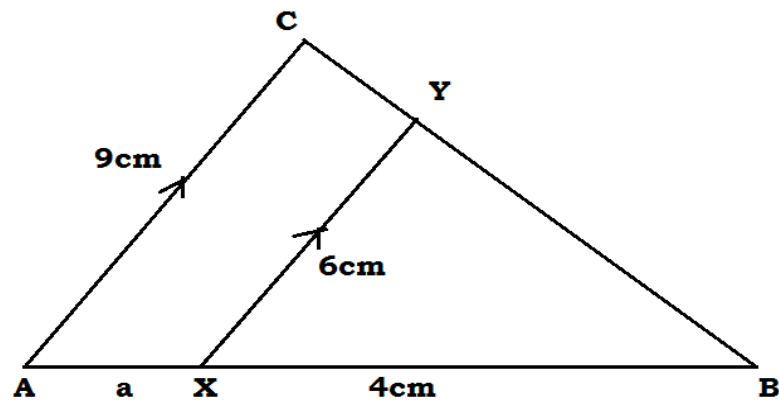


163) Triangle ABC and PQR are right-angled. Angle ACB = angle PRQ. AB = 8cm, BC = 6cm and QR = 1.5 cm.

Calculate
 a) AC
 b) PQ



164) In the diagram below, AC is parallel to XY. XB = 4cm, AX = a cm, XY = 6cm and AC = 9cm. Find the value of AB.



PROBABILITY

OUTCOMES

- ✚ Describe the meaning and.
- ✚ Determine outcomes of an experiment.

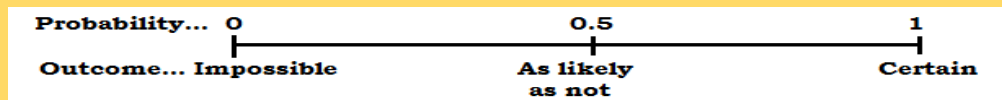
- ✚ Demonstrate favourable and possible outcomes.
- ✚ Interpret probability values.

KEY NOTES

- Where an experiment has several equally likely outcomes, the probability of a 'favourable outcome'

$$= \frac{\text{the number of favourable outcomes}}{\text{the number of possible outcomes}}$$

- If the probability of an outcome of an experiment is P , then the probability that the outcome will not happen is $1-P$.
- $0 \leq P \leq 1$
- Probability can be illustrated on a number line as shown below;



- In a number of trials the expected frequency of an outcome = the probability of the outcome $\times$ the number of trials.

165) A fair coin is tossed twice. List all the possible outcomes

- 166) a) What is the probability of an outcome which is certain to happen?
 b) What is the probability of an outcome which cannot take place?
 c) Between what two numbers must the probability of an outcome lie?

- 167) For the roll of a fair Six sided die, calculate the probability of getting;
- A 5
 - A 2
 - A 7
 - An even number
 - An odd number
 - An (even number) + (odd number)

- 168) If the probability that it will rain tomorrow is 0.35, what is the probability that it will not rain tomorrow?

- 169) The probability that an event will occur is $\frac{1}{8}$, what is the probability that it will not occur.

- 170) A bag contains 2 oranges and 3 apples. Taonga randomly picks a fruit and eats it. After some time, she randomly picks another fruit and eats it. What is the probability that;
- a) The first fruits she ate was an apple.
 - b) The second fruit she ate was an apple.
- 171) What is the probability of drawing a vowel from a bag containing the letters of the English alphabet?
- 172) a) The probability that ZESCO United wins the cup is 0.18. Work out the probability that they do not win the cup.
- b) After training, the shirts are washed. There are 5 red, 3 blue and 6 green shirts. One shirt is taken from the washing machine at random. Find the probability that it is;
- i) red
 - ii) blue or green
 - iii) white

COMPUTERS

OUTCOMES

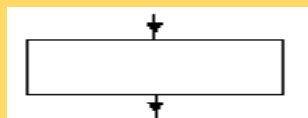
- ✚ Construct decision boxes.
- ✚ Identify and create loops in flow charts.
- ✚ Write simple computer programmes.
- ✚ Describe computer processes.
- ✚ Construct flow charts
- ✚ Use simple programmes to calculate area, volume, find averages and resolve linear equation.

