KATANGALELE TUITION CENTRE

GRADE 12 & G.C.E MATHEMATICS (4024)

QUICK REVISION OF SOME MAJOR TOPICS IN

MATHEMATICS PAPER 1 SYLLABUS D

TOPIC 1: ALGEBRA

EXAMPLES

1. Expand and Simplify each of the following

    (a) $2(a - 3b) - 2(3a - b)$

    (b) $2k - (3 - k) + 6$

    (c) $(2 - b)(b - 3)$

    (d) $7b - 2a - 3(b - a)$

    (e) $4(x + y) - (3x - 8y)$

2. Factorise each of the following

    (a) $3x^2 - 3$

    (b) $av^2b - 9ab^3$

    (c) $c^2 - bd + bc - bd$

    (d) $\frac{x^2}{4} - \frac{9}{y^2}$

    (e) $2x^2 - x - 3$

TASK

1. Simplify

    (a) $3b - 7c - 2(b - 3c)$

    (b) $3xy - x(2 - 4y) - 5x$

    (c) $(a - 2)^2$

    (d) $3(a + 5) - a(a - 2) - 4a^2$

2. Factorise the following completely

    (a) $2x^2 - 18$

This Paper consists of 22 printed pages

(b) $km - 6ln + 3kn - 2lm$

(c) $\frac{1}{x^2} - \frac{25}{y^2}$

(d) $2k^2 - 6k + 4$

3. Given that $a^2 + b^2 = 100$ and $ab = 20$, find the numerical value of $(a + b)^2$.

TOPIC 2: COORDINATE GEOMETRY

EXAMPLES:

1. Find the gradient of the line joining the line AB, where A(2,0) and B(6, −4).

2. The gradient of the point $(4, k)$ and $(3, 6k)$ is 7, find k.

3. Write down the gradient of the equation $3y - 4x = 6$.

4. Given that the midpoint of the points $(2y, 6)$ and $(4,6)$ is $(4,3)$, find the value of y.

5. Find the equation of the straight line passing through the point (4,3) and its

   (a) Parallel   (b) perpendicular to the equation $4y - x = 12$.

6. Given that A is a point $(5, 4)$ and B is a point $(8, 8)$, find the length of the line AB.

TASK

1. Given that C is a point $(2, 3)$ and D is the point $(5, -4)$. Find

   (a) the gradient of the line CD,

   (b) the equation of the line CD,

   (c) the midpoint of the line CD.

2. A straight line L is given by the equation $2y - 4x = 8$.

   (a) Write down the gradient of this line,

   (b) Find the equation of the line which passes through (2,0) and its parallel to l.

3. Find the equation of the straight line that is perpendicular to $3y = 6x - 3$ and it passes through(−3,2).

4. A straight line passing through A(3,2) and B(5, y) has a gradient of −2. Find the value of y.

5. Find the length of the line AB where A $(3,4)$ and B$(-5,-2)$.

TOPIC 3: INDEX NOTATION

EXAMPLES:

1. Evaluate each of the following

    (a) $5^0 + 5^1$ **(b)** $\left(\frac{2}{3}\right)^0 \times \left(\frac{2}{3}\right)^{-2}$ **(c)** $\sqrt[4]{16}$ **(d)** $\sqrt{4}$

2. Simplify each of the following

    (a) $8^1 \times 8^{-2}$ **(b)** $\left(y^{\frac{2}{3}}\right)^{-\frac{3}{2}}$ **(c)** $8z^3 \div 4z^4$ **(d)** $27^{\frac{1}{3}} \times 27$

3. Given that $x = 5^2 \; and \; y = 5^{-4}$. evaluate the following

    (a) xy **(b)** $\frac{x}{y}$

4. Solve the following equations

    (a) $x^0 + x^2 = 5$ **(c)** $25 \times 5^x = 1$

    (b) $4^x = 16$ **(d)** $2^{2x-1} = 16^{-2x}$

TASK

1. Evaluate the following

    (a) $\left(\sqrt{9}\right)^{-2}$ **(b)** $\left(\frac{25}{9}\right)^{-\frac{1}{2}} + \left(\frac{x}{y}\right)^0$ **(c)** $\left(\sqrt[3]{64}\right)^2$ **(d)** $5^0 \times 5^1$

2. Simplify the following

    (a) $\left(x^3\right)^{-\frac{1}{3}}$ **(b)** $y^2 \div y$ **(c)** $8 \times 2^{-2} \times 4$

3. Given that $a = 4 \times 10^4$ and $b = 2 \times 10^2$. Evaluate

    (a) ab **(b)** $a \div b$

4. Solve the following equations

    (a) $2^x = 4$ **(d)** $3^{3x-1} = 27^{-3x}$

    (b) $25^x = 1$ **(e)** $2^{2m-3} = 8^m$

    (c) $2^4 \div 2^1 = 8^x$ **(f)** $3 \times 9^x = 1$

TOPIC 4: FUNCTIONS

EXAMPLES

1. Given that $f(x) = 2x - 5$ and $g(x) = x + 3$. Find

   (a) $f^{-1}(x)$

   (b) $f^{-1}(-10)$

   (c) $gf(x)$

2. Given that $f(x) = 8x$ and $g(x) = \frac{3x-2}{4}$, find

   (a) $f^{-1}(x)$

   (b) an expression for $gf(x)$

   (c) the value of x for which $fg(x) = 20$

3. The functions f and g are defined by $f(x) = 2x + 1$ and $g(x) = 5x - 1$. Find

   (a) $g^{-1}(x)$

   (b) $fg(x)$

   (c) $fg(-3)$

4. The functions g and f are defined as $g: x \to \frac{x-1}{2}$ and $f: x \to 3x - 5$. Find

   (a) $g^{-1}(x)$

   (b) x, if $f(x) = g(x)$

   (c) $g^{-1}f(x)$

TASK

1. Given that $f(x) = \frac{5x+4}{5}$ and $g(x) = x - 1$. Find

   (a) $f^{-1}(x)$

   (b) $f^{-1}(-2)$

   (c) $gf(x)$, in its simplest form.

