456/2
MATHEMATICS
Paper 2
July/Aug. 2022
$2^1/_2$ hours

''Together for Mathematics''

SECONDARY MATHEMATICS TEACHERS' ASSOCIATION

SMATA JOINT MOCK EXAMINATIONS 2022
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 on the same answer booklet 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.

State the **degree of accuracy** at the end of each question attempted using calculator or mathematical table and indicate **Cal** for calculator or **Tab** for mathematical tables.

SECTION A: (40 MARKS)

Attempt **all** questions from this section

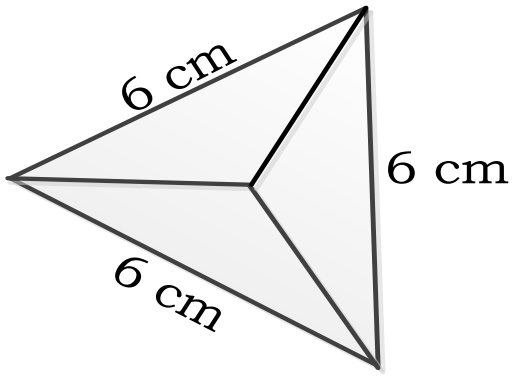
1. Given that: $2log\ x - log\ (2x + 3) = 0$ ***(04 marks)***

2. If $g(x) = \sqrt{\frac{x-3}{x}}$. Find the value of x for which, $g^{-1}(x)$ is meaningless. ***(04 marks)***

3. If 420 U.S dollars is equivalent to 1,533,000 Ug Shs. Find the;
   (a) exchange rate.

   (b) equivalent of Ug Shs. 1,832,300 in US dollars. ***(04 marks)***

4. The figure below shows a regular tetrahedron of side 6cm. Find the surface area of the tetrahedron. ***(04 marks)***



5. If $n(AnB) = X$; $n(A^InB) = 2X + 6$, $n(B) = 18$, $n(A^InB^I) = 3X$ and $n(AuB) = 30$. Give that A and B are sets, find the,
   (a) $n(AnB^I)$

   (b) $n(\in)$ where $\in$ is the universal set. ***(04 marks)***

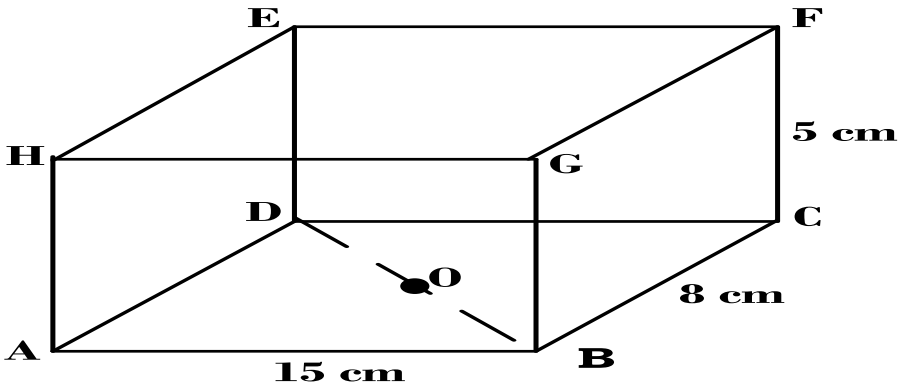
6. Given that point P is (3, 7) and vector $PQ = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$. Find the;
   (a) Coordinates of **Q**

   (b) $|\boldsymbol{OQ}|$ ***(04 marks)***

7. The area of a plot of land is 12km^2 on ground. It's area on map is 3cm^2. Find the scale of the map. ***(04 marks)***

8. Find the equation of the line perpendicular to $3x - 6 = -2y$ and passing through (4, -1). ***(04 marks)***

9. The figure below shows a cuboid labelled ABCDEFGH. Point O is the mid point of the of BD, AB = 15 cm, BC = 8 cm and CF = 5 cm.



Calculate the angle between the lines OE and OF. ***(04 marks)***

10. Without using a calculator, simplify; ***(04 marks)***

$$\frac{\sqrt{80} - \sqrt{45}}{\sqrt{45} + \sqrt{20}}$$

SECTION B: (60 MARKS)

Attempt any ***five*** questions from this sections.

11. (a) A mapping is described by; $x \longrightarrow -x^2 + 1$.
    (i) Determine the range corresponding to the domain $\{-1, 1, 2, 3\}$ of this mapping.
    (ii) Represent the mapping in (a) (i) above on an arrow diagram. Hence state the type of mapping. ***(06 marks)***

    (b) Given functions, $f(x) = x^2 - 3$ and $h(x) = 5x$. Find the value of x for which; $hf(x) + fh(x) = 102$. ***(06 marks)***

12. (a) A television set can be sold by cash price or hire purchase. Under hire purchase, a deposit of 25% of the market price is made then five equal instruments of Shs. 450,000 each. Determine the cash price of the television set whose cost under hire purchase is Shs. 2,970,000. ***(04 marks)***

(b) Sarah's monthly gross income is Shs. 900,000. Which includes tax free allowances of Shs. 250,000. The rest of the money is taxed at 10% per month. Calculate her net monthly income.

(04 marks)

(c) A car valued at 13,440,000 Ug Shs. depreciates at a rate of 10% per year. Find the number of years it will take for the value of the car to be at 9,797,760 Ug Shs. after depreciating. ***(04 marks)***

13. The distance, ***d*** in metres of an object varies partly with time, t in seconds and partly with the square root of time t. Given that, the distance, $d = 14$, $t = 4$ and $d = 27$ when $t = 9$.