KEYS POINTS

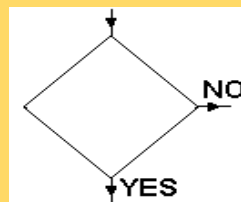
- A flowchart is a graphical representation of an algorithm.
- These flowcharts play a vital role in the programming of a problem and are quite helpful in understanding the logic of complicated and lengthy problems.
- All the flow charts we will be looking at begin with a Start Point and finish with an End Point.



- Most of the boxes on a flow chart are instructions, which tell you what to do next. These appear in rectangular boxes.



- (Decision) Sometimes a question needs to be answered to decide what instruction should happen next. These questions are put in decision boxes



- Once the flowchart is drawn, it becomes easy to write the program in any high level language.
- Often we see how flowcharts are helpful in explaining the program to others. Hence, it is correct to say that a flowchart is a must for the better documentation of a complex program
- A loop is a series of steps that are repeated until a condition is satisfied.

173) Write a flow chart to subtract 4 repeatedly, starting from 30 until the difference is smaller than 0.

- 174) The flow chart below shows how a company calculates agents's commission based on monthly sales. Mrs. Chirwa, an agent at this company, made sales of K 4 780.00 in one month. Calculate Mrs. Chirwa's commission in that month
- 175) Make a flow chart for solving the following equation; $2x - 3 = 11$
- 176) Make a flow chart for converting marks out of 150 to percentages.
- 177) Draw a flow chart for the mapping $x \rightarrow 3x - 1$, and use it to complete the ordered pairs (1,), (2,), (5,)
- 178) Both ZNBC and Muvi have advertised that they will beam the same football match. Chewie wants to watch the game. Draw a flow chart for Chewie.
- 179) Mapalo goes to school in the afternoon. He has just noticed that his shirt is dirty. Here are some steps he takes;
- 180) Here are some jumbled-up instructions for making vitumbuwa;

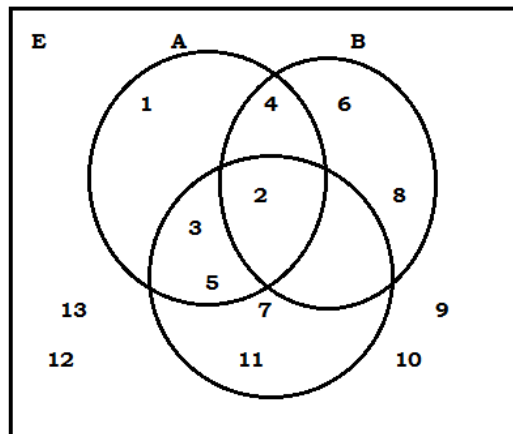
STOP
Fry sets of vitumbuwa
Is the dough ready
Mix correct ingredients
START
Put oil in the pan
Make fire
Allow dough to get ready

Re-arrange these instructions and then make a flow chart.

- 181) Establish whether or not a number is divisible by 3.
- 182) Make a flow chart for calculating the selling price of goods during a sale. On goods marked at less than K 150, the discount is 5%; on goods marked K 150 or more the discount is 10%.

