

PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

**FIRST SEMESTER EXAMINATIONS – 2021**

**FIRST YEAR BACHELOR OF BUSINESS IN ACCOUNTANCY  
FIRST YEAR BACHELOR OF BUSINESS IN BUSINESS MANAGEMENT  
FIRST YEAR BACHELOR OF BUSINESS IN APPLIED ECONOMICS  
FIRST YEAR BACHELOR OF BUSINESS IN INFORMATION TECHNOLOGY  
FIRST YEAR BACHELOR OF PROPERTY STUDIES**

**MA 114 – QUANTITATIVE METHODS I**

**TIME ALLOWED: 3 HOURS**

**INFORMATION FOR CANDIDATES**

- 1 You have 10 minutes to read this paper. You must not begin writing during this time.
- 2 Write your name and student number clearly on the front of the examination answer booklet.
- 3 There are 7 questions. You should attempt **ALL** questions.
- 4 All answers must be written in the examination answer booklet(s) provided. No other written material will be accepted.
- 5 Start the answer for each question on a **new** page. Do **not** use red ink or pencil.
- 6 Notes and textbooks are not allowed in the examination room.
- 7 Mobile phones and other recording devices are not allowed in the examination room.

**MARKING SCHEME**

Marks are as indicated at the beginning of each question. Total mark is 100.

**Question 1 [10 + (2 + 2) + 6 = 20 Marks]**

The cost of attending various heavy plant operator training at Mapex Training Institute includes the following school fees. Suppose these fees were:

- when the training runs for up to (and including) 21 days: K2500
- when the training runs for more than 21 days: add K127.50 for every extra day

Let  $C$  = the cost of school fees and  $x$  = the number of days a training runs

- Write down the multiple formula for this function
- Use this formula to calculate the school fee for a training that runs for
  - 21 days
  - 35 days
- If a student is required to pay a total of K6070 for a particular training, then for how many days will the training be run?

**Question 2 [10 Marks]**

The following table gives the profits (in thousands of kina) of a business over a period of 4 years.

Year	1	2	3	4
Profit	410	475	540	610

Assuming that the profits are growing linearly, estimate what the profit would be on the 13<sup>th</sup> year using the formula

$$y = y_1 + (x - x_1) \left( \frac{y_2 - y_1}{x_2 - x_1} \right)$$

where  $x_1$  is the first year and  $x_2$  is the fourth year.

**Question 3 [8 + (4 + 3) = 15 Marks]**

The following table summarizes the number of times a group of students were absent from a class and the marks that each student scored (out of 100) in the subsequent exam that followed.

No. of times absent ( $x$ )	7	11	9	13	15	17	16	12
Marks scored ( $y$ )	86	80	83	77	74	71	73	79

From the information presented above,

- Analyze the results in a table and calculate the **Pearson product moment correlation coefficient  $r$** .

Hint: 
$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

- Calculate the regression coefficient ( $b$ ) and the y-intercept ( $a$ ) of the regression line.

Hint: 
$$b = \frac{n \sum xy - (\sum x)(\sum y)}{n \sum x^2 - (\sum x)^2}, \quad a = \bar{y} - b\bar{x}$$

**Question 4 [12 + 8 = 20 Marks]**

A process has two variables  $x$  and  $y$ . The values of  $x$  and  $y$  must satisfy the following inequalities:

$$5x + 4y \leq 20$$

$$3x + y \leq 9$$

$$x \geq 0$$

$$y \geq 1$$

- Sketch the region satisfying all four inequalities and clearly label the  $x$  and  $y$ -intercepts as well as the points of intersection (show working out).
- Find the values of  $x$  and  $y$  that will maximize the objective function  $5x + 2y$ .

**Hint:** Create a table listing the coordinates of each vertex of the feasible region and evaluate the objective function at each vertex.

**Question 5 [7 + 3 = 10 Marks]**

The compound interest formula is given by:

$$A = P(1 + i)^n$$

where  $A$  is the final amount,  $P$  is the principle,  $i$  is the interest rate per year and  $n$  is the number of years the principle was invested.

- Find a formula for ( $n$ ), the number of years the principle was invested.
- If the final amount ( $A$ ) = K36,621.09, the principle ( $P$ ) = K12,000 and the interest rate ( $i$ ) = 0.25. Use your formula in part a) to find the value for  $n$ .  
(Give your answer correct to the nearest whole number)

**Question 6 [5 + 5 + 5 = 15 Marks]**

From a group of 6 mathematicians and 9 engineers, a committee consisting of 5 members have to be formed. In how many ways can this be done if;

- The committee must contain 2 mathematicians and 3 engineers
- The committee must contain only engineers
- The committee must contain only mathematicians

**Question 7 [(3 + 3) + 4 = 10 Marks]**

A small business finds that when producing  $x$  units of goods, its revenue function  $R(x)$  and cost function  $C(x)$  are given as follows:  $R(x) = 470x$  and  $C(x) = -0.5x^2 + 4x + 81$ .

- Find the marginal revenue and marginal cost functions.
- Use your answers in part a) above to find the marginal profit function.