

4.0 PART TWO: THE YEAR 2012 KCSE EXAMINATION QUESTION PAPERS

4.1 MATHEMATICS (121 AND 122)

4.1.1 Mathematics Alt.A Paper 1 (121/1)



SECTION I (50 marks)

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

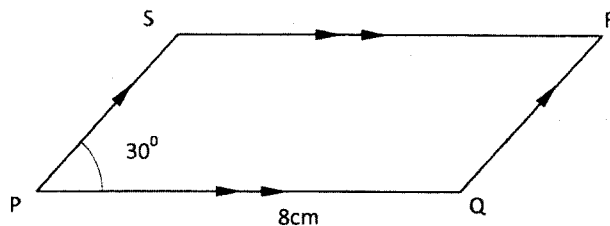
1 Without using a calculator, evaluate  $\frac{1\frac{1}{5} - 1\frac{1}{3}}{\frac{1}{8} - (-\frac{1}{2})^2} - \frac{7}{15}$  of 2. (4 marks)

2 Find the reciprocal of 0.216 correct to 3 decimal places, hence evaluate (3 marks)

$$\frac{\sqrt[3]{0.512}}{0.216}$$

3 Expand and simplify the expression  $(2x^2 - 3y^3)^2 + 12x^2y^3$  (2 marks)

4 In the parallelogram PQRS shown below, PQ = 8cm and angle SPQ = 30°.



If the area of the parallelogram is  $24 \text{ cm}^2$ , find its perimeter. (3 marks)

5 Given that  $9^{2y} \times 2^x = 72$ , find the values of x and y. (3 marks)

6 Three bells ring at intervals of 9 minutes, 15 minutes and 21 minutes. The bells will next ring together at 11.00 pm. Find the time the bells had last rang together. (3 marks)

7 Koech left home to a shopping centre 12km away, running at 8km/h. Fifteen minutes later, Mutua left the same home and cycled to the shopping centre at 20km/h. Calculate the distance to the shopping centre at which Mutua caught up with Koech. (3 marks)

8 Using a pair of compasses and ruler only, construct a quadrilateral ABCD in which AB = 4cm, BC = 6cm, AD = 3cm, angle ABC = 135° and angle DAB = 60°. Measure the size of angle BCD. (4 marks)

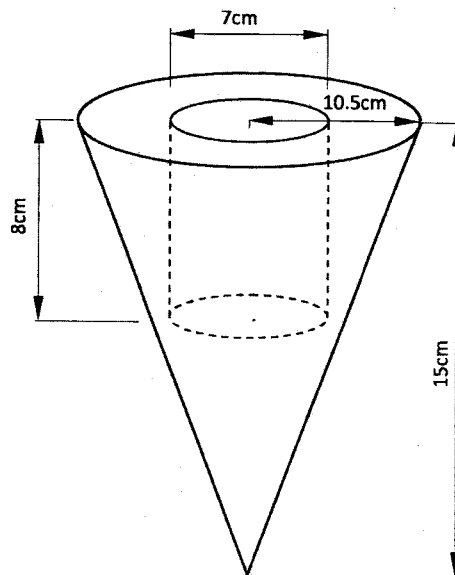
9 Given that  $\mathbf{OA} = 2\mathbf{i} + 3\mathbf{j}$  and  $\mathbf{OB} = 3\mathbf{i} - 2\mathbf{j}$   
Find the magnitude of  $\mathbf{AB}$  to one decimal place. (3 marks)

- 10 Given that  $\tan x^\circ = \frac{3}{7}$ , find  $\cos (90 - x)^\circ$  giving the answer to 4 significant figures. (2 marks)
- 11 Given that  $\mathbf{A} = \begin{pmatrix} 1 & 0 \\ -2 & 3 \end{pmatrix}$ ,  $\mathbf{B} = \begin{pmatrix} 3 & 0 \\ 2 & 1 \end{pmatrix}$  and  $\mathbf{C} = 2\mathbf{AB} - \mathbf{A}^2$ . Determine matrix  $\mathbf{C}$ . (4 marks)
- 12 Without using mathematical tables or a calculator, solve the equation  $2\log_{10}x - 3\log_{10}2 + \log_{10}32 = 2$ . (3 marks)
- 13 A line  $L$  passes through point  $(3,1)$  and is perpendicular to the line  $2y = 4x + 5$ . Determine the equation of line  $L$ . (3 marks)
- 14 A Forex Bureau in Kenya buys and sells foreign currencies as shown below:

	Buying	Selling
Currency	(Ksh)	(Ksh)
Chinese Yuan	12.34	12.38
South African Rand	11.28	11.37

A businesswoman from China converted 195 250 Chinese Yuan into Kenya shillings.