SOLUTIONS

- 1)
 - i. true
 - ii. true
 - iii. true
- 2)
 - i. $E = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$
 $P = \{2, 3, 5, 7, 11, 13\}$
 $Q = \{1, 2, 3, 4, 6, 12\}$
 - ii. $P \cap Q = \{2, 3\}$
 - iii. $n(Q') = 9$
- 3)
 - i. $n(E) = 21$
 - ii. $n(A') = 11$
- 4) $-3 < x \leq 3$
- 5)
 - i. 16
 - ii. 5
 - iii. $y = 2$
- 6)
 - i. $n(M) = 8$
 - ii. $n(M \cup B) = 12$
 - iii. $M \cap (D \cup B') = \{\text{Taziya, Mwamba, Bupe, Peter, Sarah}\}$
 - iv. 8 subsets
- 7) $C \cup (A \cap B)$
- 8) i.



- ii.
 - (a) $A' = \{6, 7, 8, 9, 10, 11, 12, 13\}$
 - (b) $(A \cup B \cup C)' = \{9, 10, 12, 13\}$
 - (c) $(A \cap B) \cup C = \{2, 3, 4, 5, 7, 11\}$
 - (d) $C' \cap B' = \{1, 9, 10, 12, 13\}$
- 9) $n(P \cap S) = 4$
- 10) $X = \{-4, -3, -2, -1, 0, 1, 2\}$
- 11)

- i. -8
 - ii. -8
 - iii. 35
 - iv. -13
 - v. 70
 - vi. $\frac{-58}{18}$
 - vii. -144
 - viii. 0
 - ix. -7
 - x. -9
- 12) i. 3
- ii. -3
 - iii. -10
 - iv -252
 - v -24
- 13) i.2
- ii. 2
 - iii. 3
 - iv. 0
 - v. 4
- 14) i. 7.34×10^3
- ii. 7.41×10^1
 - iii. 4.8×10^{-7}
 - iv. 82.475
 - v. 0.6
 - vi. 2.79×10^4
- 15) 4500kg
- 16) i. 930 000
- ii.940 000
 - iii.940 000
- 17) 5.06×10^6
- 18) 5.7×10^3
- 19) 1.6×10^6
- 20) 84.60cm
- 21) i. 340.0
- ii. 60
 - iii. 23, 900
- 22) 0.01km
- 23) 204 000

- 24) i. 1:4
 ii. 3: 9
 iii. 3: 4: 8
 iv. 7cm: 11cm
 v. 5kg: 50g.....100g: 1kg
 vi.
 vii. 1: 3
- 25) K 2 400 : K4 000
- 26) 13: 15
- 27) 10 days
- 28) 36m
- 29) i. K 13 200
 ii. 200km
- 30) 1: 3
- 31) K 2, 400 profit
- 32) 30 men
- 33) 2160m^2
- 34) 9.72m
- 35) 4 months
- 36) \$ 105
- 37) 600
- 38) 210
- 39) a. $13x - 8y$
 b. $3x^6y^4$
 c. $x - 13y$
- 40) a. $3xy(2y + 1)$
 b. $4a^2 - b^2$
 c. $5a(3a^2 - b)$
 d. $3x(3x + 2y)$
- 41) $2(b + c) + a$
- 42) i. 0.5
 ii. $-1\frac{1}{6}$ $x=3, y=4 \text{ and } z=-2$
- 43) i. 14
 ii. 20
- 44) $\frac{1}{4}$
- 45) i. $x+y$
 ii. $x+(x+2)$
 iii. $p-q$

