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MATHEMATICS
Paper 2
July/August 2023
2½ hours

MASAKA DIOCESAN EXAMINATIONS BOARD

Uganda Certificate of Education
Joint Mock Examinations 2023
MATHEMATICS
Paper 2
2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

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

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

*All necessary calculations **must** be shown clearly with the rest of the answers. Therefore, no paper should be given for rough work.*

Squared paper is provided.
Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A:

1. Use logarithm tables to evaluate $\frac{0.382 \times 14.1}{37.32}$ (4 marks)

2. Given that $y = x^4$, $w = 4x^3$ and $z = 12x^2$. Show that $\frac{4}{3}yz - w^2 = 0$ (4 marks)

3. The inverse function $f^{-1}(x)$ is defined as $f^{-1}(x) = \frac{x+3}{4}$, find $f(x)$ and $f(1)$. (4 marks)

4. Given that $n(\varepsilon) = 20$, $\cap(A \cup B)' = 7$, $n(A \cap B) = 3$ and $\cap(A \cap B') = 5$. Find;
   (a) $\cap(B)$, (2 marks)
   (b) $\cap(A' \cap B)$ (2 marks)

5. The line $2y + 3x - 4 = 0$ is the perpendicular bisector of the line segment $\overline{AB}$ where A(2, 3) and B(5, y). Determine the value of y. (4 marks)

6. Two similar cups A and B respectively have volume 100cm^3 and ~~100cm^3~~ and 12,500cm^3. Calculate the surface area of B if the surface area of A is 55cm^2. (4 marks)

7. The points A(0, 3), B(x, 9) and C(5, 13) are collinear such that $\overrightarrow{BC} = \frac{2}{3}\overrightarrow{AB}$, find the value of x. (4 marks)

8. In a village, 1kg of beans is exchanged for 3kg of millet and 1kg of millet is exchanged for 2 litres of milk. Determine the amount of milk John gets in exchange for 7kg of beans and 5kg of millet. (4 marks)

9. The table below shows student population at St. Mary's Ssanje S.S over a period of 3 years.

Year	2021	2022	2023
No. of students	1550	1473	1612

Calculate the percentage change in students' enrolment between 2021 and 2023. (4 marks)

10.

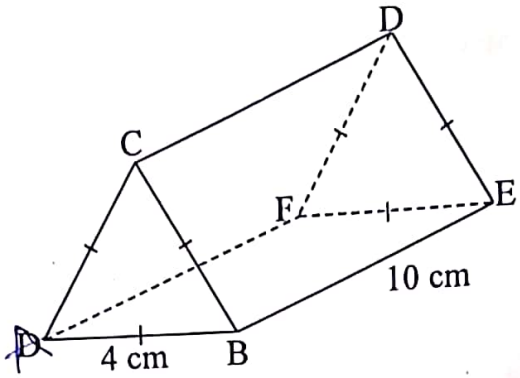

Figure 1

ABCDEF is a right triangular prism with AB = BC = AC = 4cm and BE = 10cm. X is the mid-point of AB. Calculate the angle which DX makes with the base ABEF. (4 marks)

SECTION B:

11. (a) Two mappings f and g are defined as;

f:A $\longrightarrow$ B; $f(x) = x^2 + 1$, x∈A and

g:C $\longrightarrow$ D; $g(x) = \sqrt{x}$; $x \in C$

Given that: A= {1, 2, 3}, B = {2, 5, 10} C = 0, 1, 4}

and D = {-2, -1, 0, 1, 2}

(i) Draw separate arrow diagrams to represent the mappings f and g. (4 marks)

(ii) Which of the two mappings is one-to-many? (1 mark)

(b) The function $h(x) = ax^2 + 3x - b$ such that $h(1) = 1$ and $h(-2) = 12$. Determine the;

(i) values of a and b. (4 marks)

(ii) value of x for which $h(x) = 3x$. (3 marks)

12. (a) Solve for p and q in the equation

$3^{(p-1)} \times 2^{(q+4)} = \frac{1}{72}$ (4 marks)

(b) Express $\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ in the form $a + b\sqrt{c}$, hence determine the values of a, b and c. (4 marks)

(c) Find the value of x satisfying the equation

$\log_2 4 - \log_2(x+3) = \log_2 x$ (4 marks)

13. In S.5 Science class all the 24 students take at least one of the three subjects, Mathematics (M), Biology (B) and Chemistry (C). 15 students take M, 14 students take B and 10 students take C. 3 students take M and C but not B. The number of students taking B and C only is the same as the number of students taking B and M but not C. The students taking B and C but not M account for $\frac{1}{3}$ of the students taking M only. 4 students take all the three subjects.

(a) Represent the information on a Venn diagram. (7 marks)
(b) Find the number of students who belong to Biology only. (3 marks)
(c) If a student is picked randomly from the class, what is the probability that the student takes one subject only? (2 marks)

14. (a) Sseguya is given shs 70,000 for pocked money. He made the followingbudget;

Stationary	30%
Canteen	40%
Clubs	20%
Chureh	10%

Later he decided to save 15%, 23% and $\frac{1}{3}$ of what he budgeted for stationary, canteen and clubs respectively. Express his savings as a percentage of the total amount for pocket money. (7 marks)

(b) Mary deposited shs 330,000 in a bank which offers compound interest rate of 2% per annum. Find how long it takes to claim interest totalling to shs 34,350. (5 marks)

15. (a) Revenue (R) from a farm varies inversely as the square of the units of labour (L) employed. The farm earns shs 40,000 when 5 units of labour are hired. Form an equation for the revenue R in terms of the units of labour employed (L). (4 marks)

(b) The distance, s metres covered by a motorist after t seconds is given by the formula $s = 5t^2 + 10$.

(i) For $0 \leq t \leq 6$ draw a distance-time graph, (Use 1cm = 10 metres on the vertical axis and 2cm = 1 second on the horizontal axis). (5 marks)

(ii) From your graph estimate the speed of the motorist when $t = 4$ seconds. (3 marks)

16. OACB is a parallelogram where OA = **a**, OB = **b**, T and R are mid-points of BA and BC respectively. Point Z is along BC produced such that CZ = 3BC.

(a) Express in terms of **a** and **b** the vectors.
   (i) OC (2 marks)
   (ii) AZ (2 marks)
   (iii) BT (2 marks)
   (iv) TR (4 marks)

(b) Deduce that TR is parallel to AC. (2 marks)

17. ABCV in Figure 2 is a solid with a hemispherical bottom of diameter 16m and a conical top of slant length 20cm.

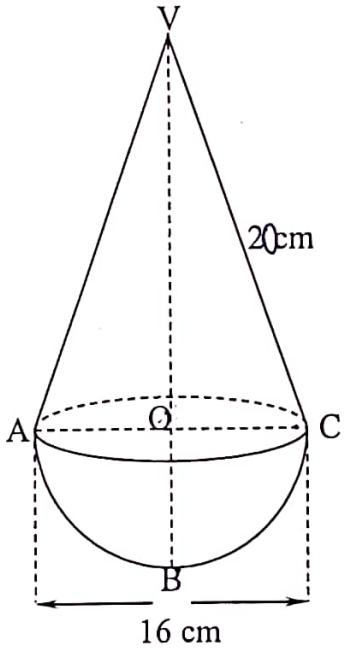

Figure 2

Calculate the;

(a) height (BOV) of the solid, (4 marks)
(b) volume of the solid
   (Use $\pi = 3.142$) (8 marks)

END