Name ……..…Index Number……/…….. Stream……..

121/1 **Candidates Signature ……..**
MATHEMATICS ALT A
PAPER 1 **Date …….**
NOV/DEC 2020
2½ hours

THE MATHEMATICATICS GURUS
JOINT EXAMINATION
MATHEMATICS ALT A
PAPER 1
2½ hours

Instructions to Candidates:

a) Write your name adm no, class and the date in the spaces provided above.
b) *This paper contains **two** sections: **Section I** and **Section II.***
c) *Answer **all** questions in **section I** and only **five** questions in **section II.***
d) Show all the steps in your calculations, giving your answer at each stage in the spaces below each question.
e) Marks may be given for correct working even if the answer is wrong.
*f) **Non-programmable** silent electronic calculators **and** KNEC Mathematical table may be used, except where stated otherwise.*
*g) **This paper consists of 14 printed pages***
*h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
*i) **Candidates should answer the questions in English***

For Examiners use only.
SECTION II

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 1 (50 MARKS)

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

1. Evaluate without using a calculator (3 marks)

$$\frac{45-8\times{}^{-}4-15\div{}^{-}3}{3\times{}^{-}3+{}^{-}8(6-2)}$$

2. Solve for n in $\frac{y^7 \times y^{11}}{y^4 \times y^n} = y^5$ (3 marks)

3. A furniture dealer imported 25 Italian-made sofas at Ksh 120 000 each. He sold 10 of the at a profit of 30% and the rest at a discount of Ksh 20 000 each. Calculate his overall profit. (3 marks)

4. Denis sold 300 tickets for a music concert. He sold adult tickets at sh 500 each and children tickets at sh 400. He collected a total of sh 144 400 in ticket sales. Determine the number children tickets he sold. (3 Marks)

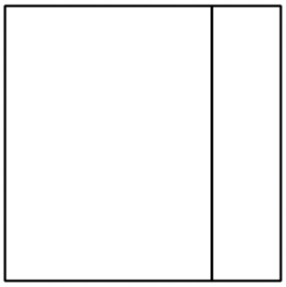
5. A ship sails from point A on a bearing of 035^0 for 9.5km to point B. At B the ship alters course and sails for 7km on a bearing of 170^0 to point C. Use a scale drawing to find the distance and bearing of A from C. (4 marks)

6. Given that $\sin x = \frac{2}{5}$, find the exact value of $\cos^2 x$ (2 marks)

7. A train whose length is 86m is travelling at a speed of 28km/h in the same direction as a truck whose length is 10m. if the truck takes 10.8 s to completely overtake the train, calculate the speed of the truck in km/h. (3marks)

8. The displacement S metres of a particle moving in a straight line after t seconds is given by $S = 2t^2 + 3t - 6$. Find the velocity when t =3 seconds. (3 marks)

9. The diagram below shows part of the net of a cuboid. Complete the net. (2 marks)



10. The surface areas of two similar solids are 352cm^2 and 792 cm^2 respectively. If the smaller solid has a mass of 1408g, find the mass of the larger solid. (3marks)

11. David paid rent using $\frac{1}{10}$ of his salary. He used $\frac{1}{2}$ of the remaining amount to make down payment for a plot. He gave his mother Ksh. 2 500 and paid school fee balance for his son of Ksh.7 500. He then saved Sh. 12,500. How much was the down payment for the plot? (4marks)

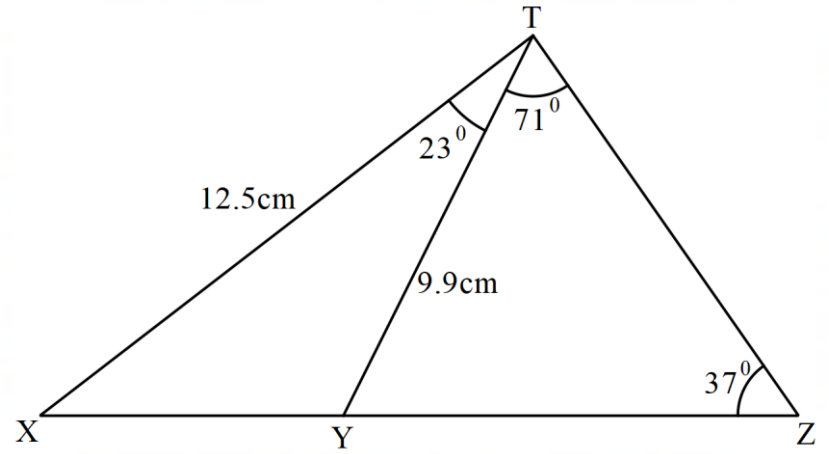
12. Using a ruler and a pair compass only, construct a triangle AB=6cm, BC= 8cm and AC= 11cm. draw a circle passing through the vertices of the triangle. Measure the radius of the circle. (4 marks)