iv. $\frac{q}{2}$

v. $2k-3r$

vi. $\frac{x-y}{5}$

46) $\frac{3b+2a}{2ab}$

47) a. $n=30$

b. $x=3$

c. $m=2$

d. $x=2$

48) i. $B=xn$

ii. ny

iii. $P=N + xn-ny$

49) $x=70$

50) 7cm

51) 34km

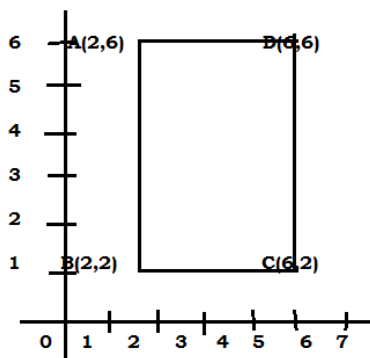
52) a. 9, 1 and 4 respectively

b. 2, 0 and 4 respectively

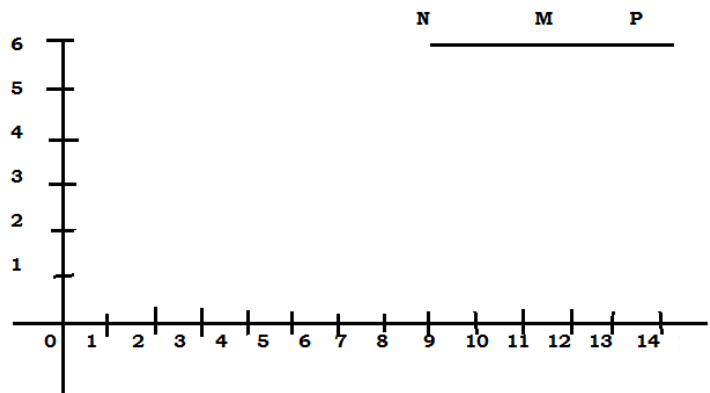
c. the point is V

53)

a)



b)



54) a. $y=x$

b. $(4,0)$

55) i. kite

ii. $P(-2,2)$ $Q(2,4)$ $R(6,2)$

56) $D(2,-2)$

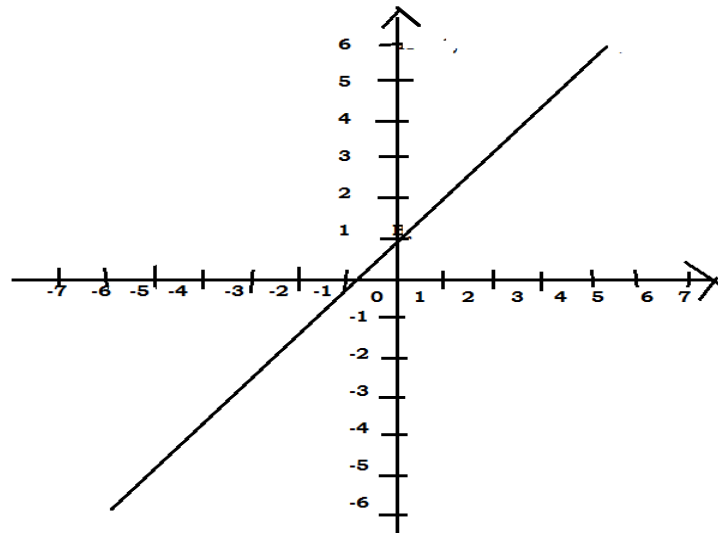
57) a. image is 8.

b. image is 11

58) Image of 2 is 2 and the image of 5 is -1.

59) Image of $D = \{-2, -1, 0, 1, 2, 3, 4, 5\}$

i.



ii. same as above

60) $X = -15$

61) 7

62) -11

63) 1

64) a. $\frac{1}{6}$ b. $\frac{-1}{3}$

65) a. Cuboid
b. Cone
c. Square based pyramid
d. Rectangular prism
e. Triangular based pyramid
f. Closed cylinder

