

**MARANDA HIGH SCHOOL**  
 Kenya Certificate of Secondary Education  
**PRE-MOCK EXAMINATIONS 2022**

121/2

**MATHEMATICS**

**Form 4**

**June 2022 – TIME 2  $\frac{1}{2}$  Hours**

Name: ..... Adm No: .....

Class: ..... Candidate's Signature: ..... Date: 29/6/2022.

**Instructions to Candidates**

- (a) Write your name, admission number and class in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of two sections; **Section I** and **Section II**.
- (d) Answer **all** the questions in **Section I** and **only five** questions from **Section II**
- (e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question**
- (f) Marks may be given for correct working even if the answer is wrong.
- (g) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- (h) This paper consists of 19 printed pages.
- (i) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

**For Examiner's Use Only**

**Section I**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

**Section II**

17	18	19	20	21	22	23	24	Total

**Grand Total**

**SECTION I (50 marks)**

Answer *all* questions in this section in the spaces provided

1. An empty tank of capacity 99 792 litres is to be filled with water using a cylindrical pipe of diameter 0.042 m. The rate of flow of water from the pipe is 6 m/s. Find the time in hours it would take to fill up the tank  
(take  $\pi = \frac{22}{7}$ ) (3 marks)

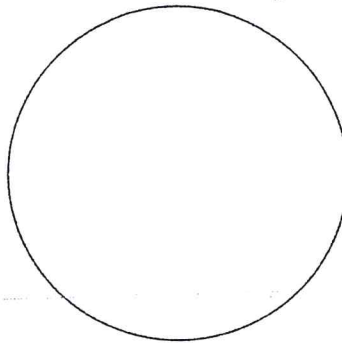
2. The first term of a Geometric Progression (G.P) is 5. The common ratio of the G.P. is 4. The product of the last two terms of the G.P. is 25 600. Determine the number of terms in the G.P. (4 marks)

3. The expression  $dx^2 - 56x + 16$  is a perfect square, where  $d$  is a constant. Find the value of  $d$ . (2 marks)

4. Make  $v$  the subject of the formula in  $s = \frac{cv}{\sqrt{dv^2 - f}}$

(3 marks)

5. The figure below shows a circle and a point Q outside the circle.

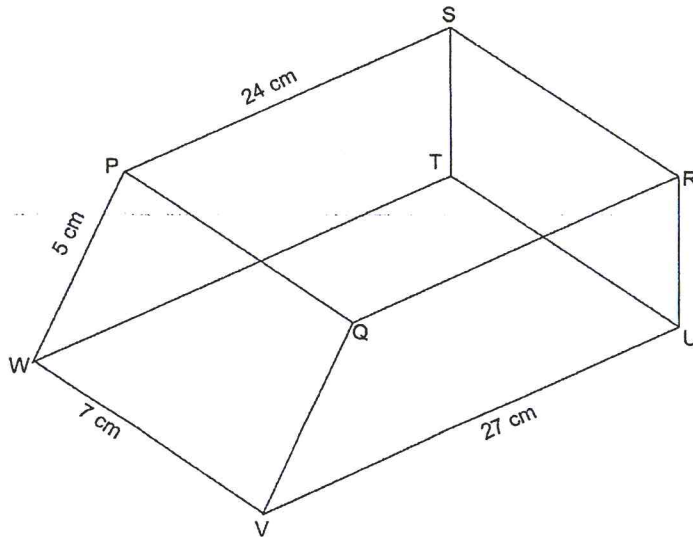


Using a ruler and pair of compasses, construct a tangent to the circle from Q.

(4 marks)

6. Four quantities W, X, Y and Z are such that W varies directly as the square root of X and inversely as the square of the sum of Y and Z. Quantity X is decreased by 19% while quantities Y and Z are each increased by 16%. Find the corresponding percentage change in W correct to 2 decimal places. (4 marks)

7. The figure below represents a prism PQRSTUWV of length 7 cm. The cross section QRUV of the prism is a trapezium in which  $VU = 27$  cm,  $QR = 24$  cm,  $QV = 5$  cm and  $\angle VUR = \angle QRU = 90^\circ$ .