13. An interior angle of a regular polygon is five times its exterior. Find the number of sides of the polygon. (3marks)

14. A rectangle whose length is 9cm longer than its width has an area of $36cm^2$. If the width is x cm, form an equation in x and solve it to find the dimensions of the rectangle (3marks)

15. Solve for $3-3x \leq x+7 \leq 9-x$ hence state the integral values of x (3marks)

16. In triangle TXZ below, TX = 12.5cm and angle TZX = 37^0. Y is a point on the line XZ such that TY = 9.9cm, angle XTY = 23^0 and angle YTZ = 71^0.



Calculate to 1 decimal place:

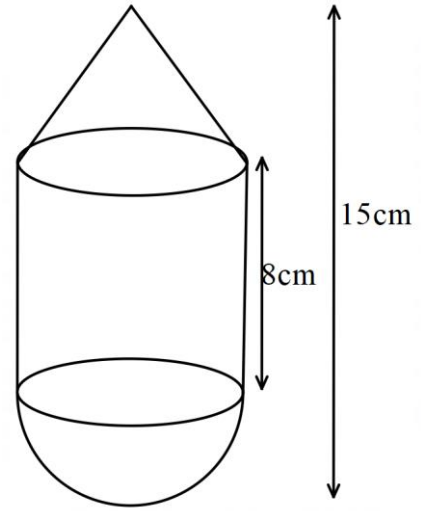
a) the length of side XY (2 marks)

b) The length of side TZ (2 marks)

SECTION II (50 MARKS)

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

17. The figure below shows a model of a storage tank is made up of a conical top, a hemispherical bottom and the middle part is cylindrical. The total height of the model is 15cm, diameter of the cone, cylinder and the hemisphere is 6cm and the height of the cylindrical part is 8cm.



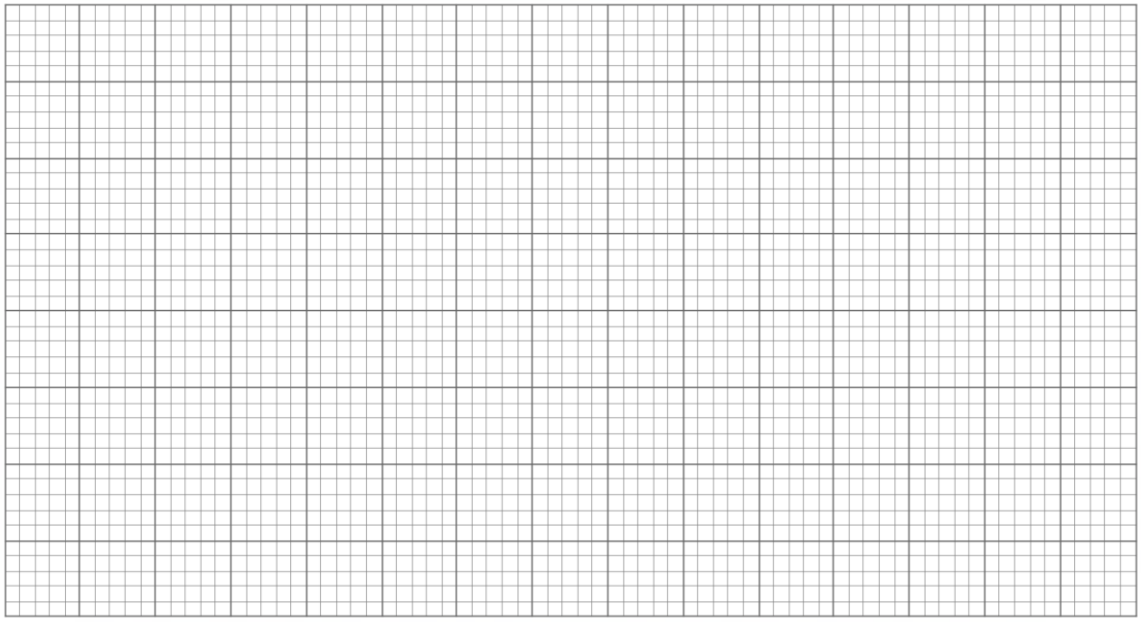
Calculate:

a) the total external surface area of the model in terms of π (5 marks)

b) the total volume of the model in cm^3 correct to 2 significant figures, (5 marks)