2. Given that $f(x) = 2x - 3$ and $g(x) = \frac{3x+1}{x+2}, x \neq 2$, find

   (a) $f^{-1}(x)$

   (b) $f^{-1}(11)$

   (c) $gf(x)$

TOPIC 5: SETS

EXAMPLES:

1. **(a)** Given that E = {1,2,3,4,5,6,7,8,9,10} $A = \{x: x \le 7, x \in E)$
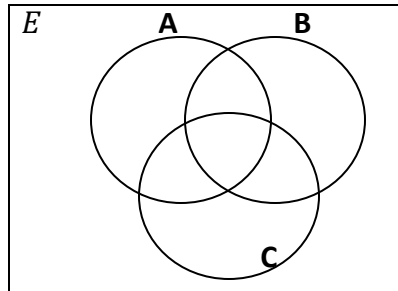
    (i)   List A **(ii)** list $E \cap A$

  (b) Use the set builder notation to describe the shaded region in the diagram below
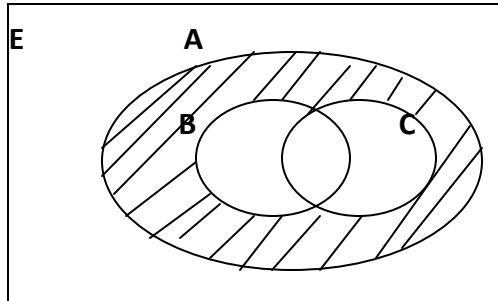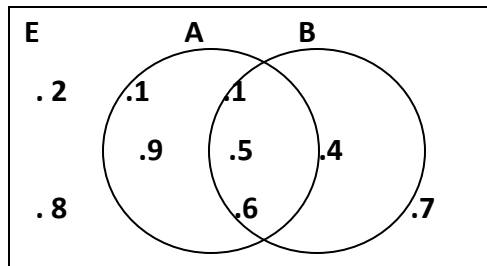

2. **(a)** Given that $E = \{1, 2, 3, 4, 5, 6, 7, 8\}, A = \{1, 2, 4, 5\} and B = \{2, 3, 4, 5, 6\}$. List $(A \cup B)'$
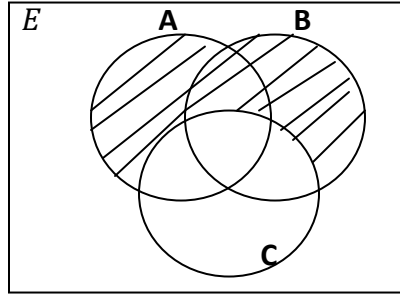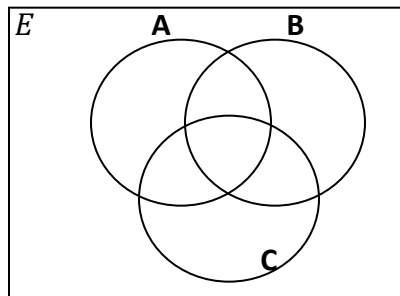
  (b) Shade $B' \cap (A \cap C)$ in the diagram below

3. **(a)** The Venn diagram below shows sets A and B. List $A' \cap B$

  (b) Use the set builder notation to describe the shaded region in the Venn diagram below.
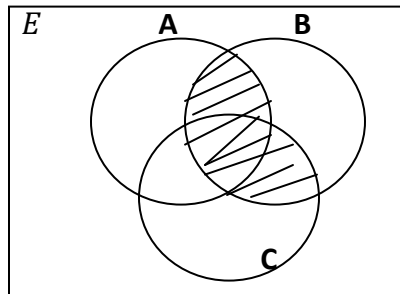
TASK

1. **(a)** Give that $E = \{2, 4, 6, 8, 10, 12 \}$, $A = \{ 4, 8, 12 \}$ and $B = \{ 2, 10, 12\}$. list $A' \cap B$

    (b) On the Venn diagram below, shade the region defined by $A' \cap (B \cup C)$

2. **(a)** Given that $E = \{1, 2, 3, 4, 5, 6, 7, 8\}, A = \{ 1, 8 \}$ and $B = \{2, 3, 4, 5, 6, 7\}$. List $(A \cup B)'$

    (b) Use the set builder notation to describe the shaded region in the Venn diagram below.

3. Given that $E = \{ a, b, c, d, e, f , g, h\}, P = \{ a, c, f)$ and $Q = \{ b, c , f)$.

    (a) Find $n(P \cup Q)'$

    (b) List $(P \cup Q)'$

TOPIC 6: VARIATION

EXAMPLES:

1. It is given that y varies directly as the square of x and that $y = 12$ when $x = 2$. Find

   (a) An expression connecting y, x and k, the constant of variation.

   (b) the values of x when $y = 36$.

   (c) the value of y when $x = 4$

2. It is given that $t = kv^2$, where k is a constant of variation

v	1	b	5
t	4	36	a

   Use the information given in the table to find

   (a) value of k,

   (b) value of a,

   (c) values of b.

3. It is given that y varies as x and inversely as the square of z and that $x = 3$ when $y = 6$ and $z = 2$, find the value of

   (a) the constant of variation k,

   (b) y when $x = 4$ and $x = 8$

   (c) z when $x = 9$ and $y = 2$

TASK

1. Given that v varies directly as the square root of x and that $v = 12$, when $x = 9$. Find the value of

   (a) k, the constant of variation,

   (b) x when $v = 36$

   (c) v when $x = 4$

2. Two variables x and y have corresponding values as shown in the table below.

x	2	3	a
y	20	40	104

Given that y varies directly as $(x^2 + 1)$, find the,

(a) constant of variation, k,

(b) equation connecting y and x,

(c) values of a

3. It is given that w varies directly as the square of v and inversely as u.

(a) Write down an expression for w, in terms of v, u and k, the constant of variation.

(b) If $v = -6, u = 12$ and $w = 15$, find k,

(c) Find the value of u when $v = 8 \; and \; w = 20$.

4. y varies directly as the square of x and $y = 96$ when $x = 4$. Find the,

(a) value of k, the constant of variation

(b) value of $y \; when \; x = 5$

(c) value of x when $y = 24$.