Calculate correct to 1 decimal place the angle between the line UP and the plane VUTW. (3 marks)

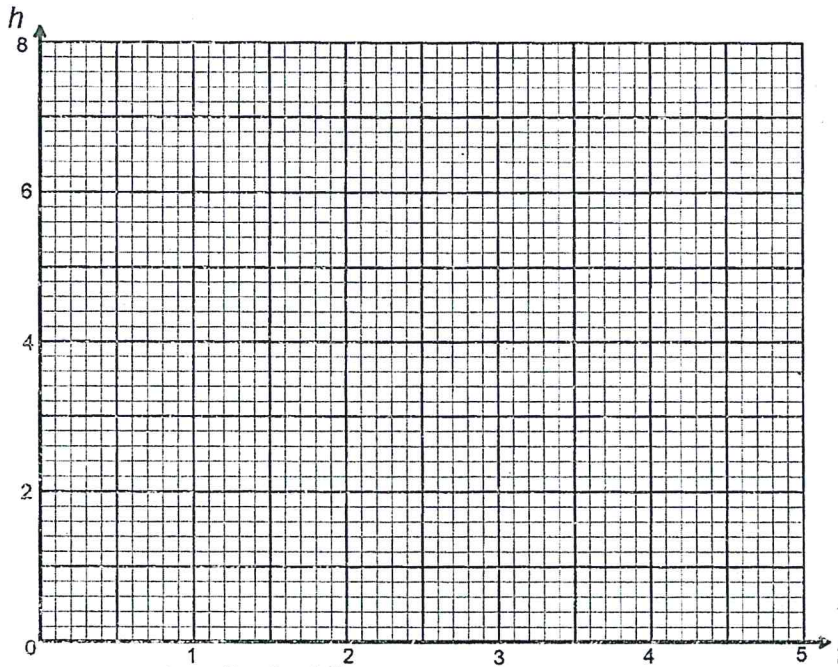
8. The cash price of a refrigerator is Ksh 45 000. A customer bought the refrigerator on hire purchase terms by paying a deposit of Ksh 18 000 followed by 15 equal monthly instalments of Ksh 2 300 each. Annual interest, compounded quarterly, was charged on the balance for the period of 15 months. Determine, correct to 1 decimal place, the rate of interest per annum. (4 marks)



9. The table below shows the values of  $t$  and the corresponding values of  $h$  for a given relation.

(a) On the grid provided, draw a graph to represent the information on the table given. (2 marks)

$t$	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
$h$	8.0	4.2	2.9	2.2	1.7	1.4	1.2	1.1	1.0



(b) Use the graph to determine, correct to 1 decimal place, the rate of change of  $h$  at  $t = 2$  (2 marks)

10. The equation of a trigonometric wave is  $y = 2 \cos(bx - 60)^\circ$ . The wave has a period of  $120^\circ$ .

(a) Determine the value of  $b$ .

(1 mark)

(b) Deduce the phase angle of the wave.

(1 mark)

11. A point R is 1800 nm to the East of a point  $T(30^\circ S, 170^\circ E)$ . Find the longitude of R to the nearest degree

(3 marks)

12. A box contains 4 blue beads and 7 yellow beads. The beads are identical except for the colours. Two balls are picked at random without replacement.

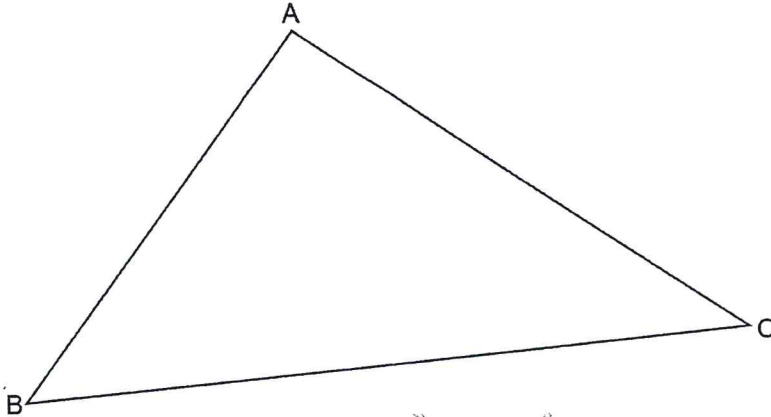
(a) Draw a tree diagram to show all the possible outcomes.

(1 mark)

(b) Determine the probability that the balls picked are of different colours.

(2 marks)

13. The figure below shows triangle ABC.



Using a ruler and a pair of compasses, locate a point X on the triangle such that X is 3 cm from line BC and is equidistant from lines AB and AC. Measure length XC. (3 marks)

14. The position vectors of points R, S and T are  $\overline{OP} = 3i - j + 1.5k$ ,  $\overline{OS} = 6i - 2.5j + 3k$  and

$\overline{OT} = 4i - 1.5j + 2k$ . Show that R, S and T are collinear points.

