

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)

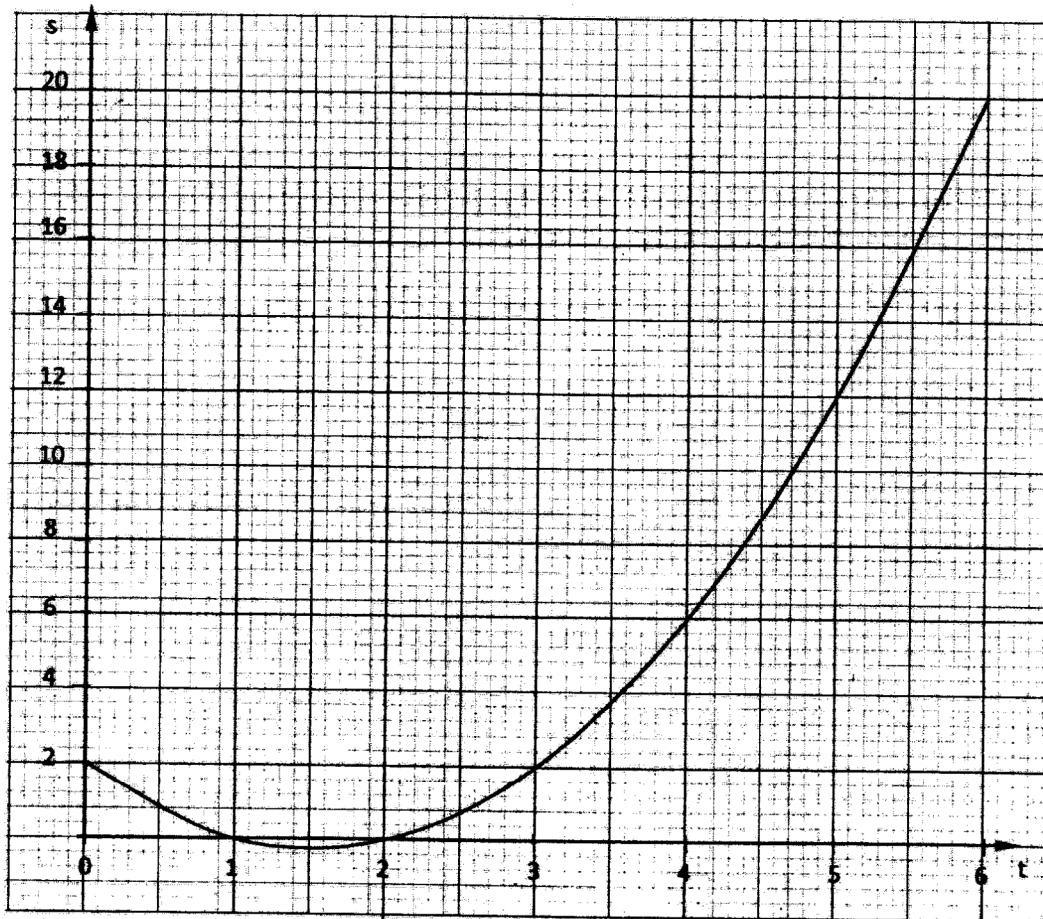
- 9 Solve the equations

$$x + y = 17$$

$$xy - 5x = 32$$
 (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)

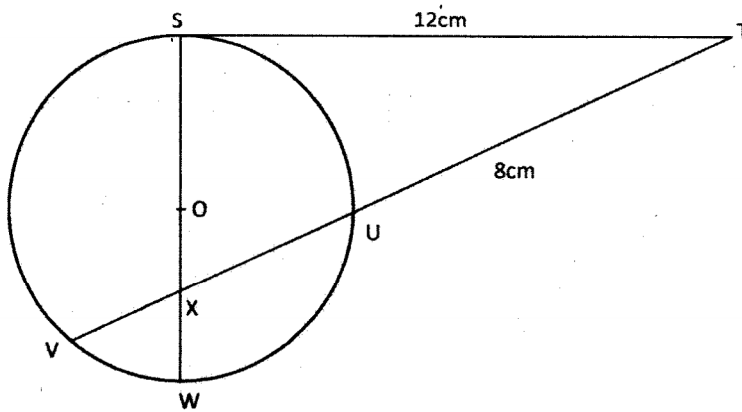
- 11 The base and height of a right angled triangle were measured as 6.4cm and 3.5cm respectively. Calculate the maximum absolute error in the area of the triangle. (3 marks)
- 12 (a) Expand $(1 + x)^7$ upto the 4th term. (1 mark)
- (b) Use the expansion in part (a) above to find the approximate value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



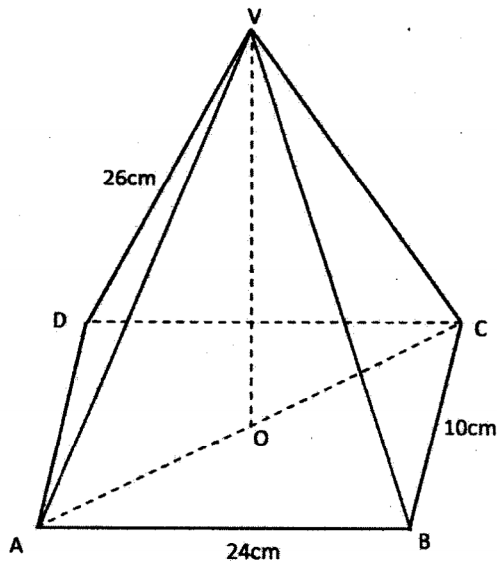
Use the graph to determine:

- (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.