TOPIC 7: CALCULUS

EXAMPLES

1. Differentiate $y = \frac{1}{4}x^4 - 2x^3$.

2. Integrate $(4x^3 - 2x)$ w.r.t x.

3. Determine $\int (5x^3 - 4)dx$

4. Find the derivative of the function $y = 2x^3 - 2x^{-2} - 3x + 4,$ with respect to x.

5. Given that $y = 4x^4 - 5x^3 + 2x^2 - 4x + 2$, find $\frac{dy}{dx}$.

6. If $y = \frac{2}{x} - x^2$, find $\frac{d^2y}{dx^2}$

TASK

1. Find the derivative of $y = -4x^{-2} - 8x$, with respect to x.

2. Determine $\int (t^3 - t^2)dt$

3. If $w = 3r^3 - 3r^{-1} + \frac{6}{r}$. Find

    (a) $\frac{dW}{dr}$

    (b) $\int w\,dr$

4. Differentiate the function $y = 3x^5 - 3x^4 - 3$

5. If $v = 12s^2 - \frac{4}{s}$, find $\frac{dv}{ds}$ at $s = -1$

6. Find the second derivative of the function $y = x^5 - 3x^4 - 2x^{-3} - 5x + 3$.

TOPIC 8: MATRICES

EXAMPLES:

1. Given that M= $\begin{pmatrix} 1 & -2 & 5 \\ 2 & 4 & -6 \end{pmatrix}$, find M^T

2. Given that the transpose of a matrix B is $(1 \quad 2 \quad 3 \quad -4)$, write down the matrix B.

3. Express $(2 \quad 3 \quad 4)\begin{pmatrix} 1 & -1 & 3 \\ 3 & 0 & 4 \\ 4 & 2 & 6 \end{pmatrix}$ as a single matrix.

4. Give that $C = \begin{pmatrix} 1 & 4 \\ 2 & 6 \\ 3 & 7 \end{pmatrix}$ and $D = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \end{pmatrix}$. Express CD as a single matrix.

5. Given that $A = \begin{pmatrix} 2 & x \\ -5 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $C = \begin{pmatrix} 14 \\ -17 \end{pmatrix}$, find the value of x if $AB = C$

6. Find the transpose of the matrix $A = \begin{pmatrix} 1 & 3 & -1 & 1 \\ 2 & 0 & 1 & 4 \end{pmatrix}$.

TASK

1. Given that $A = \begin{pmatrix} 3 & 2 & 1 \\ 4 & 3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 0 & 1 & 0 \end{pmatrix}$, find

    (a) the transpose of A

    (b) AB as a single matrix

2. Given that $Q^T = \begin{pmatrix} 1 & 3 & 4 \\ 2 & -2 & 1 \\ 3 & 0 & 2 \end{pmatrix}$, find Q.

3. Given that $M = (-2 \quad 1 \quad 4)$, find the transpose of the matrix M.

4. If $\begin{pmatrix} x & 3 & 4 \\ 2 & -1 & 0 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 16 \\ 4 \end{pmatrix}$, find the value of x.

5. Express the following matrices as a single

    (a) $\begin{pmatrix} -1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 0 & -3 \end{pmatrix} \begin{pmatrix} 3 & 2 & 0 \\ 2 & 3 & 1 \\ -2 & 1 & 2 \end{pmatrix}$

    (b) $\begin{pmatrix} 1 & 2 \\ 3 & -1 \end{pmatrix} \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

TOPIC 9: ESTIMATION

EXAMPLE

1. The length of a wire is 5.0 cm, what is the

    (a) Absolute error,

    (b) Relative error

2. The true length of a wire is given by 20.6m. Peter was given to measure this length using a meter tape and he estimated it to be 20m. Find
    (a) The absolute error of this measurement
    (b) The relative error
    (c) The percentage error
    (d) The maximum length Peter could have measured
3. The bag of cement measures (75.25 ± 0.005)kg. Find the
    (a) The tolerence,
    (b) The relative error as a fraction in its lowest terms.
    (c) The maximum mass of cement.

4. A mass of a baby is 25 kg. complete the statement below.

………………………… $\leq m <$ ………………………

TASK

1. Find the percentage error of a mass of sugar that weighs 10.00kg correct to 2 decimal.

2. A bag of potatoes has a mass of (15.4 ± 0.05) kg.

   (a) Find the tolerance of the mass

   (b) Write down the relative error as a fraction in its lowest terms.

   (c) Find the lowest mass

3. Misozi and Filamaba estimated the length of a line as 9cm and 10cm respectively. If the true length of the line is 9.6cm, find

   (a) Misozi's absolute error

   (b) Filamba's percentage error

4. (a) The length l, of a line is measured to be 8.1 cm, correct to 1 decimal place. Complete the statement about l : ………………… $\leq l <$ …………………..

   (b) The mass of a bag of mealie meal is 25.3kg measured correct to 1 decimal place. What is its relative error?

TOPIC 10: QUADRATIC EQUATIONS & FUNCTIONS

EXAMPLES:

1. Solve the following equations

   (a) $2x^2 = 18$

   (b) $(2x - 1)^2 = 9$

   (c) $(x - 2)(x + 3) = 0$

   (d) $x^2 = 3x$

2. The diagram below shows a sketch of the graph of $y = x^2 - 6x + 8$, cutting the y −axis and x −axis at A, B and C respectively.
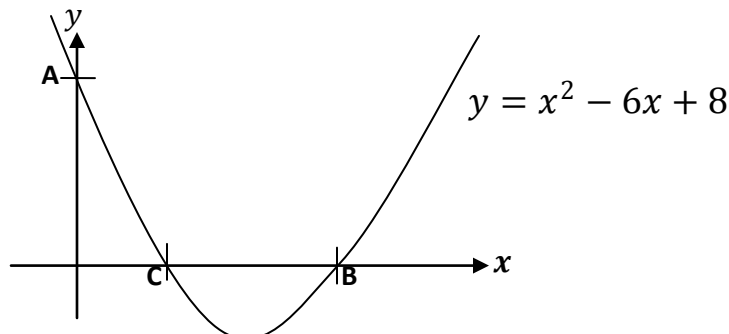
Find

(a) the coordinates of A, B and C.