(a) Find the equation connecting d and t.

(b) Using the equation above find the value of d when $t = 25$.

(12 marks)

14. Two towns P and Q are separated by a distance of ***135 km***. A bus travelling at ***45 km/hr*** heading for heading for town Q from town P got a mechanical break down at ***9:15am*** after it had travelled for one hour. It was repaired instantly and after ***45 minutes***, it continued its journey to town Q at the same initial speed. A taxi heading for town P from town Q at a speed of ***35km/hr*** started at the same time with the bus before its mechanical break down.

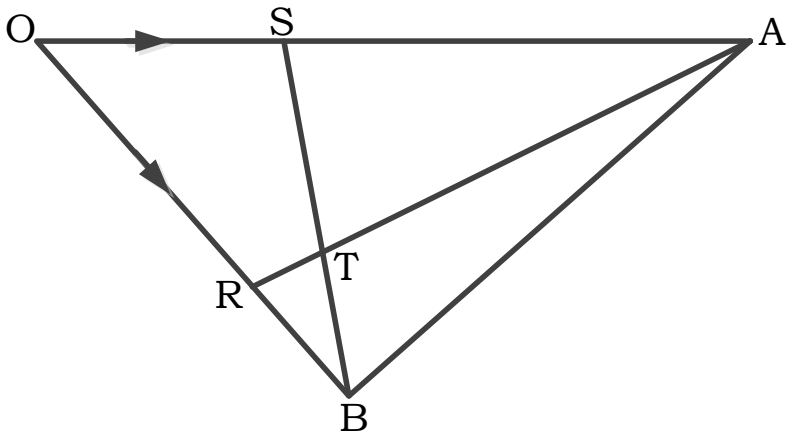
(a) Using a scale of **2cm** representing **1 hour** on the horizontal axis and **2cm** representing **20 km** on the vertical axis, draw a distance – time graph for the two vehicles and use it to determine;

(i) the time when the bus and the taxi reached their destination.

(ii) when and at what distance from town P the taxi meet the bus.

(b) Assuming that the mechanical break down was very serious and the bus had to reduce speed to ***30 km/hr,*** using the graph find how long it would take the bus to complete the remaining distance after the mechanical break down. ***(12 marks)***

15. In a triangle **OAB** below; **OA** = **a**, **OB** = **b**. **R** is a point on **OB** such that **OR : RB** = **3 : 1**. **S** is a point on **OA** such that **OS : SA** = **1 : 2**. **AR** intersects with **SB** at point **T**.



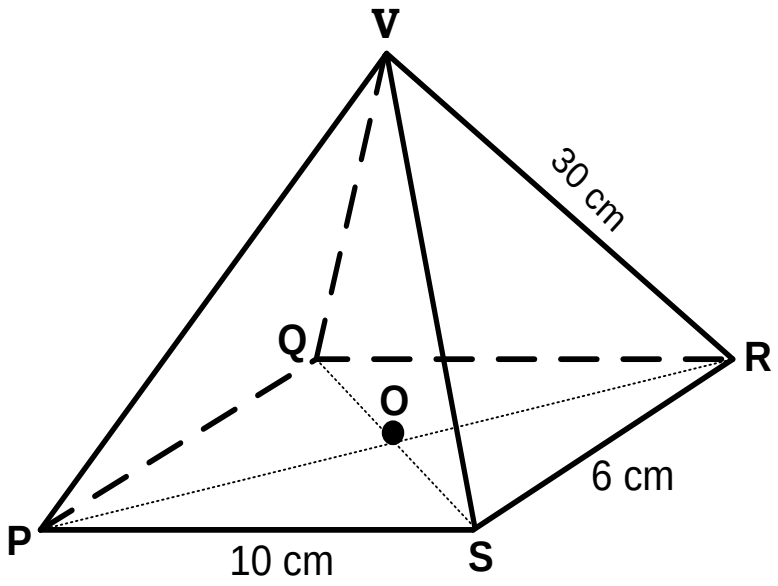
Given that, AT = x AR and BT = y BS.

(a) Find the position vector of T in terms of;
   (i) x, ***a*** and ***b***
   (ii) y, ***a*** *and* ***b***
   (iii) Hence, find x and y. ***(09 marks)***

(b) Express in terms of ***a*** and ***b*** the vector **ST.** ***(03 marks)***

16. In a class of 50 students, 15 students like Swimming (S), 20 students like Football (F) and 14 students like Volley ball (V). No student likes more than two games. 6 students like swimming and Volleyball. 4 students like swimming and football. The number of students who like football and volley ball is equal to the number of those who like volley ball but not football.
   (a) Represent the above information on a Venn diagram.
   (b) Find the number of students who like volley ball or swimming.
   (c) Find the probability of selecting a student who likes none of the games. ***(12 marks)***

17. The figure below represents a rectangular based pyramid VPQRS. PS = 10 cm and SR =6 cm. V is vertically above O and VR = 30 cm.



(a) Calculate the;

(i) length of PR, correct to **two** decimal places.

(ii) height of the pyramid.

(b) (i) Find the angle between the plane VPQ and VSR.

(ii) Calculate the volume of the pyramid, correct to **one** decimal place. ***(12 marks)***

EN D