



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022**

COURSE NAME : ALGEBRA
COURSE CODE : BIC 10303
PROGRAMME CODE : BIS / BIP / BIW / BIM
EXAMINATION DATE : JANUARY / FEBRUARY 2022
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS
CONDUCTED ONLINE AND
CLOSE BOOK

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Solve the following problems.

(i) Using synthetic division, identify quotient and remainder for

$$(5x^3 - 3x^2 + 7) \div (x + 3)$$

(2 marks)

(ii) Assuming $x \neq 0$ and $y \neq 0$ what is the quotient of $12x^6y^2 + 8x^4y^3 + 4x^2y^4 \div 4x^2y$?

(2 marks)

(b) Given a function $f(x) = 2x^3 - 5x^2 - 23x - 10$, where $x = -3$. Using Synthetic Division and Remainder Theorem,

(i) evaluate the function.

(4 marks)

(ii) prove the finding.

(2 marks)

(c) UTHM Holding monthly profit, P , from a product is given by

$$P = -x^2 + 105x - 1050,$$

where x is the price of the product in Ringgit Malaysia (RM). What is the lowest price of the product, in RM, that gives a monthly profit of RM1550?

(5 marks)

Q2 (a) A deposit of RM1000 is made in an account that earns 5% compounded yearly. The balance in the account after n years is given by

$$a_n = 1000(1 + 0.05)^n, n = 1, 2, 3, \dots$$

(i) Identify the first six terms of the sequence.

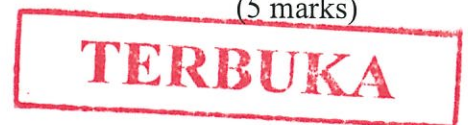
(3 marks)

(ii) What is the balance in this account after 25 years?

(2 marks)

(b) Syafi has decided to cut off 15% of the length of his hair today and will continue to cut off 15% every 2 months thereafter. Knowing that his hair is presently 15 centimetres long and that it will grow about 8 centimetres in 2 months, how long will his hair be after his haircut one year from now?

(5 marks)



- (c) The temperature of water in a bottle is 25 degrees Celsius when it is placed in a fridge. Its temperature n hours after being placed in the fridge is 5% less than 1 hour earlier.
- (i) Construct a formula for the n th term of the geometric sequence that gives the temperature of the water n hours after being placed in the fridge. (5 marks)
 - (ii) Find the temperature of the water 5 hours after it is placed in the fridge. (2 marks)
 - (iii) Estimate the time when the water temperature is 7 degrees Celsius. (3 marks)

- Q3** (a) Assume that your system performs 3×3 matrix which maps the alphabet to numbers and special symbol for space, such that $A = 5, B = 6, C = 7, D = 8, \dots, Z = 30, space = \Delta$. It calculates matrix $A = BC$.

$$A = \begin{pmatrix} H & A & Y \\ O & R & O \\ W & E & U \end{pmatrix}, B = \begin{pmatrix} I & M & I \\ space & space & N \\ A & F & E \end{pmatrix}$$

- (i) Write the matrix A and matrix B into numerical format. (3 marks)
 - (ii) Find the matrix C using adjoint method. (12 marks)
- (b) Given matrix $A = \begin{pmatrix} 1 & 7 & 5 \\ 4 & 5 & 2 \\ 3 & 8 & 8 \end{pmatrix}$. Determine whether there is any possible integer value for eigenvalue and eigenvector. (15 marks)

- Q4** (a) Vehicles using PLUS Highway are classified into small (with 2 axles and 3 or 4 wheels), medium (2 axles and 5 or 6 wheels) and large (3 or more axles). A different toll is charged for each class of vehicles. Toll rate for large vehicle is equivalent to 2.7 times the small vehicle rate. The number of vehicles of each type using the highway between Simpang Renggam to Sedenak and the total receipts for the period are shown in **Table Q4(a)**. Let x be the toll for small vehicle, y be the toll for medium vehicle and z be the toll for large vehicle.

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Table Q4(a)

Time	Small	Medium	Large	Receipts
5.45-6.00am	7	19	10	RM 226.92
6.00-6.15am	10	15	18	RM 282.31
6.15-6.30am	29	8	11	RM 239.76

- (i) Form an augmented matrix for the linear system. (1 mark)
- (ii) Show that the system has one unique solution. (4 marks)
- (iii) A new class is introduced for frequent travellers with small vehicle and the rate is 25% less than the normal rate. However, the rate may only apply at any time between midnight to 6.00am. Assuming that all small vehicles in **Table Q4(a)** at the related time belong to frequent travellers, calculate the estimated number of frequent travellers' vehicle for the period, if PLUS is targeting to collect minimum of the same total amount of the receipts. (5 marks)
- (b) Consider the following linear system. The linear system must satisfy $x + z = \frac{y+z}{2}$.

$$\begin{aligned}x + y + 2z &= 6 \\ax + 2y + 4z &= 9\end{aligned}$$

- (i) Find solution of the system using elimination method. (10 marks)
- (ii) Given $|a| > -2$, find solution for a , such that determinant of the coefficient matrix of the system will be non-negative value. For the determinant, show your work using diagonal method. (5 marks)

- END OF QUESTIONS -

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