(b) the coordinates of the turning point,

(c) the line of symmetry of the graph.

3. The diagram below represents a graph of the form $y = ax^2 + bx + c$

$y = ax^2 + bx + c$
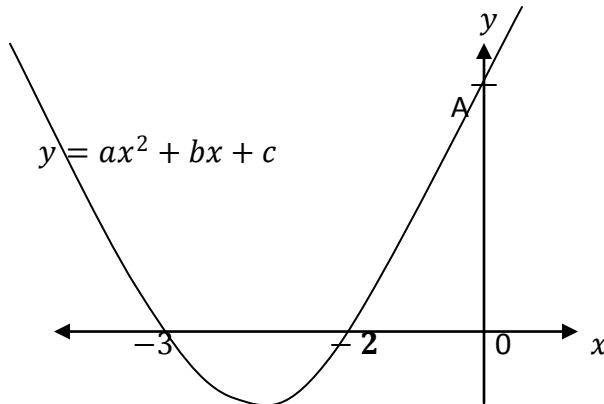
Find

(a) the values of a, b and c,

(b) the coordinates of A.

TASK

1. Solve the equation

(a) $2(x - 2)^2 = 18$

(b) $x(x^2 - 4) = 0$

(c) $(x - 4)(2x + 6) = 0$

(d) $x^3 - 9x = 0$

2. The diagram below shows a sketch of the graph of $y = -x^2 - 2x + 3$, passing through the points P, Q and R.
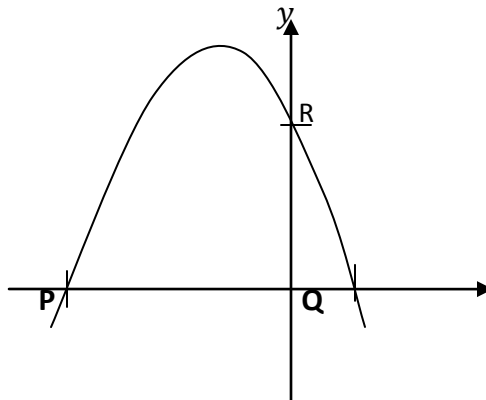
Find the

(a) coordinates of P, Q and R,

(b) equation of the axis of symmetry,

(c) the coordinates of the turning point

(d) the maximum value.

3. The diagram below shows the sketch of the graph of $y = x^2 - 2x$.
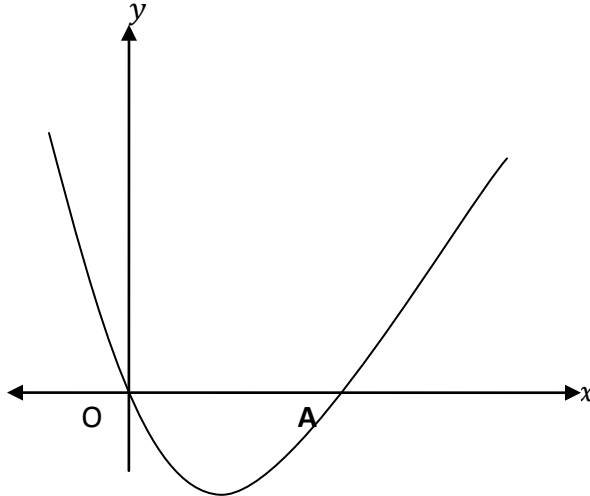
(a) Find the coordinates of the point where the curve cuts the $x - $ axis

(b) Find the coordinates of the turning points.

(c) What is the minimum value of the function?

(d) What is the equation of the axis of symmetry?

TOPIC 11: LINEAR INEQUALITIES

EXAMPLES

1. A region **R** is defined by the following inequalities.
   $x > -1, y \leq 6, x \leq 4$ and $x - y < 2$
   Show the above inequalities on an XOY plane by shading the unwanted region.

