



University of Ruhuna- Faculty of Technology

Bachelor of Biosystems Technology Honours Degree

Level 1 (Semester I) Examination, November/December 2025

Academic year 2024/2025

Course Unit: TMS 1173 Fundamentals of Mathematics

Duration: 03 hours

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- This paper contains five questions
 - Answer all questions
 - All symbols have their usual meanings
 - Calculators are not allowed

Q1.

a) A nutrition research team surveyed **160 individuals** to identify which types of diet plans they followed during a 3-months wellness program. The results revealed the following:

- **34 individuals** followed *both* vegetarian and low-carb diets.
- **29 individuals** followed *both* vegetarian and intermittent fasting.
- **48 individuals** followed intermittent fasting
- **20 individuals** followed *only* a vegetarian diet.
- **26 individuals** followed *both* a low-carb diet and an intermittent fasting plan.
- **12 individuals** followed *all three* diet plans, while **7 individuals** did not follow *any* of the three diet plans.

- i. Draw a **Venn diagram** to represent the number of individuals following each type of diet plan. (30 marks)
- ii. How many individuals used only a single diet plan? (15 marks)
- iii. Shade the regions of the Venn diagram that represent individuals who follow *exactly two* of the diet plans. (15 marks)

b) If $f(x) = 3x^2 - 5x + 2$ and $g(x) = 3x - 2$, find the followings:

- i. $f(x) + g(x)$
- ii. $f(x) - g(x)$
- iii. $f(x) \times g(x)$
- iv. $f(x) \div g(x)$

(40 marks)

Q2.

a) Solve the following linear simultaneous equations.

(20 marks)

$$4x + 3y - 17 = 0$$

$$5x - 2y - 4 = 0$$

b) Let A and B are 2×2 matrix and C is a 3×3 matrix such that,

$$A = \begin{pmatrix} 3 & 2 \\ 1 & -2 \end{pmatrix}_{2 \times 2} \quad B = \begin{pmatrix} -5 & 3 \\ 2 & 4 \end{pmatrix}_{2 \times 2} \quad C = \begin{pmatrix} -2 & 1 & 3 \\ 4 & 2 & -1 \\ 5 & 1 & -2 \end{pmatrix}_{3 \times 3}$$

- i. Determine the product of matrix A and matrix B. (10 marks)
- ii. Find the determinant of matrix A. (10 marks)
- iii. Find the inverse of matrix A. (10 marks)
- iv. Calculate the determinant of matrix C. (10 marks)

c) Solve the following linear simultaneous equations by using the above result of b (iii).

(40 marks)

$$3x + 2y = 13$$

$$x - 2y = -1$$

Q3.

a) Consider the following two functions f_1 and f_2 ,

$$f_1(x) = 3x + 1$$

$$f_2(x) = x + 3$$

- i. Identify the gradient (slope) of each function. (10 marks)
- ii. Determine the y-intercept of the f_2 function. (10 marks)
- iii. Determine the coordinates of the point at which the functions f_1 and f_2 intersect.

(20 marks)

b) Consider the following quadratic function,

$$f(x) = x^2 - 2x - 3$$

- i. Determine the coordinates of the y-intercept and x-intercepts of the function. (30 marks)
- ii. Find the coordinates of the vertex of above parabola and write the equation of its axis of symmetry. (30 marks)

Q4.

a) Turn the following two numbers in Scientific notation into their general form.

i. 4.523×10^{-2}

ii. 1.253×10^3

(20 marks)

b) Solve the following logarithmic equations.

i. $3\log x + \log 96 = 2\log 9 + \log 4$

ii. $\log_8 x = -\frac{4}{3}$

(40 marks)

c) Given that $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$ find the values of

i. $\log_{10} 18$

ii. $\log_{10} 0.012$

(40 marks)

Q5.

a) Evaluate the following limit. (20 marks)

$$\lim_{x \rightarrow 5} \frac{2x^2 - 7x - 15}{x - 5}$$

b) Find the derivative of the following function with respect to x . (20 marks)

$$y = \frac{2}{3}x^4 - \frac{4}{x^3} + 9$$

- c) Find the derivative of the following function using the quotient rule. (20 marks)

$$y = \frac{x^2}{(x+1)^2}$$

- d) Evaluate the following integral. (20 marks)

$$\int_0^1 (x+1)(x+2)^2 dx$$

- e) Solve the following differential equation. (20 marks)

$$\frac{dy}{dx} = \frac{x^3 + 1}{y^2}$$

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