456/2
MATHEMATICS
Paper 2
Oct./Nov. 2022
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

MATHEMATICS

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **all** *questions in Section* **A** *and any* **five** *questions from section* **B**.

Any additional question(s) answered will **not** *be marked.*

All *necessary calculations must be done in the Answer booklet(s) provided. Therefore, no paper should be given for rough work.*

Graph paper is provided.

Silent, non programmable scientific calculators and mathematical tables with a list of formulae may be used.

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SECTION A: (40 MARKS)

Answer **all** *questions in this section.*

1. Three students, Sarah, Jane and Ismail shared money in the ratio 4 : 6 : 9 respectively. Ismail received Shs24,300. How much money did they share? *(04 marks)*

2. Two sets A and B in a universal set ε are such that $n(\varepsilon) = 21$, $n(A) = 14$ and $n(A \cup B) = 16$.

Find:

(a) $n(A \cup B)'$

(b) $n(A' \cap B)$ *(04 marks)*

3. The points M(1, 3), N(5, 11), A(0, –3) and B(4, y) are such that ***MN*** is parallel to ***AB***. Determine the value of y. *(04 marks)*

4. A function h is defined by $h(y) = y^2 - 2$. Find the range of h if the domain is $\{-4, -2, 0, 3\}$. *(04 marks)*

5. Express $\frac{1}{\sqrt{5}} + \frac{1}{\sqrt{20}}$ in the form $\frac{a}{b}\sqrt{c}$. *(04 marks)*

6. A cone has a base radius of 21 cm and a volume of 5500 cm^3. Calculate the vertical height of the cone.

(Use $\pi = \frac{22}{7}$) *(04 marks)*

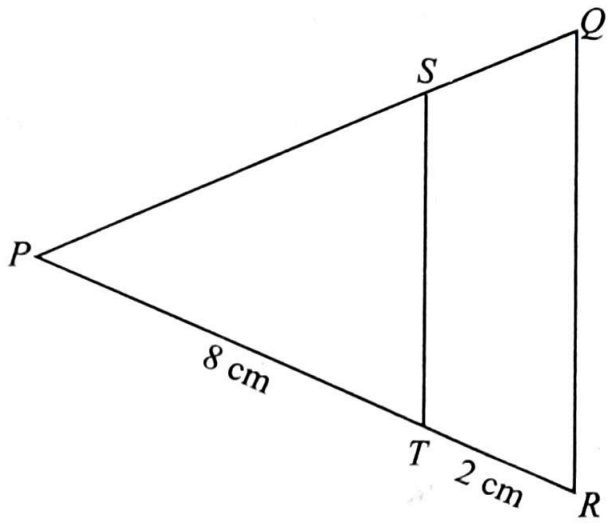
7. (a) Draw the graphs of the lines $y = 1$ and $x + y = 6$ on the same axes. *(03 marks)*

(b) Use your graph to state the coordinates of the point of intersection of the two lines. *(01 mark)*

8. Given that $\mathbf{a} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ 9 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 14 \\ 36 \end{pmatrix}$, find the value of k if $k\mathbf{a} + 2\mathbf{b} = \mathbf{c}$. *(04 marks)*

9. A camera costs £200 in Britain. Given that the exchange rates are £1 = US$1.2 and US $ 1 = Ug Shs3700, calculate the cost of the camera in Uganda shillings (Ug Shs). *(04 marks)*

10. In the figure below, $PT = 8$ cm, $TR = 2$ cm and ST is parallel to QR. The area of triangle PQR is 75 cm^2.



Calculate the area of the triangle PST. (*04 marks*)

SECTION B: (60 MARKS)

Answer any **five** *questions from this section. All questions carry equal marks.*

11. Solve for x and y in the equations

$$8^x = 4^{2y+1} \text{ and } 27^{2x} = 9^{y-3}.$$ (*12 marks*)

12. A class has 56 students. All the students belong to at least one of the following clubs: Drama (D), Mathematics (M) and Patriotism (P).

28 students belong to the Drama club, 24 belong to the Mathematics club and 32 belong to the Patriotism club.

10 students belong to Drama and Mathematics clubs. 6 students belong to Drama and Patriotism clubs. 4 students belong to all the three clubs.

(a) Represent the given information on a Venn diagram. (*04 marks*)

(b) Find the number of students who belong to the Mathematics club only. (*05 marks*)

(c) If a student is picked at random, what is the probability that the student belongs to at least two clubs? (*03 marks*)

13. (a) Given that $f(x) = 27\ (x - b^2)$ and $f(4) = 0$, find;

(i) the possible value(s) of b.
(ii) $f(-8)$. *(06 marks)*

(b) If $g^{-1}(x) = px^2 + q$, $g^{-1}(3) = 11$ and $g^{-1}(2) = 16$, determine;

(i) the values of p and q.