- (a) Calculate the amount of money, in Kenya shillings, that she received. (1 mark)
- (b) While in Kenya, the businesswoman spent Ksh 1 258 000 and then converted the balance into South African Rand. Calculate the amount of money, to the nearest Rand, that she received. (3 marks)
- 15 The figure below represents a solid cone with a cylindrical hole drilled into it. The radius of the cone is 10.5 cm and its vertical height is 15 cm. The hole has a diameter of 7 cm and depth of 8 cm.



Calculate the volume of the solid.

- 16 Bukra had two bags A and B, containing sugar. If he removed 2kg of sugar from bag A and added it to bag B, the mass of sugar in bag B would be four times the mass of the sugar in bag A. If he added 10kg of sugar to the original amount of sugar in each bag, the mass of sugar in bag B would be twice the mass of the sugar in bag A. Calculate the original mass of sugar in each bag. (3 marks)

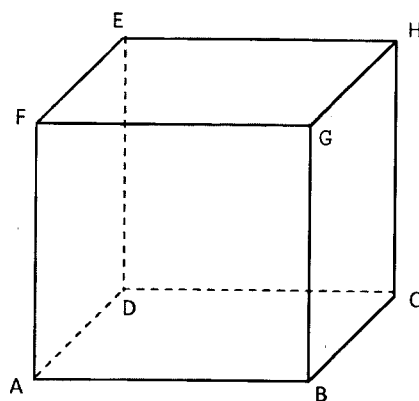
**SECTION II (50 marks)**

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

- 17 The table below shows the height, measured to the nearest cm, of 101 pawpaw trees.

Height in cm.	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Frequency	2	15	18	25	30	6	3	2

- (a) State the modal class. (1 mark)
- (b) Calculate to 2 decimal places:
- (i) the mean height; (4 marks)
- (ii) the difference between the median height and the mean height. (5 marks)
- 18 The figure below represents a solid cuboid ABCDEFGH with a rectangular base. AC = 13cm, BC = 5cm and CH = 15cm.



- (a) Determine the length of AB. (1 mark)
- (b) Calculate the surface area of the cuboid. (3 marks)
- (c) Given that the density of the material used to make the cuboid is  $7.6\text{g/cm}^3$ , calculate its mass in kilograms. (4 marks)
- (d) Determine the number of such cuboids that can fit exactly in a container measuring 1.5m by 1.2m by 1m. (2 marks)

**19** Two alloys, A and B, are each made up of copper, zinc and tin. In alloy A, the ratio of copper to zinc is 3:2 and the ratio of zinc to tin is 3:5.

(a) Determine the ratio, copper: zinc: tin, in alloy A. (2 marks)

(b) The mass of alloy A is 250kg. Alloy B has the same mass as alloy A but the amount of copper is 30% less than that of alloy A.

Calculate:

(i) the mass of tin in alloy A; (2 marks)

(ii) the total mass of zinc and tin in alloy B; (3 marks)

(c) Given that the ratio of zinc to tin in alloy B is 3:8, determine the amount of tin in alloy B than in alloy A. (3 marks)

