



FACULTY OF SCIENCE

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE **MAFT0A1**
MATHEMATICS FOR TEACHERS 1

CAMPUS **APK**

SUPPLEMENTARY EXAM **JULY 2017**

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DURATION: 2 HOURS **MARKS: 100**

SURNAME AND INITIALS

STUDENT NUMBER

CONTACT NUMBER

NUMBER OF PAGES: 13 PAGES (including front page)

INSTRUCTIONS: **ANSWER ALL THE QUESTIONS, CALCULATORS ARE NOT ALLOWED.**

Question 1**[5 x 2 = 10]**

Determine whether the following statements are true or false. **If false, explain why or give an example.**

Statement	True or False & Explanation
The graph of the function is a parabola $y = e^2x$	
The function is symmetrical with respect to the origin $f(x) = \frac{1}{x}$	
The length of the radius of the given circle is 16: $(x - 1)^2 + y^2 = 16$	
The point (x, y) where $x > 0$ and $-y > 0$ lies in the first quadrant	
$\frac{1}{a^{-1} + b^{-1}} = a + b$	

Question 2: [5 x 2 = 10]

The following questions are multiple choice questions. There is only one correct answer from the choices given. **Circle the correct option.**

2.1 Which expression is equal to

$$(-c^2)^{-\frac{1}{3}}?$$

- A. $\frac{1}{\sqrt[3]{-c^2}}$
- B. $\frac{1}{\sqrt[3]{c^2}}$
- C. $\frac{1}{\sqrt{-c^3}}$
- D. $\sqrt[3]{c^2}$
- E. None of these

2.2 Use the graph to answer this question

The line $y = \frac{1}{2}x + \frac{1}{2}$ passes through which point?

- A. A (-5; 7)
- B. B (-7; -3)
- C. C (-7; 4)
- D. D (-5; -7)
- E. None of these

2.3 Given the equation $ax + by + c = 0$, which of the following must be true for the graph of the line to have a **positive slope and a positive y-intercept**?

- A. $a > 0, b > 0, c > 0$
- B. $a > 0, b < 0, c > 0$
- C. $a > 0, b > 0, c < 0$
- D. $a > 0, b < 0, c < 0$
- E. None of these

2.4 Find the **end behaviour** of $y = -x^3 + 10x^2 - 1$

- A. $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
- B. $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
- C. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
- D. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
- E. None of these

2.5 The zeros of $y = x^3 + 4x^2 - x - 4$ are

- A. $-1; 1; 4$
- B. $-1; 2; 2$
- C. $-2; 1; 2$
- D. $-1; 1; -4$
- E. None of these

Question 3 [14]

3.1 Express as a single logarithm :

$$3 \log_2(x + 1) - \log_2 x^2 + 1$$

[2]

3.2 Express in the form $a + bi$:

$$\frac{3 - i}{1 + 2i}$$

[3]

3.3 Find the equation of the inverse function of f .

$$f(x) = e^{2x-1}$$

[3]

3.4 Find **and simplify** $f \circ g$ **and find its domain**:

$$f(x) = \frac{2}{x}, \quad g(x) = \frac{1}{x-2}$$

[3]

3.5 Find the quotient and the remainder.

$$(x^4 + 1) \div (x^2 - x - 1)$$

[3]

Question 4 [19]

4.1 Solve the equation by the method of completing the square:

$$2x^2 + 5x + 3 = 0$$

[5]

4.2 Solve for :

a.

$$\sqrt{2x + 3} - 2 = x$$

[3]

b.

$$e^{2x} - 3e^x + 2 = 0$$

[3]

c.

$$\log_3 x + \log_3(x - 8) = 2$$

[4]

d.

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

[4]

Question 5 [12]

5.1 Show that the points are vertices of a right triangle:

$$A (-2, 9), \quad B (1, 0) \quad C (-5, 3)$$

5.2 Determine the equation of a circle with centre $(-1, 5)$ that passes through the point $(-4, 6)$. [3]

[3]

5.3 Determine the equation of the straight line through the point $(-1, 2)$ that is perpendicular to the line $y = 3 - 2x$.

[3]

5.4 Describe the transformations with respect to the parent function $g(x) = \sqrt{x}$.

$$f(x) = 1 - \sqrt{x + 2}$$

[3]

Question 6 [26]

6.1 Sketch the graph of

$$y = \ln(-1 + x)$$

clearly indicating the asymptote and intercepts with the axes.

[3]

6.2 Given

$$f(x) = \begin{cases} \sqrt{x-1}, & x > 1 \\ 2 & x \leq 1 \end{cases}$$

a. Determine $f(-2)$

[1]

b. Determine $f(1)$

[1]

c. Determine $f(10)$

[1]

d. What is the y -intercept of $f(x)$?

[1]

6.3 Given

$$f(x) = -x^2 + x + 2$$

a. Express f in the form $f(x) = a(x - h)^2 + k$

[3]

b. Determine the x – and y –intercepts of $f(x)$.

[2]

- c. Sketch the graph of $f(x)$, showing the x – and y –intercepts and the turning point.

[3]

- d. State the range of f

[1]

- e. For which interval(s) is f increasing?

[1]

6.4 Given

$$f(x) = \frac{x^2 - 4}{x^2}$$

- a. Determine the x – and y -intercepts of $f(x)$.

[2]

- b. Find the vertical asymptote(s) of $f(x)$.

[1]

- c. Find the horizontal asymptote(s) of $f(x)$.

[1]

- d. Complete the table:

x	-3	-1	1	3
y				

[2]

- e. Sketch the graph of $f(x)$.

[3]

Question 7 [9]

- 7.1 Show that $x + 1$ is a factor of $f(x) = x^3 - 3x - 2$

[1]

7.2 Use (7.1) to fully factorise $f(x)$.

[3]

7.3 Now find the partial fraction decomposition of:

$$\frac{2x - 7}{x^3 - 3x - 2}$$

[5]