(ii) $g(x)$. *(06 marks)*

14. Two towns, P and Q are 300 km apart. A taxi left town P for town Q at 7:00 am and travelled non-stop at a steady speed of 80 km/hr. At 8:15 am, a saloon car left town Q for town P at a steady speed of 100 km/hr.

After one hour, the car stopped for the driver to have breakfast that lasted 30 minutes. The car then travelled at a speed of 120 km/hr until it reached town P.

(a) Using a scale of 1 cm to represent 20 km and 1 cm to represent 15 minutes, draw on the same axes the distance-time graphs for the journeys of the two vehicles. *(06 marks)*

(b) Use your graph to determine;

(i) the time when the two vehicles met.
(ii) the distance from Q when the two vehicles met. *(03 marks)*

(c) Calculate the average speed of the saloon car. *(03 marks)*

15. A dealer sells motor cycles on cash terms and hire purchase terms. A motor cycle can be bought on hire purchase terms by making a deposit of Shs1,000,000 and then paying 10 equal instalments of Shs300,000 each. The hire purchase price is 25 % higher than the cash price.

(a) Calculate the cash price. *(04 marks)*

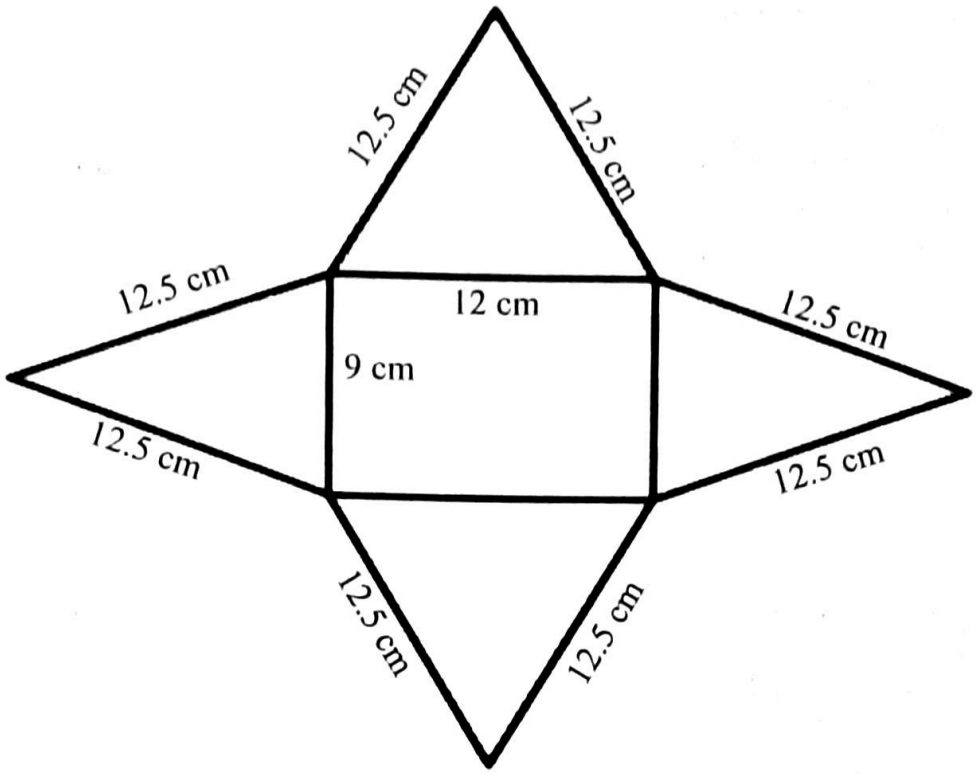
(b) The dealer bought motor cycles. The cost price of a motor cycle was Shs3,000,000. The dealer then sold 18 motor cycles on cash terms and 30 motor cycles on hire purchase terms. Calculate the percentage profit made by the dealer on the sales of the motor cycles. *(08 marks)*

16. In a parallelogram $OABC$, $\boldsymbol{OA} = \boldsymbol{a}$ and $\boldsymbol{OC} = \boldsymbol{c}$. M lies on AB Such that $\boldsymbol{AM} = 3\boldsymbol{MB}$. Lines OB and AC intersect at P such that $\boldsymbol{OP} = \boldsymbol{PB}$ and $\boldsymbol{AP} = \boldsymbol{PC}$. X is the mid-point of CB. OB is produced to Y such that $\boldsymbol{OB}:\boldsymbol{BY} = 7:3$.

Express in terms of $\boldsymbol{a}$ and $\boldsymbol{c}$ the vectors:

(a) $\boldsymbol{OP}$. *(06 marks)*
(b) $\boldsymbol{XM}$. *(03 marks)*
(c) $\boldsymbol{BY}$. *(03 marks)*

17. The figure below shows the net of a right pyramid with a rectangular base.



(a) Draw the pyramid formed from the net. (*02 marks*)

(b) Calculate;

(i) the height of the pyramid. (*04 marks*)

(ii) the angle between the slanting edge and the base of the pyramid. (*04 marks*)

(ii) the volume of the pyramid. (*02 marks*)

END