**20**

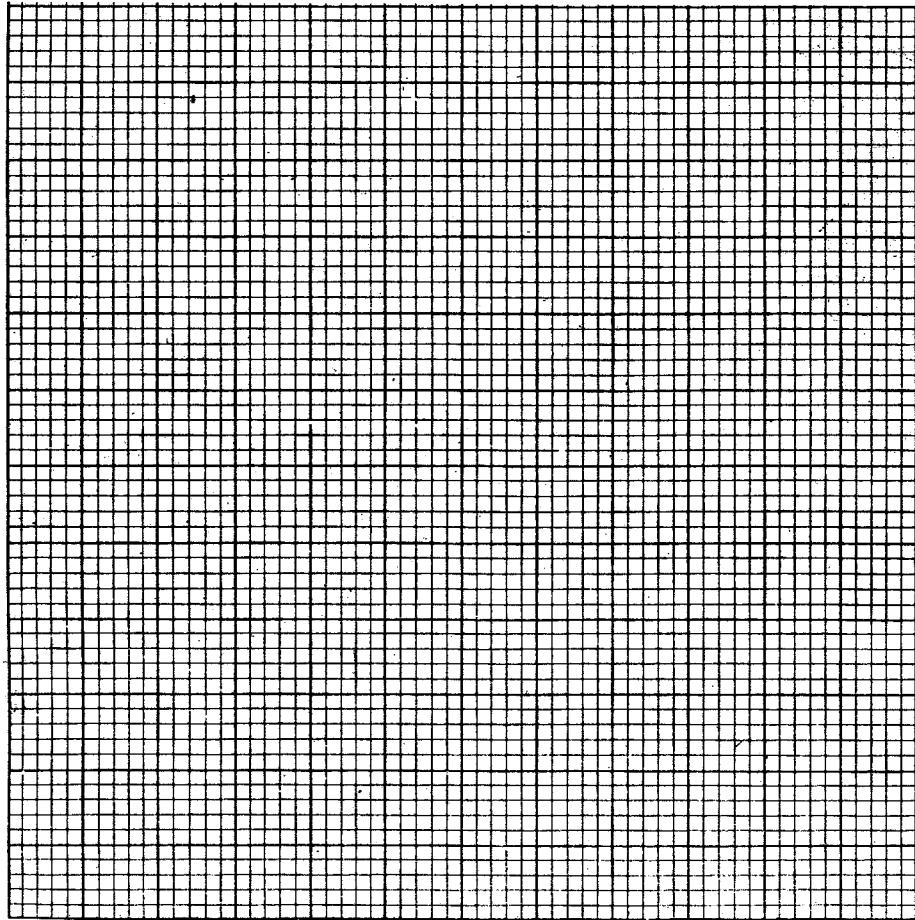
(a) Express  $\frac{1}{x-2} - \frac{2}{x+5} = \frac{3}{x+1}$  in the form  $ax^2 + bx + c = 0$ ,

where a, b and c are constants hence solve for x. (4 marks)

(b) Neema did y tests and scored a total of 120 marks. She did two more tests which she scored 14 and 13 marks. The mean score of the first y tests was 3 marks more than the mean score for all the tests she did. Find the total number of tests that she did. (6 marks)

- 21** The vertices of quadrilateral OPQR are O(0, 0), P(2, 0), Q(4, 2) and R(0, 3).  
The vertices of its image under a rotation are O'(1, -1), P'(1, -3), Q'(3, -5) and R'(4, -1).

- (a) (i) On the grid provided, draw OPQR and its image O'P'Q'R'. (2 marks)



- (ii) By construction, determine the centre and angle of rotation. (3 marks)
- (b) On the same grid as (a)(i) above, draw O''P''Q''R'', the image of O'P'Q'R' under a reflection in the line  $y = x$ . (2 marks)
- (c) From the quadrilaterals drawn, state the pairs that are:
- (i) directly congruent; (1 mark)
- (ii) oppositely congruent. (2 marks)

- 22** The equation of a curve is  $y = 2x^3 + 3x^2$ .

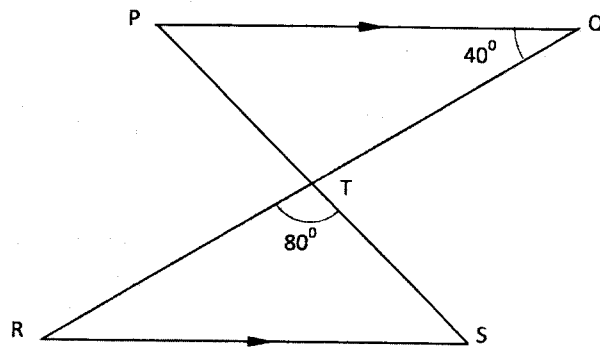
- (a) Find :
- (i) the x - intercept of the curve; (2 marks)
- (ii) the y - intercept of the curve. (1 mark)

- (b) (i) Determine the stationary points of the curve. (3 marks)  
(ii) For each point in (b) (i) above, determine whether it is a maximum or a minimum. (2 marks)
- (c) Sketch the curve. (2 marks)

23 Three pegs R, S and T are on the vertices of a triangular plain field. R is 300m from S on a bearing of  $300^\circ$  and T is 450m directly south of R.