2. Write down four inequalities that defines the unshaded region R on the diagram below.
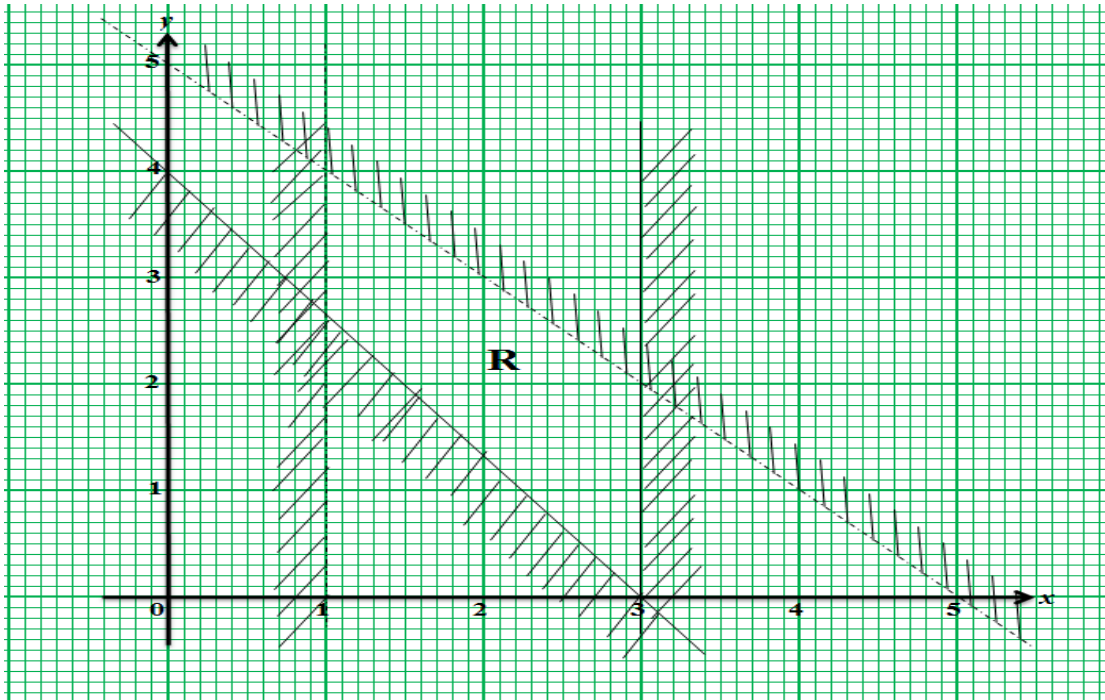
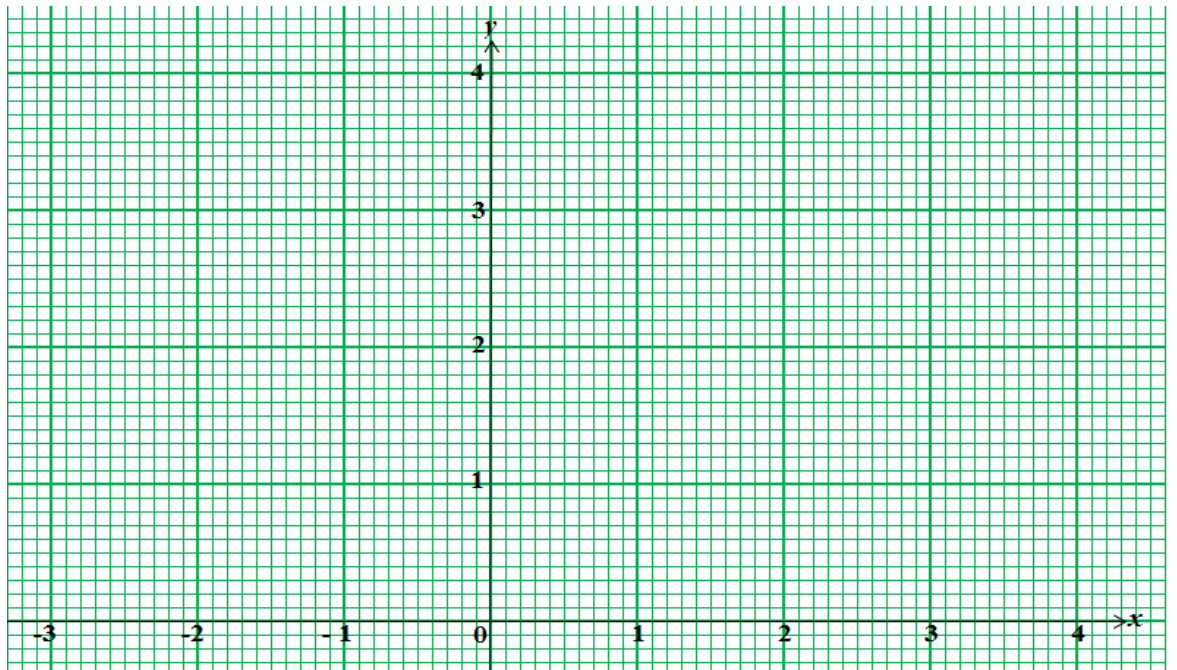3. In the diagram below, A is the unshaded region. Write four inequalities which describe the region A.
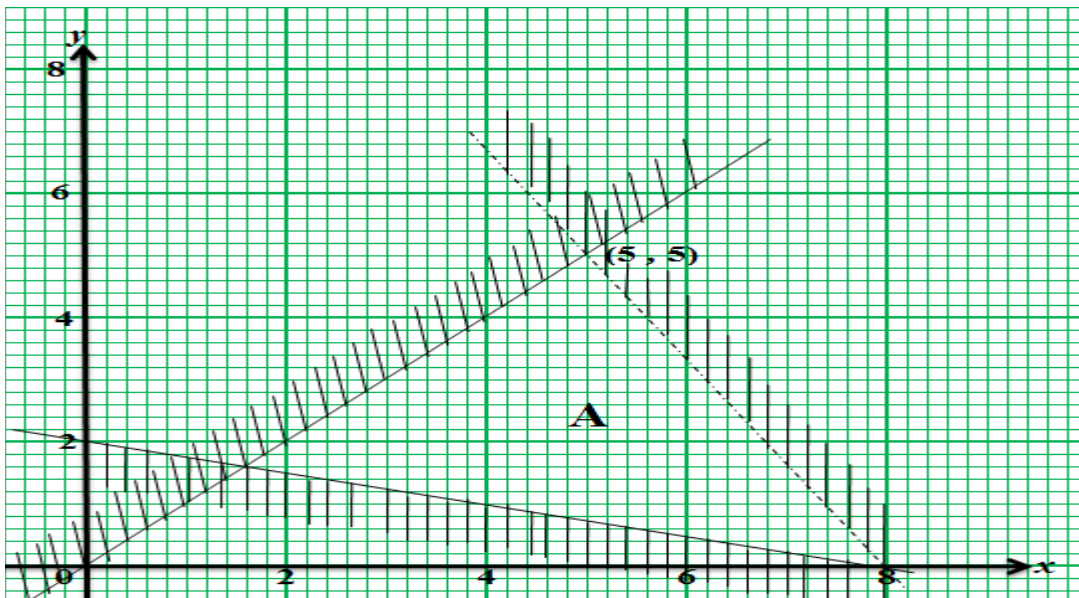
TASK

