UNIRAZAK
UNIVERSITI TUN ABDUL RAZAK

FINAL EXAMINATION
JULY 2023

COURSE TITLE	**BASIC MATHEMATICS**
COURSE CODE	**FMAT0114**
DATE/DAY	**17 OCTOBER 2023 / TUESDAY**
TIME/DURATION	**09:00 AM - 12:00 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. Solve the following to find x or the range of x.

   a) $1 - 2\log_x 2 + \log_2 x = 0$ (5 marks)

   b) $4^{x-3} = 8^{4-x}$ (5 marks)

   c) $|x+4| = |3x-7|$ (5 marks)

2. In a job interview, all short listed candidates are grouped together in the beginning as they have to go through a series of assessments and after every round of assessment, 4 candidates will be announced unsuccessful to proceed to the next round. The first round of assessment begins with 30 applicants. The second round consists of 26 applicants and the third round begins with 22 applicants and so on until the final round consists of 2 applicants.

   Given the above system, by using methods in sequence and series, how many rounds of assessments are conducted in the interview? (5 marks)

3. Isa purchased a house in 2016 at a price of RM 420 000. Assume that the house appreciates 3% per year.

   a) What is the value of the house in the 8th year? (5 marks)

   b) If the house can be sold at a market value of RM 600 000, what would be Isa's profit if he chooses to sell it? (2 marks)

4. Given the following functions below, find the minimum or maximum value of the function, intercepts and sketch the graph.

   a) $f(x) = -4x^2 + 4x - 1$ (10 marks)

   b) $f(x) = -3x^2 - 6x - 6$ (10 marks)

5. Imraan has a few types of pets which are cats, fish and hamsters. Each month he will spend some amount of his income to care for his pets. In July, he bought 1 pack of fish pellets, 2 packs of cat food and 1 pack of hamster seeds which cost him RM 66. In August, he bought 1 pack of fish pellets and 3 packs of cat food which he paid RM 61. In September, he bought 1 pack of cat food and 1 pack of hamster seeds and paid RM 35.

   Assume that the price of the pet foods are indicated follows:

   $x = price\ of\ fish\ pellets$
   $y = price\ of\ cat\ foods$
   $z = price\ of\ hamster\ seeds$

   Based on the information above, solve for x, y and z using matrices operation. (12 marks)

6. Given a polynomial of $P(x) = x^3 + 3x^2 - 24x - 80$,

   a) by using factor theorem, show that $(x-5)$ is a factor of $P(x)$ (4 marks)

   b) by using long division, find the quotient when $P(x)$ is divided with $(x-5)$. Hence, factorize the quotient. (7 marks)

7. Find the remainder for the following using remainder theorem.

   a) $3x^3 - 2x^2 - 7x - 6$ divided by $x - 2$ (5 marks)

   b) $2x^3 - 5x^2 - 28x + 15$ divided by $x - 3$ (5 marks)

8. Decompose the fraction below into its partial fraction.

$$\frac{3x+1}{2x^2-x-1}$$

(10 marks)

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

   a) $f(x) = \frac{2}{x^2-1}$ at $x = 2$ (5 marks)

   b) $f(x) = \sqrt{5+2x}$ at $x = 2$ (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

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

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

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

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

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

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

$|ax+b| = p$ *is equivalent to*
$\boldsymbol{ax+b=p}$ *or* $\boldsymbol{ax+b=-p}$

$|ax+b| < p$ *is equivalent to*
$\boldsymbol{-p < ax+b < p}$

$|ax+b| > p$ *is equivalent to*
$\boldsymbol{ax+b < -p}$ *or* $\boldsymbol{ax+b > p}$

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

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

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