- (a) Using a scale of 1cm to represent 60m, draw a diagram to show the positions of the pegs. (3 marks)
- (b) Use the scale drawing to determine:  
(i) the distance between T and S in metres; (2 marks)  
(ii) the bearing of T from S. (1 mark)
- (c) Find the area of the field, in hectares, correct to one decimal place. (4 marks)

24 In the figure below, PQ is parallel to RS. The lines PS and RQ intersect at T.  $RQ = 10\text{cm}$ ,  $RT:TQ = 3:2$ , angle  $PQT = 40^\circ$  and angle  $RTS = 80^\circ$ .



- (a) Find the length of RT. (2 marks)
- (b) Determine, correct to 2 significant figures:  
(i) the perpendicular distance between PQ and RS; (2 marks)  
(ii) the length of TS. (2 marks)
- (c) Using the cosine rule, find the length of RS correct to 2 significant figures. (2 marks)
- (d) Calculate, correct to one decimal place, the area of triangle RST. (2 marks)

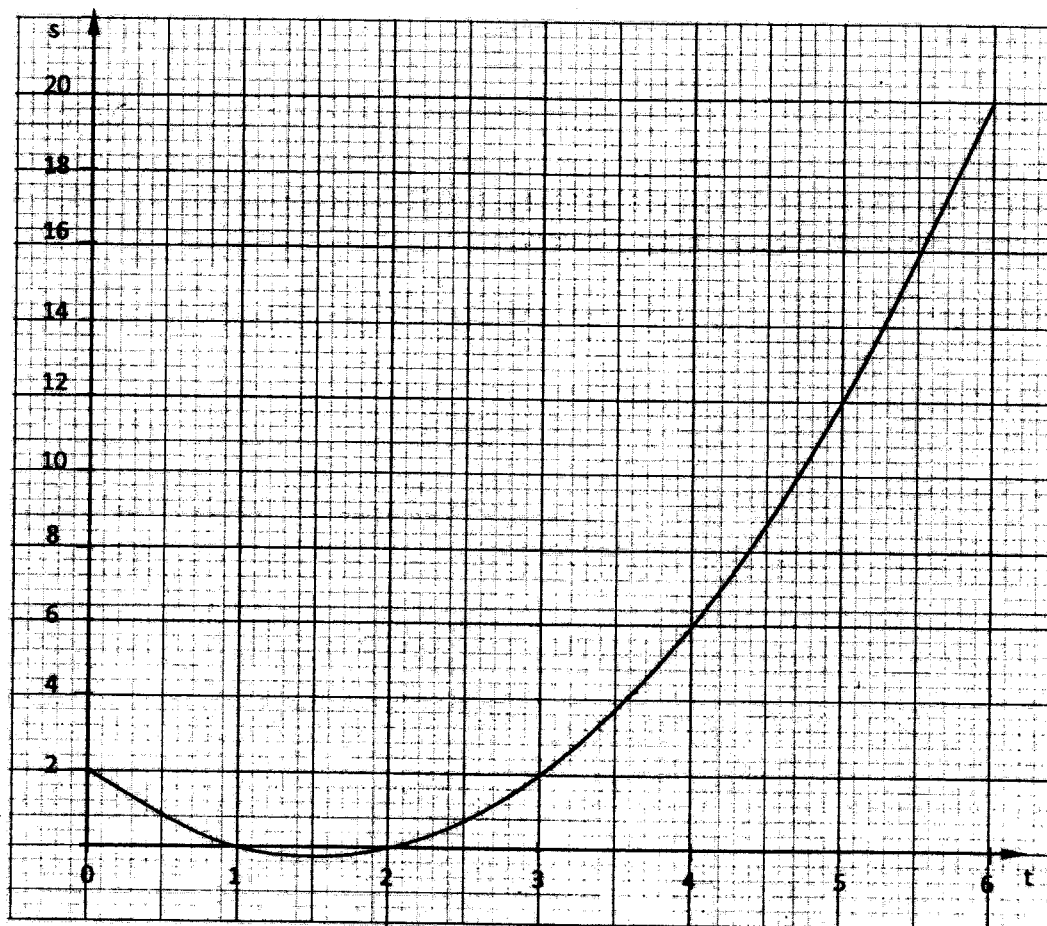
SECTION 1 (50 marks)