1. Write down four inequalities that describes the unshaded region R below.
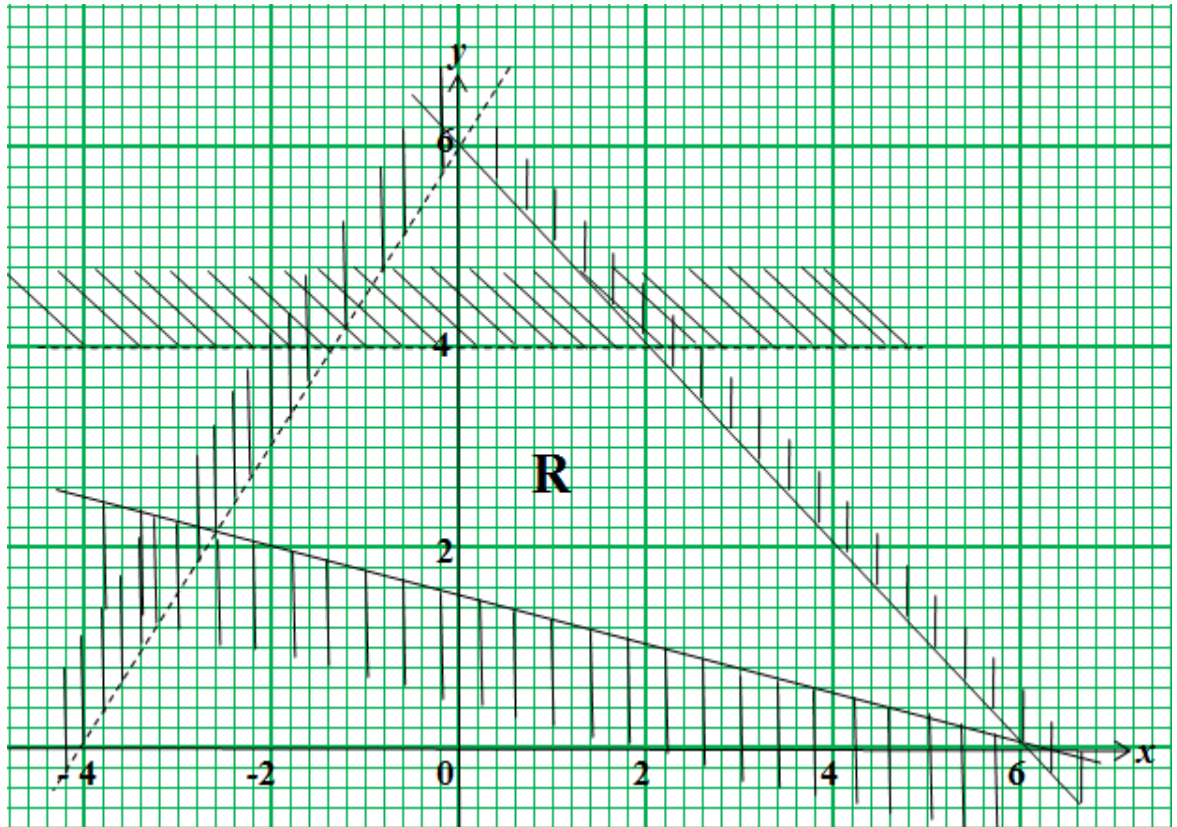
2. A region **A** is defined by the following inequalities. $y \leq x, y \geq 0$ and $y + x \leq 4.$
Show this region A by shading the unwanted region on the diagram below.

TOPIC 12: SEQUENCES AND SERIES

EXAMPLES

1. For the sequence 25, 22, 19, 16, ... Find

    (a) The formula for the nth term,

    (b) The sum of the first 20 terms.

2. Find the 13th term in the sequence, 11, 13, 15, 17, ….

3. If the arithmetic mean of 5 and c is 11, what is the value of c?

4. The first three terms of an arithmetic progression are 5, 7 and 9. Find

    (a) the common difference,

    (b) the nth term,

    (c) the sum of the first 12 terms.

5. Given that 16, x , 6 and y are the first four terms of an arithmetic progression, find the value of x and y.

6. Find the geometric mean of 4 and 9.

TASK

1. For the sequence, 11, 14, 17, 20, . . . , find the

    (a) formula for the nth term,

    (b) 15th term,

    (c) Sum of the first 10 terms.

2. Given that the first term and the second term of an arithmetic progression are 100 and 95 respectively. Find

    (a) The common difference,

    (b) The 10th term,

    (c) The sum of the first 10 terms $[S_n = \frac{n}{2}(2a + (n - 1)d]$

3. The geometric mean of 8 and a is 4, find the value of a.

TOPIC13: EARTH GEOMETRIC

EXAMPLES

1. Given that a plane flew from point A$(60°N, 60°E)$ to point B$(30°S, 60°E)$ in 9 hours. Calculate the flying speed in knots.

2. An ABZ Jet leaves town P$(0°, 30°W)$ and flies due east Q$(0°, 15°E)$ in 7hours. The distance between P and Q is 4200 nm.

   (a) Calculate the average speed,

   (b) If the Jet leaves town P at 06 00 hours, what time will it arrive at Q.

3. A is a town on $(53°S, 65°W)$ and B is a point on $(53°S, 19°E)$. A football match is scheduled to kick off at 16 30 hours local time at A. What will be the kick off time at B.

4. Given that P and Q are on the same longitude of 30°E. If P is on 90°N and the distance from P to Q is 7200nm**.**

   (a) Find the difference in latitudes between P and Q,

   (b) State the position of Q

5. Calculate the distance between two places A$(30°S, 12°E)$ and B$(60°N, 12°E)$

   [**Take R = 6370km and $\pi = \frac{22}{7}$**]

TASK

1. A plane flies north from town C$(28°S, 20°E)$ to town B$(82°N, 20°E)$ in 9 hours. Find the speed knots.

2. Given that the local time at Bonzo which is on $(35°N, 90°E)$ is 19 00 hours. What is the local time at Bonzalno which is on $(35°S, 60°E)$.

3. Given that towns A and B are 4200nm apart and that both A and B lie on the sane longitudes on 60°W, if the latitude of A is 30°N.

   (a) Find the difference in latitudes between A and B, if B is due south of A.

   (b) State the position of point B.

