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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : ALGEBRA  
COURSE CODE : BIC 10303  
PROGRAMME CODE : BIS / BIP / BIW / BIM  
EXAMINATION DATE : JULY / AUGUST 2023  
DURATION : 3 HOURS  
INSTRUCTION :  
1. ANSWER ALL QUESTIONS.  
2. THIS FINAL EXAMINATION IS 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

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**TERBUKA**

- Q1** (a) Translate the following sentences into inequalities.
- (i) The sum of 3 and a number is equal and less than 10. (1 mark)
- (ii) The sum of a number and 3 more than the number, is at least 18. (1 mark)
- (iii) A number minus  $-6$  is less than 8. (1 mark)
- (iv) The sum of  $x$  and 7 less than  $x$ , is not equal to 3. (1 mark)
- (v) A number plus 3, is not equal but less than 23. (1 mark)
- (b) Solve the following inequalities.
- (i)  $\frac{1}{x+4} - \frac{2}{x-3} \geq 0$  (5 marks)
- (ii)  $4|x+3| - 7 \leq 12$  (6 marks)
- (c) A fence is to enclose a rectangular vegetable farm with an area of 400 square meters.  $x$  is the length of one side of this fence. Find a function  $P(x)$  representing the perimeter of the fencing. (4 marks)

- Q2** (a) The sum of the first  $n^{\text{th}}$  term of a sequence is given as

$$\sum_{r=1}^n u_r = 3n + 2n^2.$$

Find:

- (i) The first term of the sequence. (1 mark)
- (ii) The  $n^{\text{th}}$  term of the sequence. (5 marks)

- (b) Rewrite the  $r^{\text{th}}$  term of the series below using sigma ( $\Sigma$ ) notation.

$$\frac{1}{2 \bullet 3} + \frac{1}{3 \bullet 4} + \frac{1}{4 \bullet 5} + \dots$$

(5 marks)

- (b) A water tank develops a leak. Each week, the tank loses 5 gallons of water due to the leak. Initially, the tank is full and contains 1500 gallons.

- (i) How many gallons are in the tank 20 weeks later? (3 marks)
- (ii) How many weeks until the tank is half-full? (3 marks)
- (iii) How many weeks until the tank is empty? (3 marks)

- Q3** (a) Given that

$$Z = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 3 & 1 & 2 \\ 2 & 3 & 1 & 0 \\ 1 & 0 & 2 & 1 \end{bmatrix}$$

Find the inverse of matrix  $Z$  by using the elementary row operation method. (5 marks)

- (b) Find the determinant of matrix  $Q$  if given

$$Q = \begin{bmatrix} 2 & -1 & 3 & 0 \\ -3 & 1 & 0 & 4 \\ -2 & 1 & 4 & 1 \\ -1 & 3 & 0 & -2 \end{bmatrix}$$

(7 marks)

- (c) Compute the eigenvalues and eigenvectors of the following matrix.

$$R = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$$

(8 marks)

- Q4** (a) Solve the following system of equations using Gauss-Elimination method.

$$\begin{aligned} x + 3y + 4z &= 4 \\ -x + 3y + 2z &= 2 \\ 3x + 9y + 6z &= -6 \end{aligned}$$

(8 marks)

- (b) The annual furniture 'show and sale' occurs next month and the School of Vocational Studies is planning to make furniture for the sale. There are three wood working classes, I year, II year and III year. They have decided to make three styles of chairs A, B and C. Each chair must receive work in each class. During the next month, there will be 120 hours available in the I year class, 160 hours in the II year class and 100 hours in the III year class to produce the chairs. The time in hours required for each chair in each class is given in **Table 1**.

**Table 1:** The time in hours required for each chair

	I year	II year	III year
Chair A	2	4	3
Chair B	3	3	2
Chair C	2	1	4

- (i) Obtain a system of linear equations based on above problem. (2 marks)
- (ii) Determine how many chairs of each type should be made by using Cramer's rule method. (10 marks)

- Q5** (a) Draw a graph for the following system of inequalities.

$$x \geq 0, y \geq 5,$$

$$x + y \leq 15,$$

$$2x - y \leq -3.$$

(5 marks)

- (b) Maximize and minimize the value of  $B = 4x + 2y$  subject to the following constraints.

$$-3x + 2y \leq 6$$

$$3x + y \leq 3$$

$$y \geq 0$$

(8 marks)

- (c) Ahmad has 20 hectares land for growing apples and grapes. Ahmad has to decide how much of each to grow. The cost per hectare for apple is RM30 and for grape is RM20. Ahmad has budget of RM480. Apple requires 1 man-day per hectare and grape requires 2 man-days per hectare. There are 36 man-days available. The profit on apple is RM100 per hectare and on grape is RM120 per hectare. Find the number of hectares of each crop Ahmad should sow to maximize profits.

(12 marks)

-END OF QUESTIONS-