UNIRAZAK
UNIVERSITI TUN ABDUL RAZAK

FINAL EXAMINATION

NOVEMBER 2022

COURSE TITLE **BASIC MATHEMATICS**

COURSE CODE **FMAT0114**

DATE/DAY **13 FEBRUARY 2023 / MONDAY**

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 **8** Printed Pages including front page)

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

This paper consists of EIGHT (8) questions. Answer ALL questions in the Answer Booklet. **(100 MARKS)**

Question 1 (10 Marks)

a) The linear expression $ax + b$ and the quadratic expression $a^2 + bx + c$ are examples of functions called polynomials.

i. Using long division, find the quotient $Q(x)$ and the remainder $R\ (x)$ when $P(x) = 2\ x^4 - 6$ is divided by $D(x) = x^2 + x - 2$. (5 marks)

ii. The polynomial $P(x) = 2x^3 + px^2 + qx - 2$ has a remainder 7 when divided by $2x - 3$ and has a remainder -20 when divided by $(x + 3)$. Find the value of p and q. (5 marks)

Question 2 (12 Marks)

a) Verify the following identities.

i. $\frac{cos\ \theta}{1+sin\ \theta} + \frac{1+sin\theta}{cos\ \theta} = 2sec\ \theta$ (3 marks)

ii. $\frac{tan^2\theta+sin^2\theta}{sec\ \theta-cos\ \theta} = sec\ \theta + cos\ \theta$ (3 marks)

b) Use the compound angle formulae to find the values for each trigonometric expression (in terms of surds).

i. $cot\ 120° - 60°$ (3 marks)

ii. $tan\ \frac{7\pi}{12}$ (3 marks)

Question 3 **(12 Marks)**

a) By using the factorisation or conjugate multiplication method, evaluate the following limits.

i. $\frac{x^2-36}{x-6}$ (3 marks)

ii. $\frac{4x+x^2}{5x}$ (3 marks)

b) Find $\lim_{x\to\infty} f(x)$ for each of the following functions.

i. $f(x) = \frac{2x-4}{x+5}$ (3 marks)

ii. $f(x) = \frac{-4}{x^2+3}$ (3 marks)

Question 4 **(10 Marks)**

a) JK saves 80 cents of his daily expenses the first day of working and every day thereafter increases his daily savings by ten cents. If JK follows this saving method persistently, how much saving will JK have in the month of July? (3 marks)

b) The price of a unit in a serviced apartment in Petaling Jaya is RM 400 000 for the first floor, RM 402 500 for the second floor, RM 405 000 for the third floor and the price of a unit increases by RM 2 500 as the floor gets higher. Based on the information given, calculate

i. the price of a unit on the tenth floor. (2 marks)

ii. the total price of units from first floor to fifth floor. (2 marks)

iii. the total price from the sixth floor to tenth floor. (3 marks)

Question 5 **(15 Marks)**

a) Joon, JK and Agust craves for ice cream. One day, they all went to a shop selling various types of ice creams. Agust bought 2 cones of chocolate ice cream and 1 cone of strawberry ice creams and paid RM 19 while JK bought 1 cone of cheese ice cream, 2 cones of chocolate ice cream and 2 cones of strawberry ice cream and paid RM 35. Joon bought 1 cone of ice cheese ice cream, 1 cone of chocolate ice cream and 2 cones of strawberry ice cream and paid RM 29.

Assume that the price of each cone of chocolate ice cream, cheese ice cream and strawberry ice cream are represented by x, y and z respectively.

Based on the information above,

i. Write the system of linear equation to the above scenario (3 marks)

ii. Based on your answer in (a), write the equation in the form of matrices equation (2 marks)

iii. Find the value for x, y and z using matrices operation (10 marks)

Question 6 **(10 Marks)**

a) Express each of the following in terms of $log\ x$, $log\ y$, and $log\ z$.

i. $log\ x^2y^3$ (2 marks)

ii. $log\ \sqrt{\frac{xy^2}{z}}$ (2 marks)

b) Solve following exponential functions for x

i. $3e^{2x+1.2}=4018.9$ (3 marks)

ii. $7e^{3x}=630$ (3 marks)

Question 7 **(15 Marks)**

a) Solve the following inequalities to find x or the range of x

i. $2x - 2 \geq 9 - 5x$ (5 marks)

ii. $x^2 - 2x - 5 > 3$ (5 marks)

iii. $|6x - 5| < 2$ (5 marks)

Question 8 **(16 Marks)**

a) Sketch the graph of each of the following functions. From the graph, state the domain and the range.

i. $f(x) = x^2 - 2x - 3 \; for \; x \in R$ (3 marks)

ii. $f(x) = \begin{cases} x, & x < 0 \\ x - 2, & 5 \leq x < 9 \\ x^2 - 75, & x \geq 9 \end{cases}$ (4 marks)

b) Find the inverse and sketch the graph of the function. (3 marks)

$$f: x \to 3x - 2$$

c) Given the functions,

$$f(x) = 2x - 1$$

$$g(x) = x^2$$

$$h(x) = \sqrt{x + 1}$$

Find the composite functions.

i. $f \circ h$ (3 marks)

ii. $h \circ g \circ f$ (3 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

$$(xy) = x + y$$
$$\left(\frac{x}{y}\right) = x - y$$
$$x^n = n\,x$$
$$\left(\sqrt[n]{x}\right) = \frac{1}{n}(x)$$
$$a = \frac{a}{b}$$

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

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

Function and graph

$$y - y_1 = m(x - x_1)$$
$$m_1 m_2 = -1 \; if \; perpendicular$$
$$m_1 = m_2 \; if \; parallel$$

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

$$AX = B$$
$$A^{-1} = \frac{1}{|A|} Adj\,(A)$$
$$Adj(A) = [C_{ij}]^T$$
$$C_{ij} = (-1)^{i+j} M_{ij}$$
$$X = A^{-1}B$$

Properties of Limits

$$c = c$$
$$x = a$$
$$x^n = a^n$$
$$c.f(x) = c.f(x)$$
$$[f(x) \pm g(x)] = f(x) \pm g(x)$$
$$[f(x).g(x)] = f(x)\,.\,g(x)$$
$$\frac{f(x)}{g(x)} = \frac{f(x)}{g(x)'} \; provided \; g(x) = 0$$

Trigonometric

$$sin\,sin\,\theta \rightarrow sin\,sin\,\theta = \frac{a}{b}$$
$$\theta \rightarrow cos\,cos\,\theta = \frac{b}{c}$$
$$\theta \rightarrow tan\,tan\,\theta = \frac{sin\,sin\,\theta}{cos\,cos\,\theta}$$
$$\theta \rightarrow cot\,cot\,\theta = \frac{1}{tan\,tan\,\theta}$$

Formula

Table 1.0: **Trigonometric special angles**

θ	**0°**	**30°**	**45°**	**60°**	**90°**
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	undefined
cosec θ	undefined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec θ	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	undefined
cot θ	undefined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	undefined