



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

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

- COURSE NAME : ALGEBRA
- COURSE CODE : BIC 10303
- PROGRAMME CODE : BIS / BIP / BIW / BIM
- EXAMINATION DATE : JULY 2022
- DURATION : 3 HOURS
- INSTRUCTION :
1. ANSWER ALL QUESTIONS
  2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK**.
  3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

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

- Q1** (a) If  $f(x) = 108x - 60 + 20x^4 - 40x^2 - 4x^5 - 24x^3$ , answer the following.
- (i) What is the degree of  $f(x)$ ? (1 mark)
- (ii) What is the leading coefficient of  $f(x)$ ? (1 mark)
- (iii) If  $(x \pm \sqrt{3})$  are factors of  $f(x)$ , find an integer factor of  $f(x)$ . (6 marks)
- (b) Find the rational zeros and the other zeros of  $f(x) = 4x^3 - 4x^2 - 3x + 3$ , that is solve  $f(x) = 0$ . Then factor  $f(x)$  into linear factors. (6 marks)
- (c) Answer Q1(c)(i) and Q1(c)(ii) based on the Figure Q1(c).

A local social media owner currently has 85,000 subscribers at a quarterly charge of RM25.00 for advertisement and product marketing. Market research has suggested that if the owners raise the price to RM30.00, they will lose 5,000 subscribers. Assuming that subscriptions are linearly related to the price, the social media owner charge for a quarterly subscription to maximize their revenue is based on the formula Revenue = Price  $\times$  Quantity.

**Figure Q1(c)**

- (i) Derive the quadratic formula for revenue. (6 marks)
- (ii) If the charge is RM27.10 for subscription, calculate the maximum revenue. (2 marks)
- Q2** (a) Given the set of numbers  $1, 1 + 2, 1 + 2 + 3, 1 + 2 + 3 + 4, \dots, 1 + 2 + 3 + 4 + \dots + n$ .
- (i) Derive the formula for the sum of an arithmetic series. (6 marks)
- (ii) Find the value of  $n$  if the sum of all numbers equals to 286. (3 marks)

- (b) Answer Q2(b)(i) and Q2(b)(ii) based on the Figure Q2(b).

Ammar's hobby is riding a bicycle. Normally, the time that it takes him to cycle every kilometre (km) of the track is longer than the time it has taken for the previous km by the same amount each time (the second km took  $s$  seconds more than the first, the third km took  $s$  seconds more than the second and so on). The time it takes him to cycle for the first km is 40 seconds. Then, the second and the fourth km can be added together to get 3 minutes and 20 seconds.

**Figure Q2(b)**

- (i) List the sequence of time taken for the first 5km. (7 marks)
- (ii) Calculate the total time Ammar takes for the first 10km. (2 marks)

- Q3** (a) Assume that your system performs  $3 \times 3$  matrix which maps the alphabet to numbers and special symbol for space, such that  $A = -1, B = 0, C = 1, D = 2, \dots, Z = 24, \text{space} = \delta$ . It calculates matrix  $\Omega = \beta\theta$ . Given the matrix are as follows.

$$\Omega = \begin{pmatrix} D & E & A \\ C & B & C \\ C & A & F \end{pmatrix}, \beta = \begin{pmatrix} C & C & E \\ \text{space} & C & A \\ A & E & \text{space} \end{pmatrix}$$

- (i) Write the matrix  $\Omega$  and matrix  $\beta$  into the numerical format. (3 marks)
- (ii) Find the matrix  $\theta$  using the adjoint method. (12 marks)
- (b) Given matrix  $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 0 & -2 \\ -1 & 2 & 3 \end{pmatrix}$ .
- (i) Calculate the eigenvalues. (9 marks)
- (ii) Find the associated eigenvectors. (6 marks)

- Q4** (a) Local fruits are graded according to their size and quality. Different prices per kilogram (kg) are identified for each grade of fruit as shown in **Table Q4**. Based on **Table Q4**, answer **Q4(a)(i)** to **Q4(a)(iv)**.

**Table Q4:** List of Fruits with their Grades

<b>Fruits/Grades (kg)</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>Total (RM)</b>
Banana	7.00	6.00	4.00	6178.00
Pineapple	5.00	4.00	3.00	4340.00
Durian	40.00	30.00	20.00	32900.00

- (i) Form an augmented matrix for the linear system. (1 mark)
  - (ii) Show that the system has one unique solution. (5 marks)
  - (iii) Calculate the grade in kilograms of A, B and C using Cramer’s Rule. (9 marks)
  - (iv) A durian grade C is increased by 10%. Calculate the new grade in kilograms of A, B and C using the Gauss-Jordan elimination method. (9 marks)
- (b) Three motorcycle convoy riders went into a roadside food truck. One rider purchased four keropok lekor, a cup of coffee and ten doughnuts for RM8.45. Another rider purchased three keropok lekor, a cup of coffee and seven doughnuts for RM6.30. What did the third motorcycle rider pay for a keropok lekor, a cup of coffee and a doughnut? (6 marks)

**- END OF QUESTIONS -**

**TERBUKA**