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

- 1 Evaluate  $\frac{\log 4^5 - \log 5^4}{\log 4^{\frac{1}{5}} + \log 5^{\frac{1}{4}}}$ , giving the answer to 4 significant figures. (2 marks)
- 2 Make  $n$  the subject of the equation. (3 marks)
 
$$\frac{r}{p} = \frac{m}{\sqrt{n-1}}$$
- 3 An inlet tap can fill an empty tank in 6 hours. It takes 10 hours to fill the tank when the inlet tap and an outlet tap are both opened at the same time. Calculate the time the outlet tap takes to empty the full tank when the inlet tap is closed. (3 marks)
- 4 Given that,  $P = 2i - 3j + k$ ,  $Q = 3i - 4j - 3k$  and  $R = 3P + 2Q$ , find the magnitude of  $R$  to 2 significant figures. (3 marks)
- 5 Solve the equation  $\sin(2t + 10)^\circ = 0.5$  for  $0^\circ \leq t \leq 180^\circ$  (2 marks)
- 6 Construct a circle centre  $x$  and radius 2.5cm. Construct a tangent from a point  $P$ , 6cm from  $x$  to touch the circle at  $R$ . Measure the length  $PR$ . (4 marks)
- 7 Kago deposited Ksh 30 000 in a financial institution that paid simple interest at the rate of 12% per annum. Nekesa deposited the same amount of money as Kago in another financial institution that paid compound interest. After 5 years, they had equal amounts of money in the financial institutions. Determine the compound interest rate, to 1 decimal place, for Nekesa's deposit. (4 marks)
- 8 The masses in kilograms of 20 bags of maize were; 90, 94, 96, 98, 99, 102, 105, 91, 102, 99, 105, 94, 99, 90, 94, 99, 98, 96, 102 and 105. Using an assumed mean of 96kg, calculate the mean mass, per bag, of the maize. (3 marks)
- 9 Solve the equations
 
$$x + y = 17$$

$$xy - 5x = 32$$
 (4 marks)
- 10 Simplify  $\frac{\sqrt{5}}{\sqrt{5}-2}$ , leaving the answer in the form  $a + b\sqrt{c}$ , where  $a$ ,  $b$  and  $c$  are integers. (2 marks)

- 11 The base and height of a right angled triangle were measured as 6.4cm and 3.5cm respectively. Calculate the maximum absolute error in the area of the triangle. (3 marks)
- 12 (a) Expand  $(1 + x)^7$  upto the 4<sup>th</sup> term. (1 mark)
- (b) Use the expansion in part (a) above to find the approximate value of  $(0.94)^7$ . (2 marks)
- 13 The graph below shows the relationship between distance  $s$  metres and time  $t$  seconds in the interval  $0 \leq t \leq 6$ .

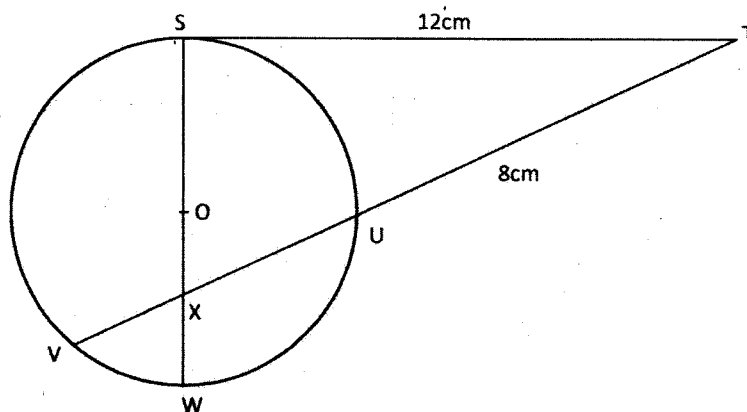


Use the graph to determine:

