PAPUA NEW GUINEA UNVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

FIRST SEMESTER EXAMINATIONS – 2023

FIRST YEAR BACHELOR OF SCIENCE IN FORESTRY

MA116 – MATHEMATICS AF (A)

TIME ALLOWED: 3 HOURS

INSTRUCTIONS FOR CANDIDATES

1. Write your name and student number clearly on the front of the examination answer booklet.
2. You have 10 minutes to read this paper. You must not begin writing during this time.
3. This paper contains **five (5)** questions. You are to **answer ALL** the questions.
4. All answers must be written in examination answer booklets provided. No other written materials will be accepted.
5. Start the answer for each question on a **new** page. Do **not** use red ink.
6. Notes, textbooks, mobile phones and other devices are not allowed in the examination room.
7. Scientific and business calculators are allowed in the examination room.
8. A formula sheet is attached to this examination paper.

Marking Scheme

Marks are as indicated at the beginning of each question.

Total Mark is **100.**

Question 1 [(5 + 5) + (5 + 5) = 20 marks].

(a) A ***circular ring (torus)*** that has an internal diameter of 20 centimetres and an external diameter of 40 centimetres. Find the:

i. ***volume*** of the ***torus*** and express the answer correct to two decimal places.

ii. ***lateral surface area (LSA)*** and express the answer correct to three significant figures.

(b) A ***trapezium*** has parallel sides 80cm and 75cm, and these parallel sides are 10cm apart. The two angles, the two slanted sides make with the side measuring 80cm are 30^{o} and 45^{o}. Calculate the:

i. ***perimeter*** of the ***trapezium*** and give the answer correct to one decimal place.

ii. ***area*** of the trapezium and give the answer in scientific notation correct to 3 significant figures.

Question 2 [10 + 10 = 20 marks].

(a) The cost of 4 apples and 3 oranges is K20. The cost of 2 apples and 5 oranges is K24. Use the Cramer's rule to find the cost of an apple and an orange.

(b) Determine if the solutions exist for the quadratic equation $2x^2 + 5x + 1 = 0$ and why. Solve the quadratic equation if solutions do exist and leave the answer in surd form.

Question 3 [10 + 10 = 20 marks].

There are four (4) functions given below. Select only the functions that display the ***many-to-one*** correspondence and sketch them clearly showing the x and y – intercepts.

$(a)\ y - 2 = 2^x$ $\quad (b)\ 3y = 12 - 3x^2$ $\quad (c)\ 2x - y - 2 = 2$ $\quad (d)\ y = 12x - 3x^3$

Question 4 [10 + 10 = 20 marks].

(a) Find the equation of the normal to the curve $\mathbf{y = 4e^{2x} + 2}$ at the point where $x = 0$.

(b) Evaluate the definite integral of $\int_{-2}^{3} (4x^3 - 3x^2 + 2x)dx$.

Question 5 [5 + 5 + 5 + 5 = 20 marks].

The following numbers 1, 2, 3, 2, 4, 5, 2, 4, 1, 2 were written on separate cards and placed in a bucket.

(a) Which number is equally likely to be selected from the bucket and what is its probability?

(b) Compare the probabilities of even and odd numbers and say which is more likely to be picked.

(c) Find the mode and the range of these numbers.

(d) Find the median and mean of these numbers.

................**End of Examination** ....

MA 116 SEMESTER 1 EXAMINATION FORMULA SHEET 2023

Function: f(x)	Standard derivatives: dy/dx = f '(x)	Standard Integral: $\int f(x)dx = F(x) = A(x)$
$f(x) = ax^n$	$f'(x) = anx^{n-1}$	$F(x) = \frac{ax^{n+1}}{n+1} + c$
$f(x) = c$	$f'(x) = 0$	$F(x) = cx + c$
$F(x) = (ax + b)^n$	$f'(x) = na(ax + b)^{n-1}$	$F(x) = \frac{(ax+b)^{n+1}}{a(n+1)}$
$f(x) = uv$	$f'(x) = v\frac{du}{dx} + u\frac{dv}{dx}$	$F(x) = uv - \int vdu$
$f(x) = \frac{u}{v}$	$f'(x) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$	
$f(x) = a \sin bx$	$f'(x) = ab \cos bx$	$F(x) = -\frac{a}{b}\cos bx + c$
$f(x) = a \cos bx$	$f'(x) = -ab \sin bx$	$F(x) = \frac{a}{b}\sin bx + c$
$f(x) = a \tan bx$	$f'(x) = ab \sec^2 bx$	$F(x) = \frac{a}{b}\ln(\sec bx) + c$
$f(x) = ae^{bx}$	$f'(x) = ab\, e^{bx}$	$F(x) = \frac{a}{b} e^{bx} + c$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

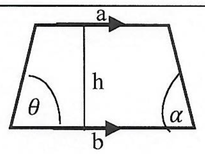
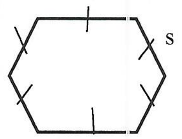
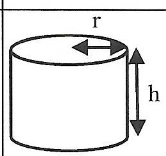
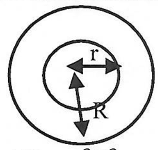
Discriminant

$$\Delta = b^2 - 4ac$$

Cramer's Rule

If $a_1x + b_1y = d_1$ and $a_2x + b_2y = d_2$ then:

- Find determinant $D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = a_1b_2 - a_2b_1$
- Find x - determinant $D_x = \begin{vmatrix} d_1 & b_1 \\ d_2 & b_2 \end{vmatrix} = d_1b_2 - d_2b_1$
- Find y - determinant $D_y = \begin{vmatrix} a_1 & d_1 \\ a_2 & d_2 \end{vmatrix} = a_1d_2 - a_2d_1$
- $x = \frac{Dx}{D}$ $y = \frac{Dy}{D}$

Trapezoid of altitude ***h*** and parallel sides ***a*** and ***b***	***Regular Polygon*** of ***n*** sides, each of length ***s***	***Right circular cylinder*** of radius ***r*** and height ***h***	***Ring (torus)*** of inner radius ***r*** and outer radius ***R***
 $P = a + b + h(\operatorname{cosec}\theta + \operatorname{cosec}\alpha)$ $A = \frac{(a+b)h}{2}$	 $P = ns$ $A = \frac{1}{4}ns^2\cot(\frac{\pi}{n})$	 $TSA = 2\pi r^2 + 2\pi rh$ $V = \pi r^2 h$	 $LSA = \pi^2R^2 - \pi^2r^2$ $V = \frac{1}{4}\pi^2(R + r)(R - r)^2$

Probability $P(A) = \frac{n(A)}{n(S)}$ where A is the event and $n(A)$ – number of outcomes in A and $n(S)$ – total sample space