4. Calculate the distance in kilometre between L$(0°, 30°W)$ and K$(0°, 60°E)$

   [Take the radius of the earth R= 6370km and $\pi = \frac{22}{7}$]

TOPIC 14: KINAMATICS

EXAMPLES

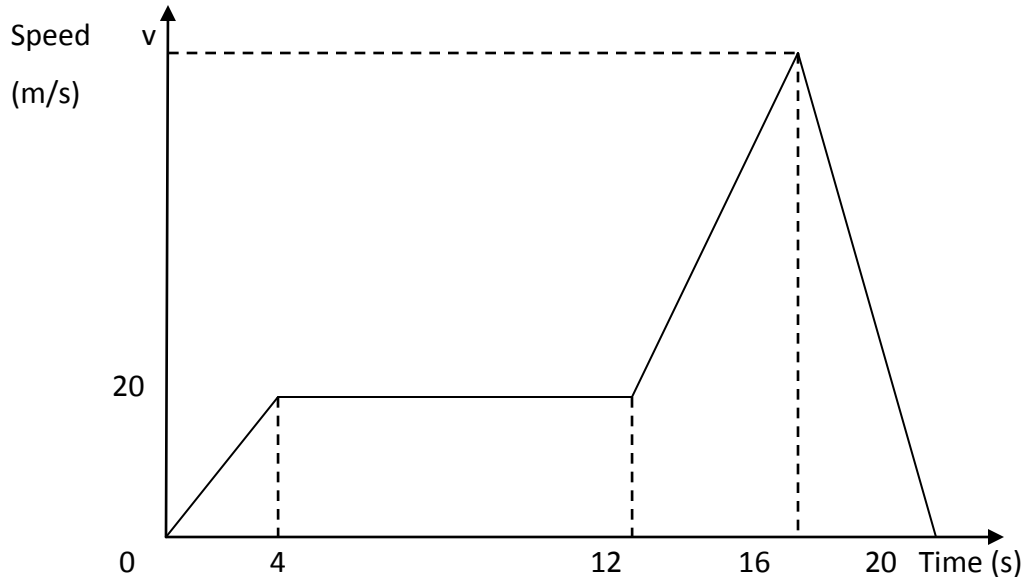1. The diagram below shows a speed-time graph of a car of a journey.
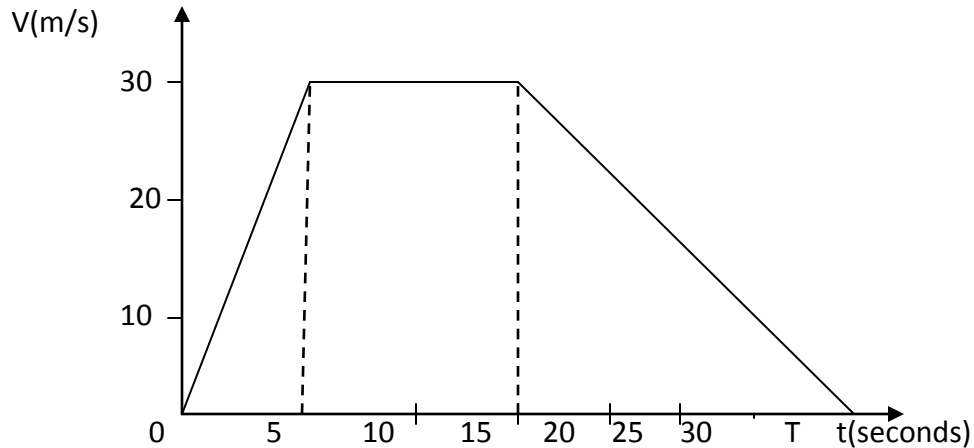
   (a) Find the acceleration during the first 5 seconds.

   (b) If the total distance travelled was 825m, find the value of T.

   (c) Find the average speed for the whole journey.

2. The diagram below is the speed-time graph of a particle. The particle accelerates uniformly from a speed of v m/s to a speed of 5v m/s in 20 seconds.
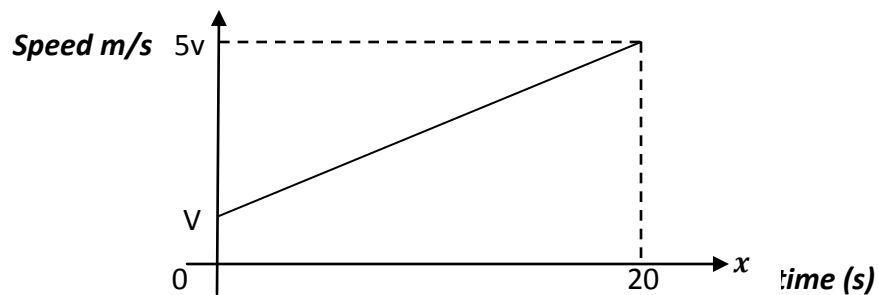
   (a) Find an expression in terms of v, for acceleration.

   (b) The distance travelled by the object from 0 to 20 seconds is 80m. Find the value of v.

   (c) Find the speed at $t = 15$ seconds.

3. The speed-time graph below shows how Mr Mwendanjila drove from his home to his friend's home.

(a) Find his acceleration during the first 4 seconds.

(b) If his deceleration was 10 m/s^2, what was the maximum speed, v, attained?

(c) Calculate the distance that he covered between 12th and 20th seconds.

TASK

1. The diagram below show a speed- time graph of a 100m sprinter who accelerates uniformly for 3 seconds until he reaches a speed of 12m/s. He maintains the speed for 7 seconds and then uniformly retards for a further 4 seconds and comes to rest.
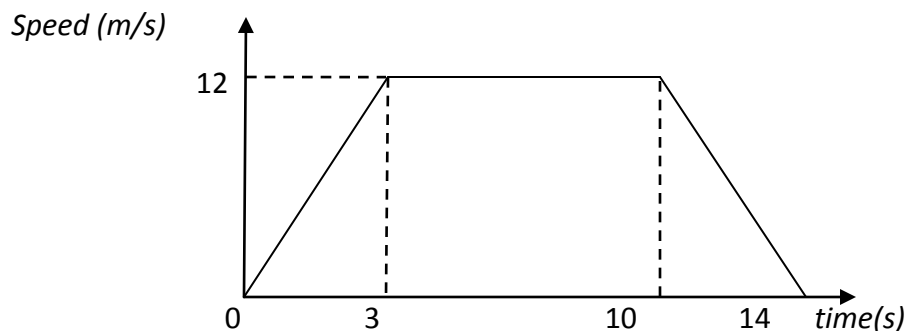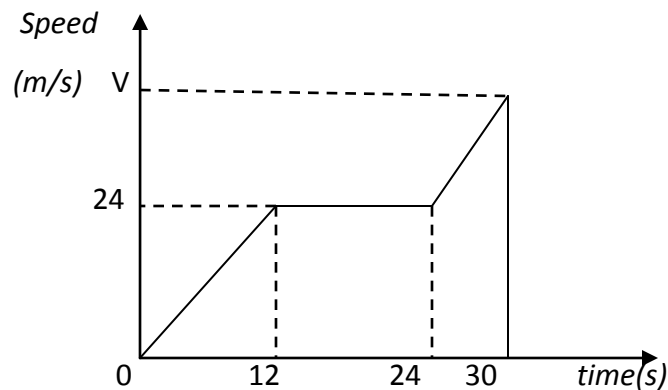

Calculate

(a) acceleration during the 3 seconds

(b) retardation at the of his race

(c) distance he covered in the first 10 seconds.