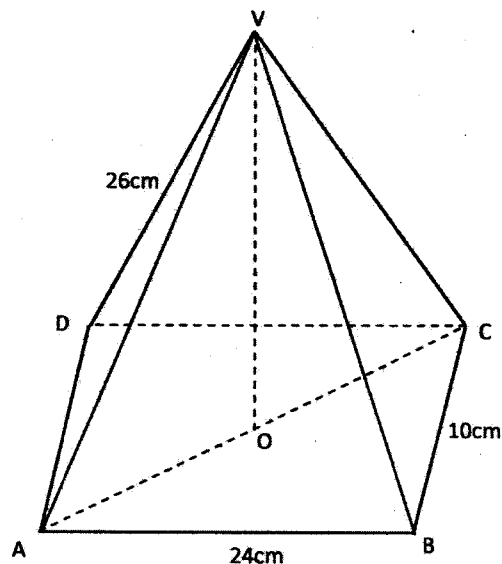
- (a) the average rate of change of distance between  $t = 3$  seconds and  $t = 6$  seconds; (2 marks)
- (b) the gradient at  $t = 3$  seconds. (2 marks)



- 14 In the figure below, the tangent  $ST$  meets chord  $VU$  produced at  $T$ . Chord  $SW$  passes through the centre,  $O$ , of the circle and intersects chord  $VU$  at  $X$ . Line  $ST = 12\text{cm}$  and  $UT = 8\text{cm}$ .



- (a) Calculate the length of chord  $VU$ . (2 marks)
- (b) If  $WX = 3\text{cm}$  and  $VX:XU = 2:3$ , find  $SX$ . (2 marks)
- 15 Three quantities  $P$ ,  $Q$  and  $R$  are such that  $P$  varies directly as  $Q$  and inversely as the square root of  $R$ . When  $P = 8$ ,  $Q = 10$  and  $R = 16$ . Determine the equation connecting  $P$ ,  $Q$  and  $R$ . (3 marks)
- 16 In the figure below,  $VABCD$  is a right pyramid on a rectangular base. Point  $O$  is vertically below the vertex  $V$ .  $AB = 24\text{cm}$ ,  $BC = 10\text{cm}$  and  $AV = 26\text{cm}$ .



Calculate the angle between the edge  $AV$  and the base  $ABCD$ . (3 marks)

**SECTION II (50 marks)**

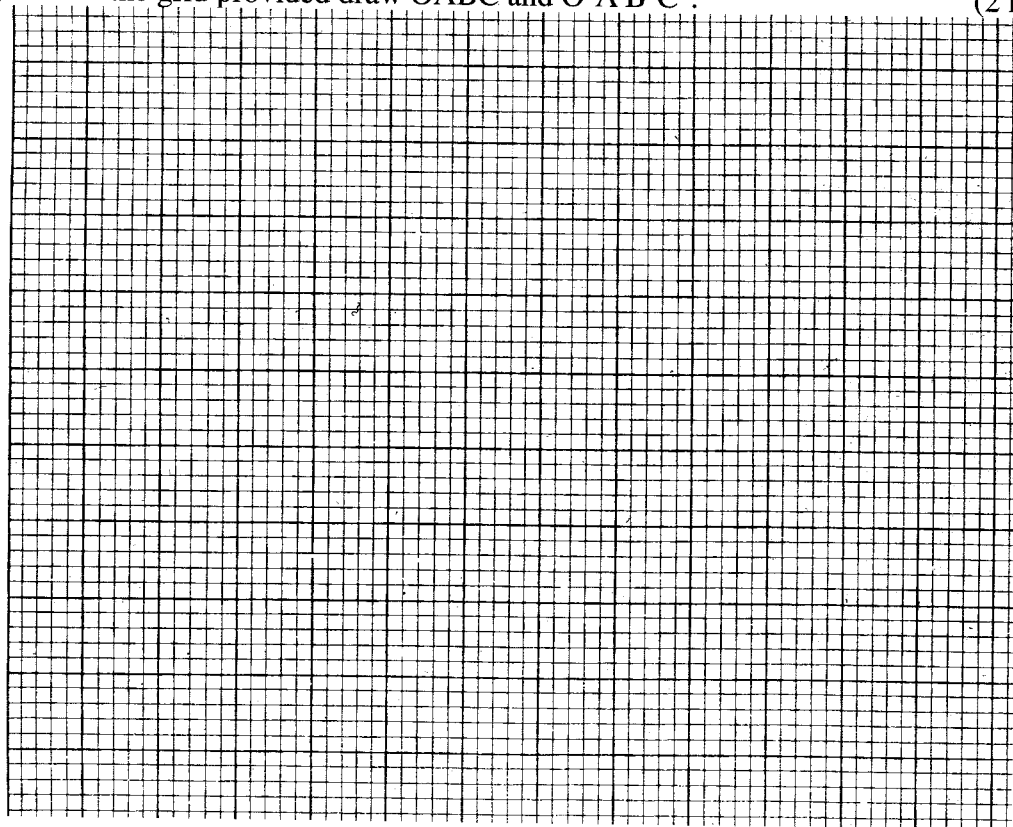
*Answer only five questions in this section in the spaces provided.*