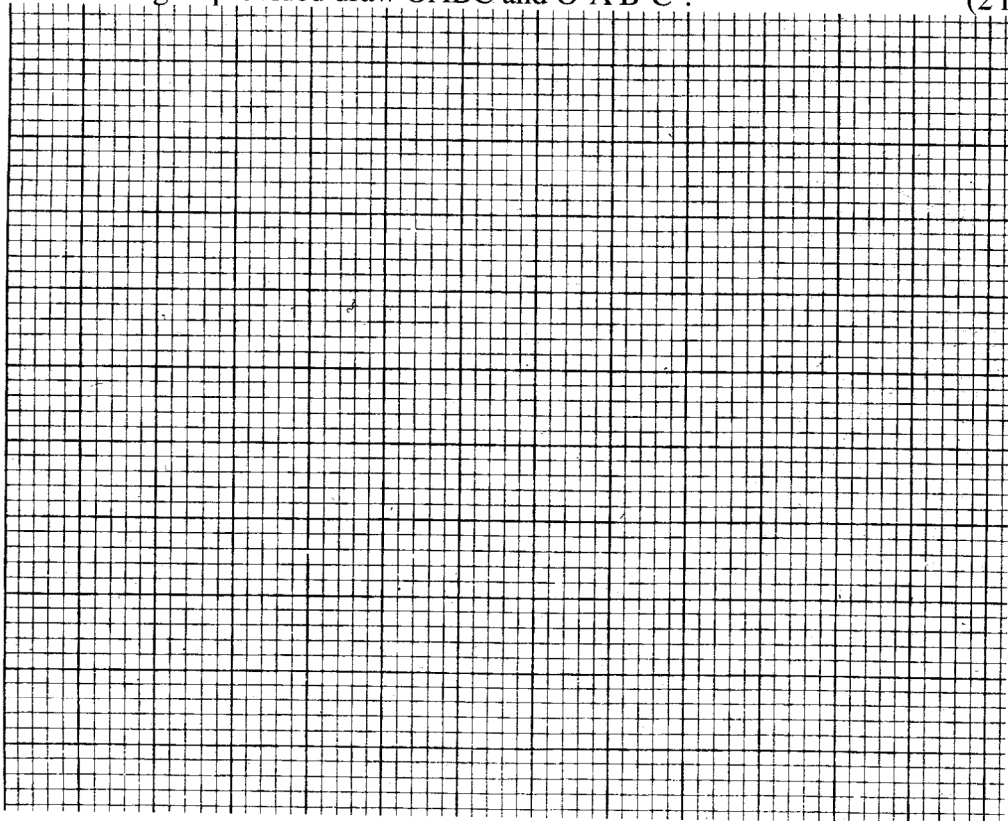
17 Amaya was paid an initial salary of Ksh 180 000 per annum with a fixed annual increment. Bundi was paid an initial salary of Ksh 150 000 per annum with a 10% increment compounded annually.

- (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).

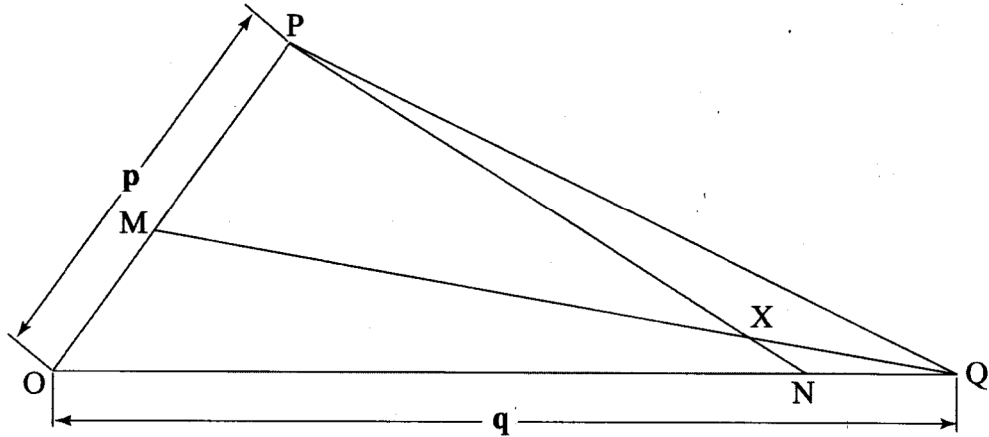
O'A'B'C' is the image of OABC under transformation matrix $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

- (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°S , 35°E) to town U(9°N , 35°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°N , 5°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 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)