(3 marks)

15. In a transformation an object of area  $y \text{ cm}^2$  is mapped on to an image whose area is  $9y \text{ cm}^2$ . Given that the matrix of the transformation is  $\begin{pmatrix} 2y & 1 \\ y+1 & y \end{pmatrix}$ , find the possible values of  $y$ . (3 marks)

16. Given that  $\sin(y+20)^\circ = -0.7660$ , find  $y$  to the nearest degree, for  $0^\circ \leq y \leq 360^\circ$  (3 marks)



## SECTION II (50 marks)

Answer only **five** questions from this section in the spaces provided

17. Pump R can fill an empty water tank in  $6\frac{1}{4}$  hours while pump S can fill the same tank in  $7\frac{1}{2}$  hours. On a certain day, when the tank was empty, both pumps were opened for  $1\frac{7}{8}$  hours.

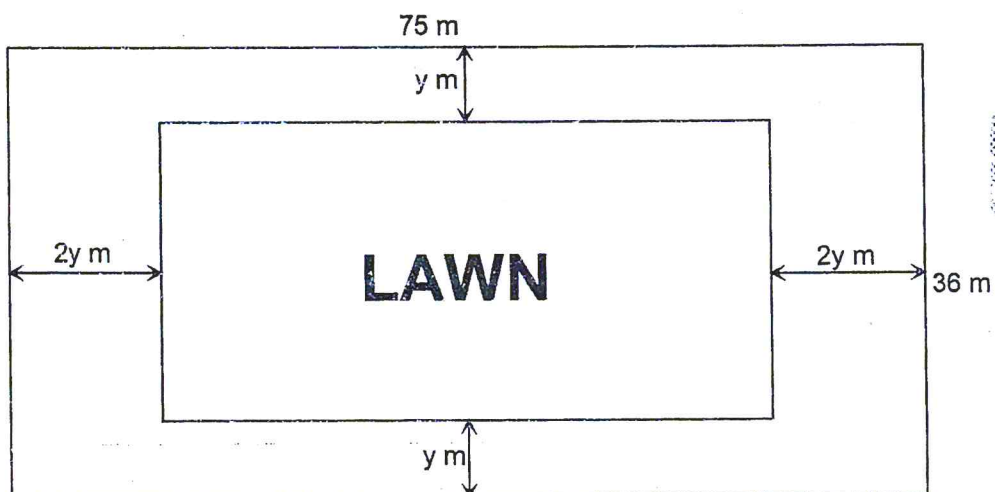
a) Determine the fraction of the tank that was still empty at the end of the  $1\frac{7}{8}$  hours. (4 marks)

b) Pump R was later opened alone to completely fill the tank. Determine the time it took pump R to fill the remaining fraction of the tank. (2 marks)

c) The two pumps R and S are operated by different proprietors. Water from the full tank was sold for Ksh 31 500. The money was shared between the two proprietors in the ratio of the quantity of water supplied by each.

Determine the amount of money received by the proprietor of pump R. (4 marks)

18. A rectangular plot measures 75 m by 36 m. A lawn, rectangular in shape, is situated inside the plot with a path surrounding it as shown in the figure below.



The width of the path is  $y$  m between the lengths of the lawn and those of the plot and  $2y$  m between the widths of the lawn and those of the plot.

- a) Form and simplify an expression in  $y$  for the area of the:

(i) Lawn;

(2 marks)

b) The ratio of the area of the path to the area of the lawn 3:2

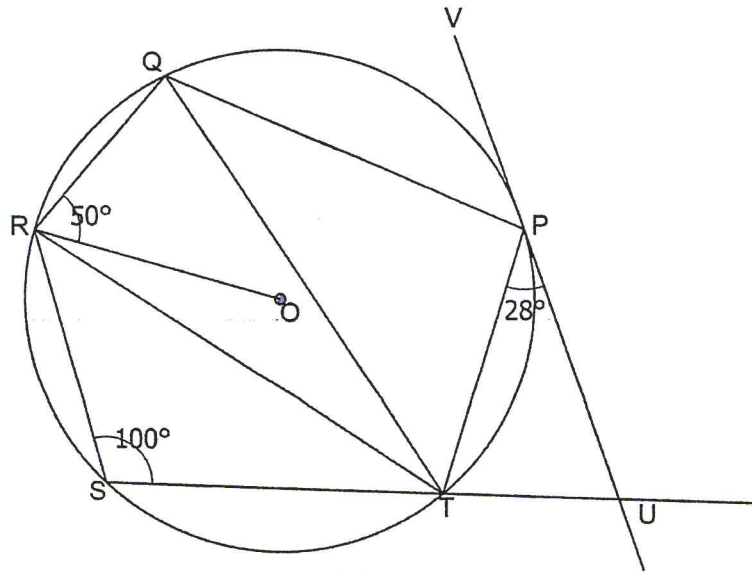
(i) Form an equation in  $y$  and hence solve for  $y$  .