66) Diagram

67) Diagram

68) Diagram

69) Diagram

70) $P = 13p - r$

71) 6cm

72) 400cm^3

73) 3000people/km^2

- 74) Volume= 44339.904cm^3
Mass= 886798.08g
Area= 6994.092cm^2
- 75) 21cm^2
- 76) a. Trapezium
b. $25,200\text{cm}^2$
- 77) a. 300.763cm^3
b. 269.34cm^2
- 78) $x=10$
- 79) 44.5cm^2
- 80) a. 44cm
b. 10cm
- 81) a. acute
b. reflex
c. parallel
d. perpendicular
- 82) a. $a=74^\circ$
b. $b=53^\circ$
- 83) a. 138°
b. Obtuse angle.
- 84) (use scale drawing)
- 85) Use scale drawing for a, b, and c.
- 86) i. 85°
ii. 45°
- 87) 52°
- 88) 83°
- 89) i. 62°
ii. 26°
- 90) Diagram to scale
- 91) Diagram to scale
- 92) Diagram to scale
- 93) Diagram to scale
- 94) Diagram to scale
- 95) Diagram to scale
- 96) Diagram to scale
- 97) Diagram to scale
- 98) Diagram to scale
- 99) Diagram to scale
- 100) Diagram to scale
- 101) 4, 4 and 10.

- 102) $X=8$
 103) 84^0
 104) a. 40.3^0
 b. August
 105) a. 200 bags b. 2000 bags
 106) 4 hours
 107) 118 years
 108) i. 22 pupils
 ii. 10 failed
 109) Ff
 110) Fff
 111) Ff
 112) Ff
 113) Ff
 114) Fff
 115) Ff
 116) 1.775
 117) i. 4
 ii. 5
 iii. 16
 iv. 6
 v. 11
 118) a. 9
 b. 8
 119) a. p^{10}
 b. t^3
 c. $-5x^4$
 d. $\frac{1}{2}q^2$
 e. $2p$
 f. $4r$
 120) $K=4$
 121) i. $3q^4 \times 5q$
 ii. $15q^8$
 iii. t^4
 122) i. 72
 ii. 77
 123) 11
 124) -25, $\frac{1}{3}$, 0.5 and 2.
 125)

Square numbers	Prime numbers	Odd numbers	Irrational numbers
4, 16, 25, 81	29, 3, 5, 13, 23, 41	3, 5, 13, 25, 23, 1, 41, 81, 29	$\sqrt{7}$

126)

- i. True
- ii. True
- iii. False
- iv. False
- v. True
- vi. True
- vii. False
- viii. False
- ix. False
- x. False
- xi. True
- xii. False

127) a. 2, 5, 7

b. 36

c. 0.02, 2, $\frac{3}{4}$, 45, 36, 5, 17

d. π , $\sqrt{2}$

128) $\sqrt{2^2 \times 3^2 \times 7^2} = 2 \times 3 \times 7 = 42$

129) If we are able to re-write a repeating decimal as a common fraction, that gives the proof.

130) 10cm

131) 6cm

132) 25cm

133) 030°

134) 0.9km

135) 045°

136) Use scale drawing

137) Use scale drawing

138)

- i. $X=1$
- ii. $X=12$
- iii. $X=1/4$
- iv. $X=4$
- v. $X=4$
- vi. $X=7$
- vii. $X=6$

viii. $X=16$

ix. $X=5$

139) a. $x \leq 5$ b. $x \leq \frac{3}{2}$

140) 105 cubic units

141) $x \geq 3$

142)

i. $X=-1$ and $y=2$

ii. $X=5$ and $y=-3$

iii. $X=-5$ and $y=-2$

iv. $X=1$ and $y=-4$

v. $X=2$ and $y=-3$

143) K 240

144) a. 2400 b. $37\frac{1}{2}$ hours

145) K 2 per unit

146) K 230

147) K 211.20

148) K 560

149) K 289

150) K3600

151) K9000

152) K 30

153) K 9500

154) K 450

155) i. $2*4$

ii. $1*4$

iii. $3*2$

iv. $3*1$

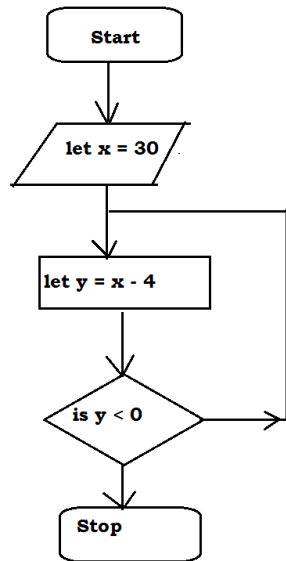
156) i. $\begin{pmatrix} -3 & 0 & 0 \\ -9 & -15 & -14 \end{pmatrix}$

ii. $\begin{pmatrix} -2 & 2 & -1 \\ -6 & -8 & 7 \end{pmatrix}$

iii. $\begin{pmatrix} 1\frac{1}{2} & -3 & 1\frac{1}{2} \\ \frac{9}{2} & \frac{5}{2} & \frac{-7}{2} \end{pmatrix}$