18.

a) Three vertices of a parallelogram ABCD are $A(-7,3)$, $B(1,-1)$ and $C(5,1)$. On the grid provided, draw the parallelogram ABCD. (2 marks)



b) Determine:

(i) the gradient of line AB. (2 marks)

(ii) the equation of line AB in the form $y = mx + c$, where m and are constants. (2 marks)

c) Another line L is perpendicular to CD and passes through the point (1, 3). Determine:

(i) the equation of L in the form $ax + by = c$ where a, b and c are constants. (3 marks)

(ii) the coordinates of the y-intercept of line L. (1 mark)

19. The table below shows the age in years of workers in a factory

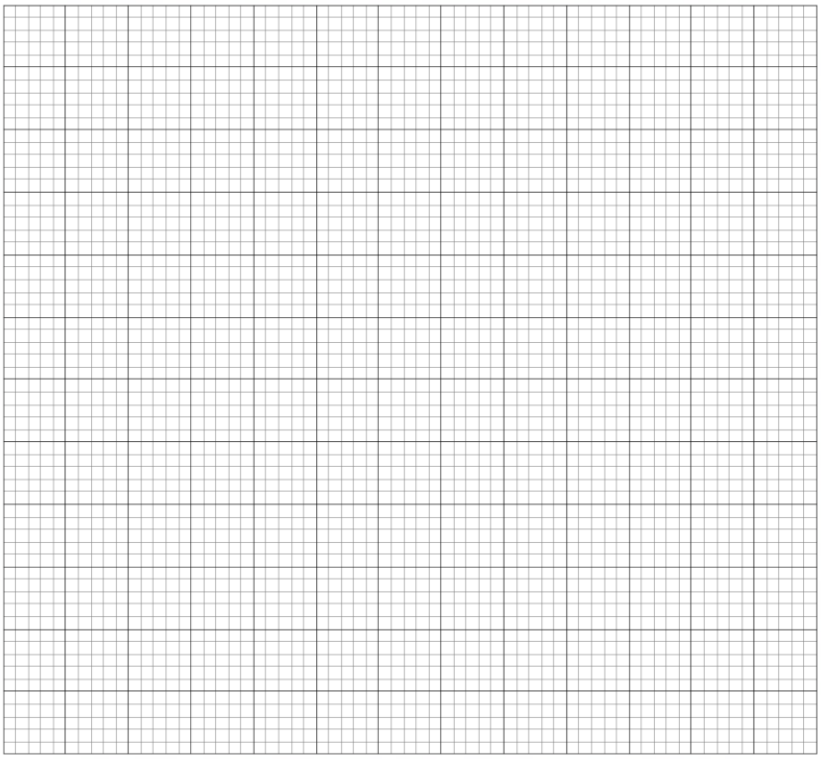
Age x	No of workers
15 – 20	4
20 – 25	10
25 – 30	6
30 – 40	22
40 - 60	8

a) Calculate the estimate of:

(i) the mean age of the workers (3 marks)

(ii) the median age of the workers (3 marks)

b) (i) Draw a histogram to represent the data (3 marks)



(ii) Use the histogram to determine the number of workers who are aged 23 and below years. (1 mark)