(4 marks)

(ii) Determine the perimeter of the lawn.

(3 marks)

19. In the figure below, points P, Q, R, S and T lie on the circumference of a circle centre O. Line UPV is a tangent to the circle at A. Chord ST of the circle is produced to intersect with the tangent at U. Angle  $\text{UPT} = 28^\circ$ ,  $\angle \text{RST} = 100^\circ$  and  $\angle \text{ORQ} = 50^\circ$ .



- a) Determine the size of :

(i)  $\angle \text{PTR}$

(3 marks)

(ii)  $\angle \text{PTQ}$

(3 marks)

- b) Given that  $\text{PQ} = 6 \text{ cm}$ ,  $\text{ST} = 5.4 \text{ cm}$  and  $\text{TU} = 3.5 \text{ cm}$ . Calculate correct to 1 decimal place:

(i) The radius of the circle

(2 marks)

(ii) The length of line PU

(2 marks)



20. The table below shows income tax rates in a certain year.

Monthly taxable income in Kenya Shillings	Tax rates
0 – 13 458	10%
13 459 – 26 351	15%
26 352 – 39 244	20%
39 245 – 52 137	25%
52 138 and above	30%

In the year, the monthly earnings of Kaliech were as follows:

Basic salary                      Ksh 75 500  
House allowance                Ksh 13 600

Kaliech contributes 12.5% of his basic salary to a pension scheme. This contribution is exempted from taxation. He is entitled to a personal tax relief of Ksh 2 400 per month.

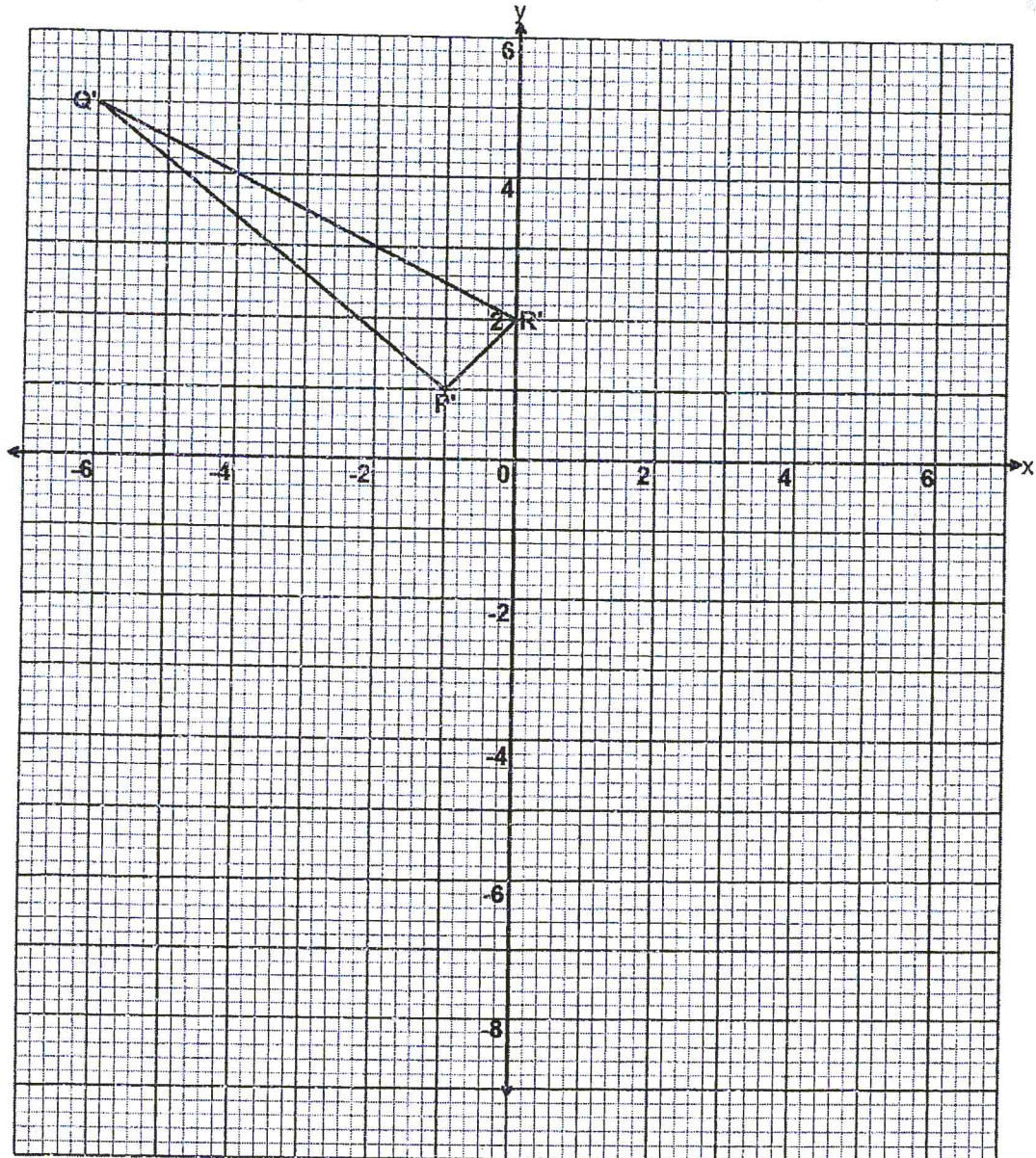
Calculate:

a) Kaliech's monthly taxable income (2 marks)

b) The tax payable by Kaliech that month. (6 marks)

c) Kaliech's net pay that month. (2 marks)

21. The vertices of the triangle shown on the grid are  $P'(-1,1)$ ,  $Q'(-6,5)$  and  $R'(0,2)$ . Triangle  $P'Q'R'$  is the image of triangle  $PQR$  under a transformation whose matrix is  $\begin{pmatrix} -2 & 1 \\ 1 & 0 \end{pmatrix}$ .



- a) Find the coordinates of triangle  $PQR$ .

(4 marks)

- b) Triangle  $P''Q''R''$  is the image of triangle  $P'Q'R'$  under a transformation matrix  $\begin{pmatrix} -1 & 0 \\ 0 & -2 \end{pmatrix}$ .  
Determine the coordinates of triangle  $P''Q''R''$ . (2 marks)

- c) On the same grid provided, draw triangles  $PQR$  and  $P'Q'R'$  (2 marks)

- d) Determine a single matrix that maps  $PQR$  onto  $P''Q''R''$  (2 marks)



22. Workers in an institution commute from their homes to the institution. The table below shows the distances in kilometres, covered by the workers.

Distance (km)	4–6	7–9	10–12	13–15	16–18	19–21	22–24
Number of workers	4	15	21	$k$	13	9	5

The mean distance covered was 13.4 km.

- a) Determine the value of  $k$  and hence the standard deviation of the distances correct to 2 decimal places. (6 marks)

- b) Calculate, correct to 2 decimal places, the interquartile range of the distances. (4 marks)



23.

a) Complete the table below giving the values correct to 1 decimal place.