2. The diagram below shows the speed-time graph of a particle. The particle started off from rest and accelerated uniformly for 10 seconds. It then travelled at a constant speed for 20 seconds and then decelerated to rest.
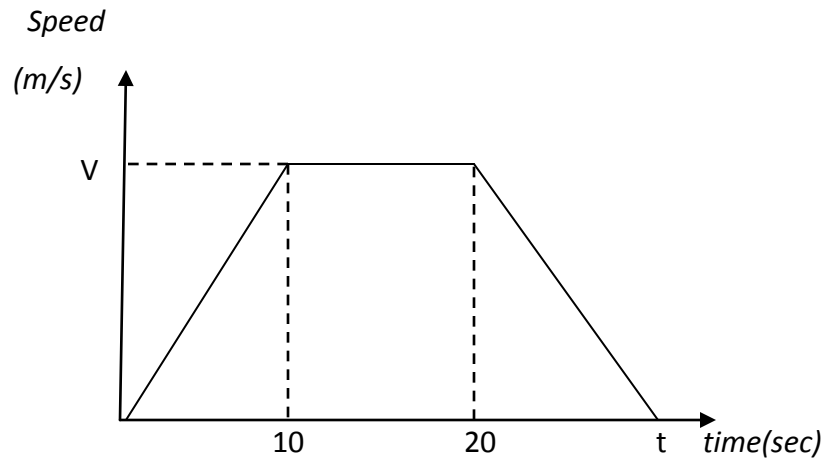
(a) Find the speed V the particle reached if its acceleration was $2m/s^2$ in the first 10 seconds.

(b) Given that the total distance covered was 750m, find the value of *t* in the diagram.

(c) What was the speed at 40 seconds?

**3.** The diagram below shows speed-time graph of a particle moving in a straight path.

(a) Calculate its acceleration for the first 12 seconds.

(b) Find the distance which the particle covered in the 24 seconds.

(c) Given that the total distance covered was 600m, calculate the value of V.
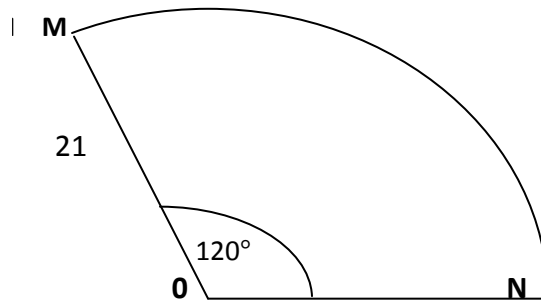
TOPIC 15: MENSURATION

EXAMPLES

1. The diagram below is a sector, with centre O and radius 7cm. Angle at O is 270°.

7 cm

7cm

270°O
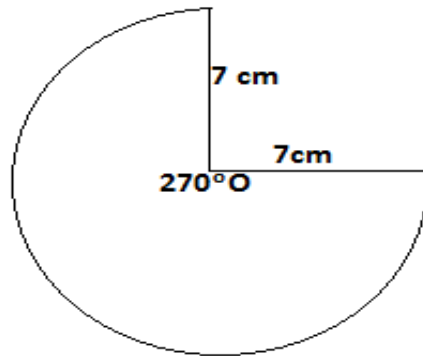
   Calculate the area of the sector. $[\pi = \frac{22}{7}]$

2. In the diagram below, MN is an arc of the circle whose centre is O and radius 21cm

M

21

120°

0   N

   Given that angle MON $= 120°$, calculate the area of the sector **MON**

3. The curved area of a cone is 88 cm² Given that the base radius is 4cm, calculate the slant height of the cone. $[\pi = \frac{22}{7}, A = \pi rl]$

TASK

1. Calculate the curved surface area of a cone with base radius of 14cm and slant height.

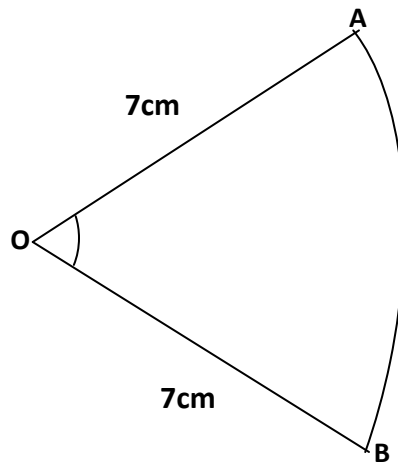2. The diagram below shows a sector of a circle with centre O and angle AOB= 70°
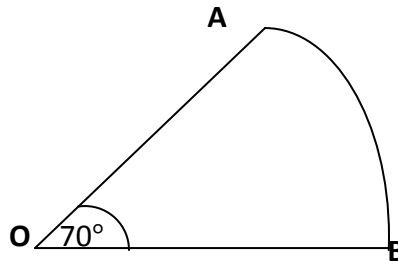
Given that the area of the sector AOB is 5.5cm^2, calculate the radius of the sector.

$[\pi = \dfrac{22}{7}]$

3. The diagram below shows a sector AOB of a circle with centre O and radius 7cm.

The area of the sector is $25\dfrac{2}{3}$ cm^2. $\pi = \dfrac{22}{7}]$

Calculate **AÔB**

To Be Continued……………

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