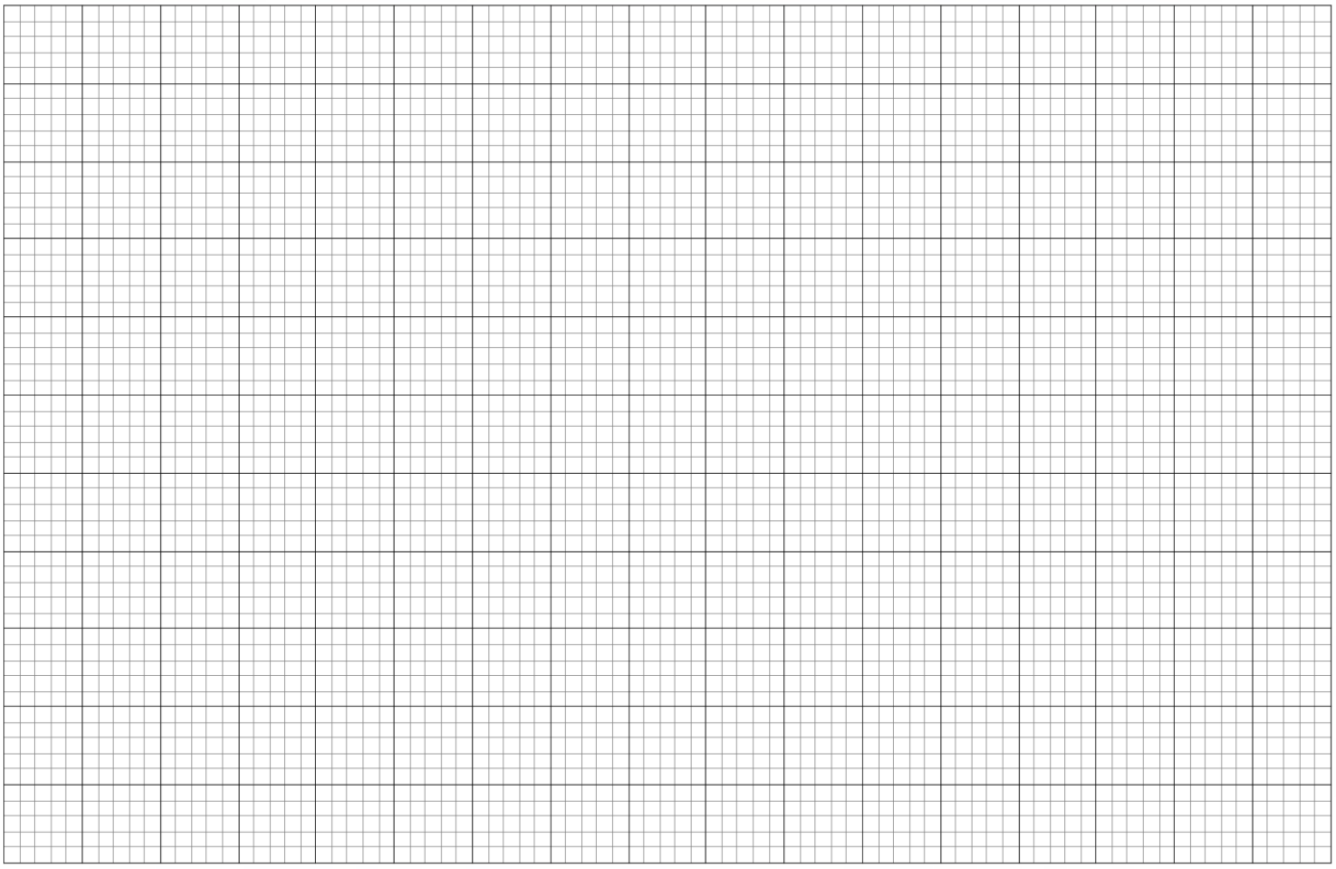
20. a) Given $\mathbf{A} = \begin{pmatrix} -2 & 4 \\ 1 & 0 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 0 & 1 \\ p & q \end{pmatrix}$, and that $\mathbf{AB} = \mathbf{I}$, find the value of p and q. (4 marks)

b) Find $\mathbf{P}^{-1}$, the inverse of the matrix $\mathbf{P} = \begin{pmatrix} 5 & 3 \\ 2 & 7 \end{pmatrix}$.

Hence determine the coordinates of the point of intersection of the lines:
$5x + 3y = 21$ and $2x + 7y = 20$ (6 marks)

21. On the grid provided, Using a scale of 1cm to represent 5 units on each axis and taking values of x from -40 to 40 and values of y from -10 to 40.

a) Draw triangle PQR with vertices P(15, 5), Q(30, 10) and R(35, 20) (2 marks)