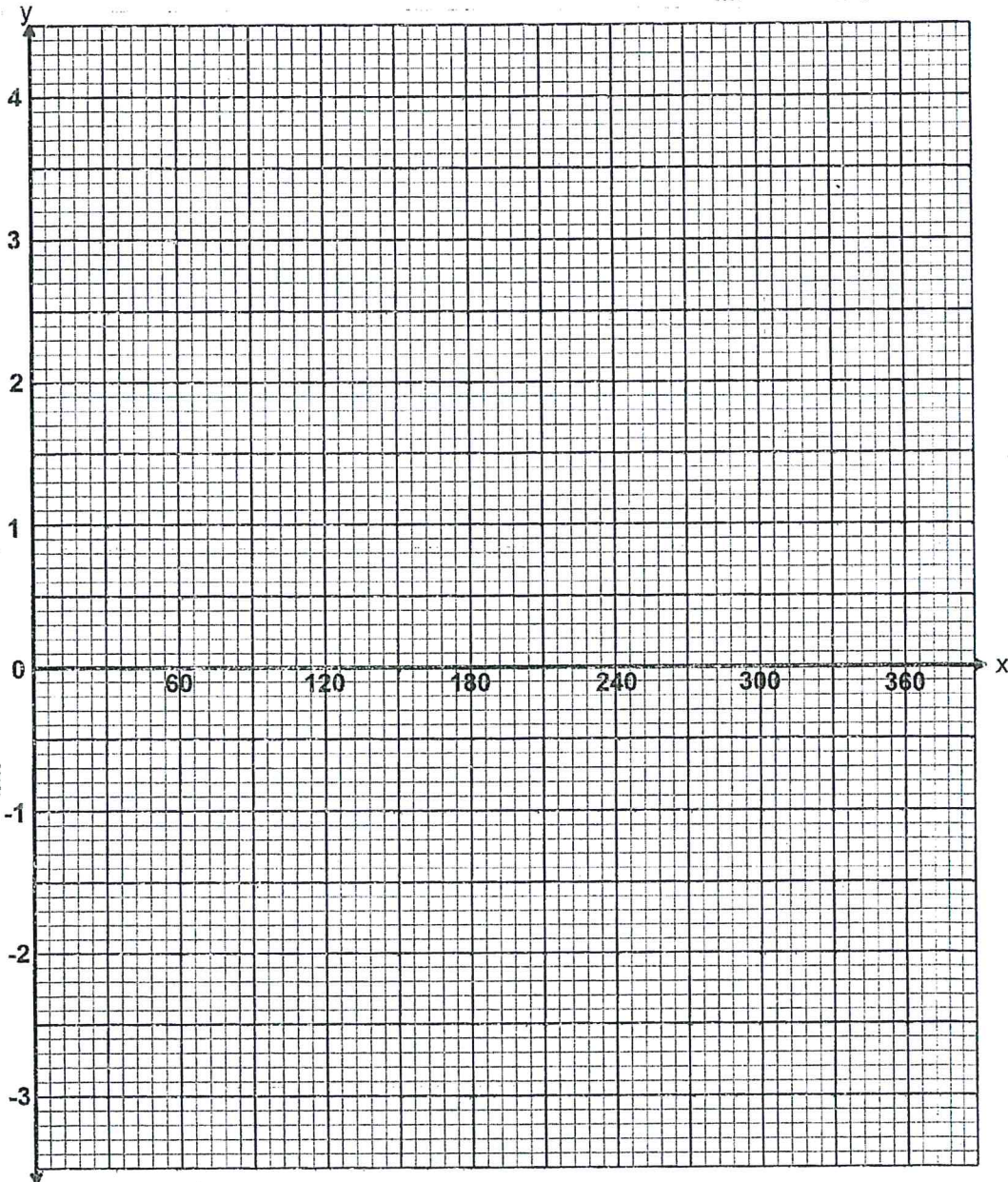
(2 marks)

$x^\circ$	0	30	60	90	120	150	180	210	240	270	300	330	360
$y = 3\sin\left(\frac{2}{3}x\right) - 3\cos\left(\frac{2}{3}x\right)$	-3	-1.8		1.1	2.4	3.5		4.2	3.8	3	1.8		-1.1
$y = 1 - 2\sin x$	1	0		-1		0	1	2	2.7			2	1

b) On the grid provided and using the same axis, draw the graphs of  $y = 3\sin\left(\frac{2}{3}x\right) - 3\cos\left(\frac{2}{3}x\right)$

and  $y = 1 - 2\cos x$  for the range  $0^\circ \leq x \leq 360^\circ$

(4 marks)



c) Using the graphs in part (b):

(i) Find the values of  $x$  for which  $\sin\left(\frac{2}{3}x\right) = \frac{1}{2} + \cos\left(\frac{2}{3}x\right)$  (2 marks)

(ii) Determine the range of  $x$  which  $3\sin\left(\frac{2}{3}x\right) - 3\cos\left(\frac{2}{3}x\right) > 1 - 2\cos x$  (2 marks)

24. A particle moves along a straight line such that its displacement  $s$  metres after  $t$  seconds is given by  $s = t^3 - pt^2 + qt + 4$ . Given that its velocity,  $v$  after 5 seconds was 28 m/s and its acceleration,  $a$  after 5 seconds was  $20\text{m/s}^2$ .

a) Determine the value of  $p$  and  $q$

(5 marks)

b) Find the values of  $t$  when the particle is momentarily at rest.

(3 marks)

c) Calculate the displacement of the particle at  $t = 5$  seconds

(2 marks)