- 17** Amaya was paid an initial salary of Ksh 180 000 per annum with a fixed annual increment. Bundi was paid an initial salary of Ksh 150 000 per annum with a 10% increment compounded annually.
- (a) Given that Amaya's annual salary in the 11th year was Ksh 288 000, determine:
    - (i) his annual increment; (2 marks)
    - (ii) the total amount of money Amaya earned during the 11 years. (2 marks)
  - (b) Determine Bundi's monthly earning, correct to the nearest shilling, during the eleventh year. (2 marks)
  - (c) Determine, correct to the nearest shilling:
    - (i) the total amount of money Bundi earned during the 11 years. (2 marks)
    - (ii) The difference between Bundi's and Amaya's average monthly earnings during the 11 years. (2 marks)

- 18** OABC is a parallelogram with vertices O(0,0), A(2,0), B(3,2) and C(1,2).

O'A'B'C' is the image of OABC under transformation matrix  $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

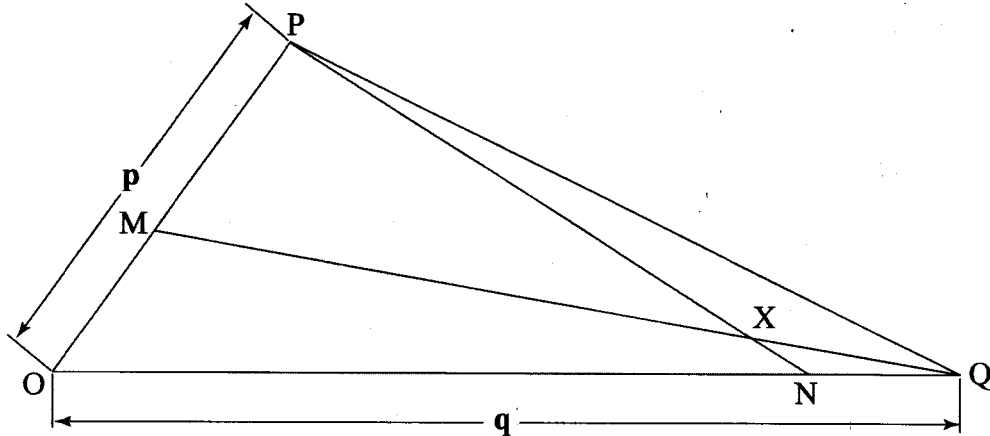
- (a) (i) Find the coordinates of O'A'B'C'. (2 marks)
- (ii) On the grid provided draw OABC and O'A'B'C'. (2 marks)



- (b) (i) Find  $O''A''B''C''$ , the image of  $O'A'B'C'$  under the transformation matrix  

$$\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}.$$
 (2 marks)
- (ii) On the same grid draw  $O''A''B''C''$ . (1 mark)
- (c) Find the single matrix that maps  $O''A''B''C''$  onto OABC. (3 marks)

- 19 In triangle OPQ below,  $OP = p$ ,  $OQ = q$ . Point M lies on  $OP$  such that  $OM : MP = 2 : 3$  and point N lies on  $OQ$  such that  $ON : NQ = 5 : 1$ . Line PN intersects line MQ at X.



