UNIRAZAK
UNIVERSITI TUN ABDUL RAZAK

FINAL EXAMINATION

MARCH 2023

COURSE TITLE	**BASIC MATHEMATICS**
COURSE CODE	**FMAT0114**
DATE/DAY	**15 JUNE 2023 / THURSDAY**
TIME/DURATION	**02:30 PM - 05:30 PM / 03 Hour(s) 00 Minute(s)**

INSTRUCTIONS TO CANDIDATES :

1. Please read the instruction under each section carefully.
2. Candidates are reminded not to bring into examination hall/room any form of written materials or electronic gadget except for stationery that is permitted by the Invigilator.
3. Students who are caught breaching the Examination Rules and Regulation will be charged with an academic dishonesty and if found guilty of the offence, the maximum penalty is expulsion from the University.

(This Question Paper consists of 4 Printed Pages including front page)

*****DO NOT OPEN THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO*****

This paper consists of NINE (9) questions. Answer ALL questions in the answer booklet provided. **[100 MARKS]**

1. Given a polynomial of $P(x) = 6x^3 - 7x^2 - x + 2$,

   a) by using factor theorem, show that $3x - 2$ is a factor of $P(x)$ (4 marks)

   b) by using long division, find the quotient when $P(x)$ is divided with $3x - 2$ (4 marks)

2. Decompose the fraction below into its partial fraction.

   a) $\frac{2x+1}{(x-2)(x+1)}$ (7 marks)

   b) $\frac{2x+1}{(x-2)(x+1)^2}$ (10 marks)

3. Idris purchased a Perodua Myvi for RM 55 300. The car depreciates at a rate of 10% each year. Find

   a) the value of the car in 5 years (5 marks)

   b) the profit he will make if he sells the car at RM 38 000 (2 marks)

4. Given that $f[g(x)] = x^2 + 1$,

   a) find $g(x)$ if $f(x) = 1 - 2x$ (5 marks)

   b) find $f(x)$ if $g(x) = x + 3$ (5 marks)

   c) evaluate $3f(x) + 2g(x)$ (5 marks)

5. Determine the continuity of $f(x)$ for each of the following.

   a) $f(x) = \frac{x+1}{\sqrt{8-x}-3}$ at $x = -1$ (5 marks)

   b) $f(x) = 2x - 12$ at $x = 3$ (5 marks)

6. Ishaq buys drink from Ramadhan bazar for three days. On Friday, he paid RM 17 for 2 sugarcane, 2 watermelon and 1 mango juice. On Saturday, he paid RM 13 for 3 watermelon and 1 mango juice. On Sunday, he paid RM 15 for 2 sugarcane and 2 mango juice.

   Assume that the price of the juices are indicated follows:

   $x = \ price\ of\ sugarcane$
   $y = \ price\ of\ watermelon\ juice$
   $z = price\ of\ mango\ juice$

   Based on the information above,

   a) write the system of linear equation to explain the scenario (3 marks)

   b) solve for x, y and z using matrices operation (10 marks)

7. Kamarul purchased his double-storey terrace house for RM 520 000 about 15 years ago. He intends to sell it and move to a bigger house. Suppose that the price of the house appreciates by RM 1 500 per month, how much the house can be sold this year? Assume n in months. (5 marks)

8. The polynomial $f(x) = 2x^3 + px^2 + qx - 2$ has a remainder of 7 when divided with $(2x - 3)$ and a remainder of -20 when divided with $(x + 3)$. Find the value of p and q. (10 marks)

9. Solve the following to find x or the range of x.

   a) $\log_3 x^2 + \log_3 x = \log_9 27$ (5 marks)

   b) $x(x + 10) > 4x + 7$ (5 marks)

   c) $|2x + 8| = 12$ (5 marks)

***** END OF QUESTION PAPER *****

Formula

$x^a \times x^b = x^{a+b}$

$\frac{x^a}{x^b} = x^{a-b}$

$(x^a)^b = x^{ab}$

$(xy)^a = x^a y^a$

$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$

$\frac{1}{x^a} = x^{-a}$

$\sqrt{x} = x^{\frac{1}{2}}$

$\sqrt[a]{x} = x^{\frac{1}{a}}$

Properties of logarithms

$\log_a(xy) = \log_a x + \log_a y$

$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$

$\log_a x^n = n \log_a x$

$\log_a\left(\sqrt[n]{x}\right) = \frac{1}{n}(\log_a x)$

$\log_b a = \frac{\log_c a}{\log_c b}$

Properties of equations and inequalities involving $|ax + b|$

$|ax + b| = p$ *is equivalent to* $ax + b = p$ *or* $ax + b = -p$

$|ax + b| < p$ *is equivalent to* $-p < ax + b < p$

$|ax + b| > p$ *is equivalent to* $ax + b < -p$ *or* $ax + b > p$

Arithmetic progression

$T_n = a + (n-1)d$

$S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric progression

$T_n = ar^{n-1}$

$S_n = \frac{a(1-r^n)}{1-r}$

Matrices

$AX = B$

$A^{-1} = \frac{1}{|A|}\text{Adj}(A)$

$\text{Adj}(A) = [C_{ij}]^T$

$C_{ij} = (-1)^{i+j}M_{ij}$

$X = A^{-1}B$

Partial fraction

If $Q(x)$ has a form of $(ax + b)$, then

$$\frac{P(x)}{Q(x)} = \frac{P(x)}{(x+a)(x+b)} = \frac{A}{(x+a)} + \frac{B}{(x+b)}$$

If $Q(x)$ has a form of $(ax + b)^k$ then

$$\frac{P(x)}{Q(x)} = \frac{P(x)}{(ax+b)^2} = \frac{A}{(ax+b)} + \frac{B}{(ax+b)^2}$$

If $Q(x)$ has a form of $(ax^2 + bx + c)$ then

$$\frac{P(x)}{Q(x)} = \frac{P(x)}{(x-d)(ax^2+bx+c)}$$

$$= \frac{C}{(x-d)} + \frac{Ax+B}{(ax^2+bx+c)}$$

If $Q(x)$ has a form of $(ax^2 + bx + c)^k$ then

$$\frac{P(x)}{Q(x)} = \frac{P(x)}{(ax^2+bx+c)^2}$$

$$= \frac{Ax+B}{(ax^2+bx+c)} + \frac{Cx+D}{(ax^2+bx+c)^2}$$