PAPUA NEW GUINEA UNVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

FIRST SEMESTER EXAMINATIONS - 2022

FIRST YEAR NATURAL RESOURCES MATHEMATICS

MA116 – MATHEMATICS FOR NATURAL RESOURCES

TIME ALLOWED: 3 HOURS

INSTRUCTIONS FOR CANDIDATES

1. You have 10 minutes to read this paper. You are **not** to write during this time.

2. This examination consists of two sections:

   Part A – 10 Multiple Choice Questions worth 1 mark each to give a total of 10 marks.

   Part B – 6 Long Answer Questions worth 15 marks each to give a total of 90 marks.

3. Write ALL answers in the answer booklet provided.

4. For **Multiple Choice**, organise first page (page 1) of your answer booklet by numbering 1 – 10 and write the correct letter of your answer next to question number.

5. There are ten (10) multiple choice questions and you are to write the letter A, B, C or D of the correct answer onto the first page (page 1) of the answer booklet provided.

6. There are six (6) long answer questions. Start long questions on page 2 of the answer booklet.

7. Start each question of Part B (Long Answer Questions) on a new page and clearly write its question number at the top of the page.

8. Show all necessary working out in the booklet provided.

9. Scientific and business calculators are allowed.

10. Write your name and ID number clearly on the examination answer booklets and sign off.

11. **Mobile phones** must be **switched off** during the examination period.

Marking Scheme

Marks are as indicated at the beginning of each question.

Total Mark is **100**

PART A – MULTIPLE CHOICE: Write the correct letter **A, B, C** or **D** next to question number on the first page (page 1) of your examination answer booklet.

Question 1   If $\frac{10}{25}$ of the children in a class are girls, what is the simplified ratio of girls to boys?

A $2:3$ B $3:2$ C $10:15$ D $15:10$

Question 2   The perimeter of a rectangular field with length x is 210 m. The correct expression for the width of this rectangular field in terms of x is:

A $210 - x$ B $105 - x$ C $210 + x$ D $105 + x$

Question 3   If you factorise $12x - 3x^3$ completely, you will get:

A $3x(x+2)(2-x)$ B $x(x+2)(2-x)$ C $3(x+2)(2-x)$ D $3(x^2+2)(2-x)$

Question 4   The inverse function, (f^{-1}) of $2y = 12 - x$ is?

A $y = -x + 12$ B $y = x - 12$ C $y = -2x + 12$ D $y = 2x + 12$

Question 5   The differential coefficient of $f(x) = \frac{x^2}{2}$ is:

A $2x$ B x C $4x$ D x^2

Question 6   If $f(x) = 2x^2 - 1$,   what will be $f\,'(1)$?

A   1   B   2   C   3   D   4

Question 7   Evaluate $\int_1^2 (2x)\,dx$.

A   1   B   2   C   3   D   4

Question 8   What is the probability of event A, P(A), if $n(S) = 12$ and $n(A) = 4$?

A   1/3   B   1/4   C   1/6   D   1/12

Question 9   A and B are independent events. If $P(A \cap B) = 1/6$ and $P(A) = 1/2$; then the value of P(B) is:

A   1/2   B   1/3   C   1/4   D   1/5

Question 10   What is the median of this data set $\{3, 3, 3, 4, 4, 5, 2, 2, 1\}$?

A   4   B   3   C   2   D   1

Question 11   **[3+4+4+4 = 15 marks]**
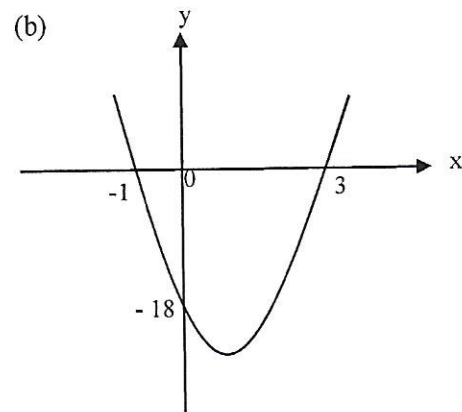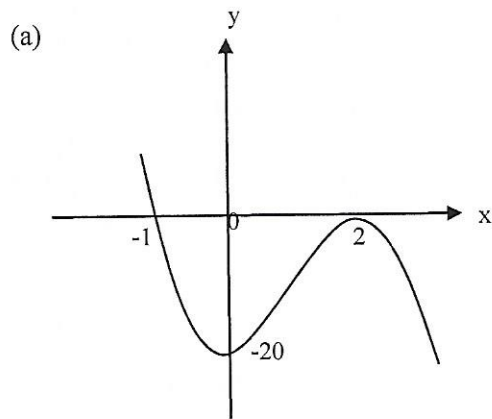
The *length* of a rectangle is 12 metres and *diagonal* of that rectangle is 13 metres.

  (a) Draw a diagram to represent the above information.

  (b) Find the width of the rectangle.

  (c) Find the perimeter of this rectangle.

  (d) Find the area of the rectangle.

Question 12   **[8+7 = 15 marks]**

Find the equation and express in the general form for each of the functions shown below.

(a)

(b)

Question 13   **[7+8 = 15 marks]**

  (a) Find the equation of tangent to $y = x^2 - 6\sqrt{2x}$ at the point $(2, 12)$

  (b) Find the equation of the normal to the curve $y = 4e^{2x} - 0.5x$ at the point $(0, 4)$

Question 14   **[7+8 = 15 marks]**

Evaluate the following definite integrals.

  (a) $\int_0^2 (8x^3 - 6x^2 + 2x)dx$

  (b) $\int_0^{\frac{\pi}{2}} (-20\sin 2x - 5\cos x)dx$

Question 15 [6+9 = 15 marks]

A and B are two events with $P(A) = \frac{1}{3}$, $P(A \cup B) = \frac{3x}{4}$. If $P(B) = \frac{x}{4}$, use appropriate formula to find value of x with respect to the following:

(a) A and B are mutually exclusive.

(b) A and B are independent.

Question 16 [6+3+3+3 = 15 marks]

Complete the table frequency table below with the data set given below. *Note that μ - mean of scores.*

Score x	Frequency f	Frequency x score fx	Deviation x - μ	Squared Deviation $(x - \mu)^2$
1	2			
2	3			
3	2			
4	2			
5	1			
6	1			
	$\sum f =$	$\sum fx =$		$\sum (x - \mu)^2 =$

(a) Calculate the mean (μ) ($\frac{\sum fx}{\sum f}$)

(b) Find the variance (σ²) of the data set above ($\frac{\sum (x-\mu)^2}{\sum f}$)

(c) Find the standard deviation (σ) of the data set above ($\sqrt{\frac{\sum (-\mu)^2}{\sum f}}$)

........................**End of Semester 1 Examination** ....

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

Quadratic Formula

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

Discriminant

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

Pythagoras Theorem

$$c^2 = a^2 + b^2$$

The sum of the squares of the two shorter sides equals the square of the hypotenuse

Probability.

Additional Law of Probability: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Exclusive Events: $P(A \cup B) = P(A) + P(B)$ where $P(A \cap B) = 0$

Independent Events $P(A \cap B) = P(A) \times P(B)$