- (a) Express in terms of  $p$  and  $q$
- (i)  $PN$ ; (1 mark)
- (ii)  $QM$ . (1 mark)
- (b) Given that  $PX = kPN$  and  $QX = rQM$ , where  $k$  and  $r$  are scalars:
- (i) write two different expressions for  $OX$  in terms of  $p$ ,  $q$  and  $k$  and  $r$ ; (2 marks)
- (ii) find the values of  $k$  and  $r$ ; (4 marks)
- (iii) determine the ratio in which  $X$  divides line  $MQ$ . (2 marks)

- 20 In June of a certain year, an employee's basic salary was Ksh 17 000. The employee was also paid a house allowance of Ksh 6 000, a commuter allowance of Ksh 2 500 and a medical allowance of Ksh 1800. In July of that year, the employee's basic salary was raised by 2%.

- (a) Calculate the employees:
- (i) basic salary for July; (2 marks)
- (ii) total taxable income in July of that year. (2 marks)

- (b) In that year, the Income Tax Rates were as shown in the table below:

Monthly taxable income (Kshs)	Percentage rate of tax per shilling
Up to 9680	10
From 9881 to 18 800	15
From 18 801 to 27 920	20
From 27 921 to 37 040	25
From 37041 and above	30

Given that the Monthly Personal Relief was Ksh 1056, calculate the net tax paid by the employee. (6 marks)

- 21 (a) On the same diagram construct:
- triangle ABC such that  $AB = 9\text{cm}$ ,  $AC = 7\text{cm}$  and angle  $CAB = 60^\circ$ ; (2 marks)
  - the locus of a point P such that P is equidistant from A and B; (1 mark)
  - the locus of a point Q such that  $CQ \leq 3.5\text{cm}$ . (1 mark)
- (b) On the diagram in part (a):
- shade the region R, containing all the points enclosed by the locus of P and the locus of Q, such that  $AP \geq BP$ ; (2 marks)
  - find the area of the region shaded in part (b)(i) above. (4 marks)
- 22 A tourist took 1h 20minutes to travel by an aircraft from town T( $3^\circ\text{S}$ ,  $35^\circ\text{E}$ ) to town U( $9^\circ\text{N}$ ,  $35^\circ\text{E}$ ).  
(Take the radius of the earth to be 6370km and  $\pi = \frac{22}{7}$ ),
- Find the average speed of the aircraft. (3 marks)
  - After staying at town U for 30 minutes, the tourist took a second aircraft to town V( $9^\circ\text{N}$ ,  $5^\circ\text{E}$ ). The average speed of the second aircraft was 90% that of the first aircraft. Determine the time, to the nearest minute, the aircraft took to travel from U to V. (3 marks)
  - When the journey started at town T, the local time was 0700h. Find the local time at V when the tourist arrived. (4 marks)
- 23 A box contains 3 brown, 9 pink and 15 white clothes pegs. The pegs are identical except for the colour.
- Find the probability of picking:
    - a brown peg; (1 mark)
    - a pink or a white peg. (2 marks)

(b) Two pegs are picked at random, one at a time, without replacement. Find the probability that:

- (i) a white peg and a brown peg are picked; (3 marks)
- (ii) both pegs are of the same colour. (4 marks)

24 The acceleration of a body moving along a straight line is  $(4 - t) \text{ m/s}^2$  and its velocity is  $v \text{ m/s}$  after  $t$  seconds.

- (a) (i) If the initial velocity of the body is  $3 \text{ m/s}$ , express the velocity  $v$  in terms of  $t$ . (3 marks)
- (ii) Find the velocity of the body after 2 seconds. (2 marks)

(b) Calculate:

- (i) the time taken to attain maximum velocity; (2 marks)
- (ii) the distance covered by the body to attain the maximum velocity. (3 marks)