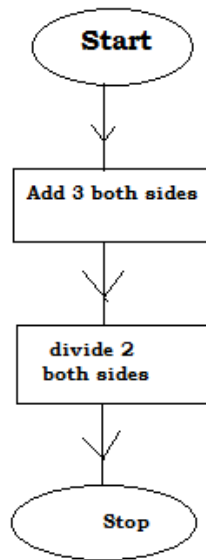
157) a. $\begin{pmatrix} 7 \\ -5 \end{pmatrix}$

- b. $\begin{pmatrix} 10 \\ -15 \end{pmatrix}$
 c. (26)
- 158) $\begin{pmatrix} 6 \\ -13 \end{pmatrix}$
- 159) 8.69cm
- 160) 2160cm²
- 161) SSS, SAS, ASA, AAS and RHS or HL
- 162) 10 units.
- 163) a. 10 units
b. 2.5 units
- 164) 6 cm
- 165) HH, HT, TH, TT
- 166) a. 1 b. 0 c. 0-1
- 167)
- i. $\frac{1}{6}$
 ii. $\frac{1}{6}$
 iii. 0
 iv. $\frac{1}{2}$
 v. $\frac{1}{2}$
 vi. $\frac{1}{2} + \frac{1}{2} = 1$
 vii.
- 168) 0.65
- 169) $\frac{7}{8}$
- 170) a. $\frac{3}{5}$ b. $\frac{2}{4}$ or $\frac{1}{2}$
- 171) $\frac{5}{26}$
- 172) a. $P(L) = 0.82$
b.
- i. $\frac{5}{14}$
 ii. $\frac{3}{14} + \frac{6}{14} = \frac{9}{14}$
 iii. $P(W)=0$
- 173)

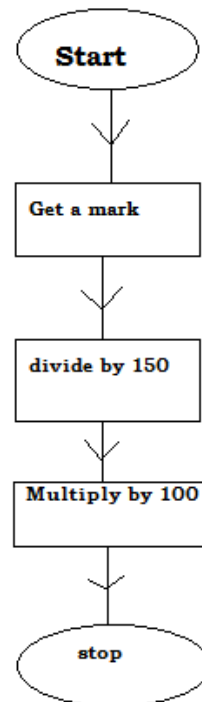


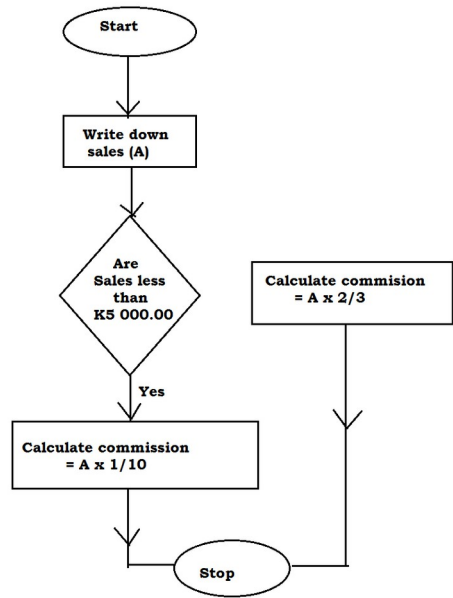
174)

175



176





179)

Start
Wash the shirt
Put it on the line to dry
Keep on checking to see if it is dry
Iron it
Wear it
Go to school
Stop