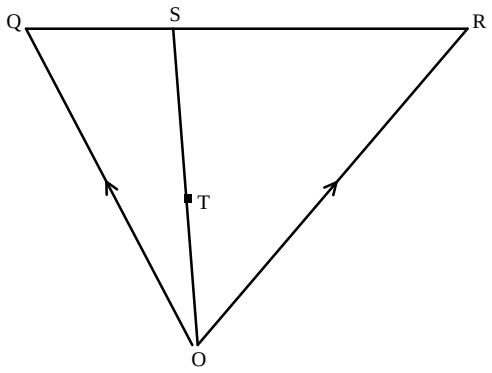


b) Draw triangle P'Q'R', the image of triangle PQR under reflection in the line y = 2x. (3 marks)

c) Draw triangle P"Q"R", the image of triangle P'Q'R' under a reflection in the line y + x = 0. (2 marks)

d) Determine by construction, the centre and the angle of rotation that maps triangle P"Q"R" onto triangle PQR. (3 marks)

22. In the figure below S divides QR in the ratio 1:2, T divides OS in the ratio 3:2, **OR** = **r** and **OQ** = **q**.



a) Write in terms of **q** and **r**:

i) **RQ** (1 mark)

ii) **OS** (2 marks)

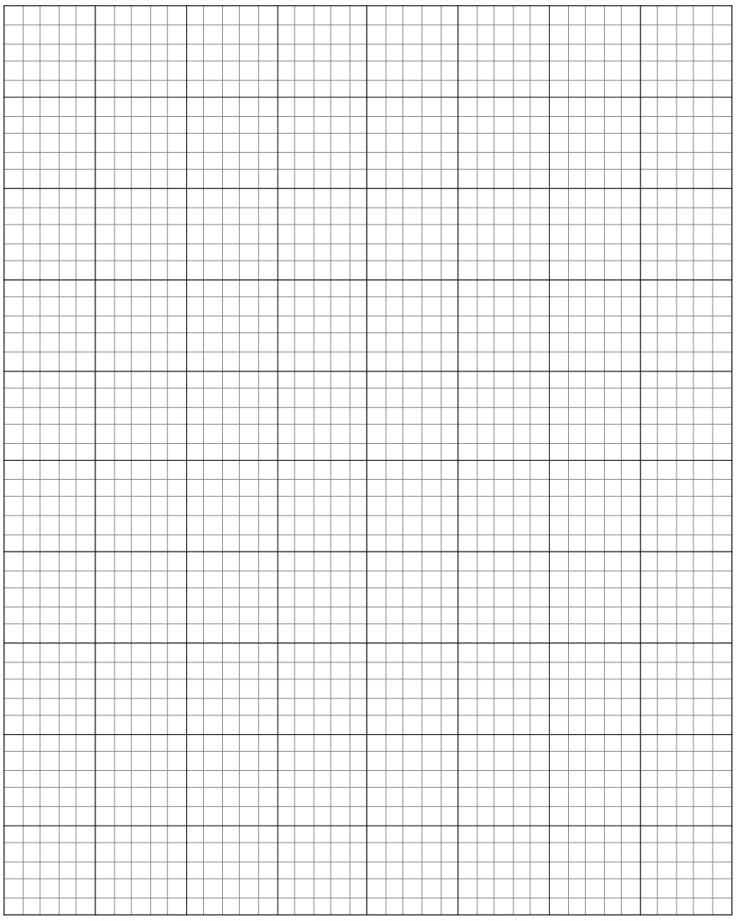
iii) **RT** (2 marks)

b) i) If L is the midpoint of line OQ, show that the points R, T and L are collinear. (4 marks)

ii) Hence find the ratio of RT:TL (1 mark)

23.

a) On the grid provided, draw the graph of the function $y = \frac{1}{2}x^2 - x + 3$ for $0 \le x \le 6$. (3 marks)



b) Use the graph and the trapezium rule, to approximate the area under the curve between x = 1, x=6 and the x axis using 6 ordinates. (3 marks)

c) Calculate the mid-ordinates for 5 strips between x = 1 and x = 6 and hence use the mid-ordinate rule to approximate the area under the curve between x = 1, x=6 and the x axis. (3marks)

d) Determine the difference in area between the trapezium rule and the mid-ordinate rule estimates (1 mark)

24. The equation of a curve is $y = 2x^3 - 9x^2 + 12x - 9$.

a) The gradient of the curve when x = 3. (3 marks)

b) i) The turning points of the curve. (3 marks)

ii) The nature of the turning point b(i) above. (2 marks)

c) Sketch the curve. (2 marks)