

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

PMT0101 – MATHEMATICS I
(Foundation in Information Technology)

(SOLUTION)

OCTOBER 2015

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages with **FIVE** questions.
2. Attempt all **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.
4. **No calculators are allowed.**

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You are required to write proper steps.

QUESTION 1 Solution

$$(a) \frac{3x^4y^{-3}}{(6x^3y)^2} = \frac{3x^4y^{-3}}{6^2x^6y^2} = \frac{x^{4-6}y^{-3-2}}{12} = \frac{x^{-2}y^{-5}}{12} = \frac{1}{12x^2y^5} \text{ or equivalent.}$$

[0.5+0.5+0.5+0.5]

$$(b) \frac{6}{\sqrt{7}-2} = \frac{6}{\sqrt{7}-2} \cdot \frac{\sqrt{7}+2}{\sqrt{7}+2} = \frac{6(\sqrt{7}+2)}{7-4} = \frac{6(\sqrt{7}+2)}{3} = 2(\sqrt{7}+2) \text{ or } 2\sqrt{7}+4$$

[0.5+0.5+0.5+0.5]

$$(c) \frac{2-i}{3-i} = \frac{2-i}{3-i} \cdot \frac{3+i}{3+i} = \frac{6+2i-3i-i^2}{9+1}$$

$$= \frac{7-i}{10} = \frac{7}{10} - \frac{1}{10}i$$

[0.5+0.5+0.5+0.5]

$$(d) 27x^3 + 8 = (3x)^3 + 2^3 = (3x+2)(9x^2 - 6x + 4)$$

[1+1]

$$(e) \frac{7}{(x-2)(x-1)} - \frac{4}{(x-2)(x+2)} = \frac{7(x+2)-4(x-1)}{(x+2)(x-2)(x-1)}$$

$$= \frac{7x+14-4x+4}{(x+2)(x-2)(x-1)}$$

$$= \frac{3x+18}{(x+2)(x-2)(x-1)}$$

[0.5+0.5+0.5+0.5]

QUESTION 2 Solution

(a) (i) $2x^2 + 5x - 7 = 0$,
 $(2x + 7)(x - 1) = 0$,
 $2x + 7 = 0$ or $x - 1 = 0$,
 $x = -\frac{7}{2}$ or $x = 1$

[0.5+0.5+0.5]

(ii) $(2x + 7)(x - 1) > 0$

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

or equivalent [0.5+0.5+0.5+0.5]

The solution is $(-\infty, -\frac{7}{2}) \cup (1, \infty)$

[0.5+0.5]

(iii) The domain is $(-\infty, -\frac{7}{2}) \cup (1, \infty)$

[0.5]

(b) $|8x + 1| = 8$, $8x + 1 = 8$ or $8x + 1 = -8$

[0.5+0.5]

$8x = 7$ $8x = -9$

$x = \frac{7}{8}$ or $x = -\frac{9}{8}$

[0.5+0.5]

(c) $x = \sqrt{3x + 4}$, $x^2 = 3x + 4$,

[0.5]

$x^2 - 3x - 4 = 0$, $(x + 1)(x - 4) = 0$,

[0.5]

$x = -1$ or $x = 4$

[0.5]

Checking:

When $x = -1$, LHS = -1, RHS = $\sqrt{3(-1) + 4} = \sqrt{1} = 1$ ✗

When $x = 4$, LHS = 4, RHS = $\sqrt{3(4) + 4} = \sqrt{16} = 4$ ✓

[0.5+0.5]

Conclusion: $x = 4$

[0.5]

QUESTION 3 Solution

(a) The domain is $(-3, 4]$; the range is $[0, 2) \cup [3, 4]$. The function is NOT one-to-one.

[0.5+(0.5+0.5)+0.5]

(b) (i) $(f \circ g)(1) = f(g(1)) = f\left(\frac{1}{1+3}\right) = f\left(\frac{1}{4}\right)$ [0.5+0.5]

$$= \sqrt{\frac{1}{4} + 2} = \sqrt{\frac{9}{4}} = \frac{3}{2} \quad [0.5]$$

(ii) Let $y = \sqrt{x+2}$. Need to solve for x in terms of y .

$$y^2 = x + 2,$$

$$x = y^2 - 2$$

[0.5+0.5]

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

[0.5]

or equivalent

(c) (i) Degree = 5

[0.5]

(ii) Zeros of f : $-1, 1, 3$

Zeros	Multiplicities	Cross/Touch
-1	1	Cross
1	2	Touch
3	2	Touch

[0.5]

[0.5]

[0.5]

(iii) y-intercept.: $P(0) = -\frac{1}{2}(-1)^2(-3)^2 = -\frac{9}{2}$ [0.5]

(iv) As $x \rightarrow -\infty$, $y \rightarrow \infty$ [0.5]

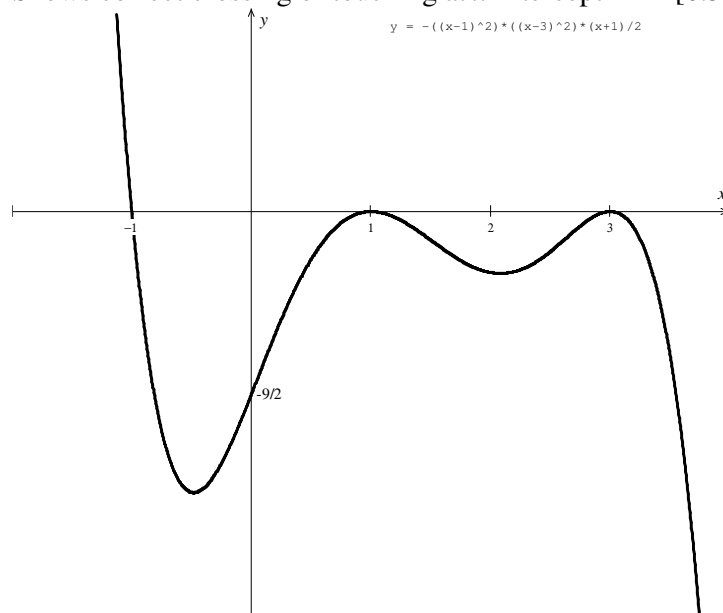
As $x \rightarrow +\infty$, $y \rightarrow -\infty$ [0.5]

(v) Sketch of graph:

Shows all intercepts [0.5]

Exhibits the proper end behaviour [0.5]

Shows correct crossing or touching at x-intercept [0.5]



QUESTION 4 Solution

(a) $-7 \leq 3 - 2x < 11$

$-7 - 3 \leq -2x < 11 - 3$

$-10 \leq -2x < 8$

$5 \geq x > -4$

Solution set: $(-4, 5]$

[0.5+0.5+0.5+0.5]

(b) (i) $f(x) = 2^{-x+1}$

[1]

(ii) $h(x) = \log_2(x+2)$

[1]

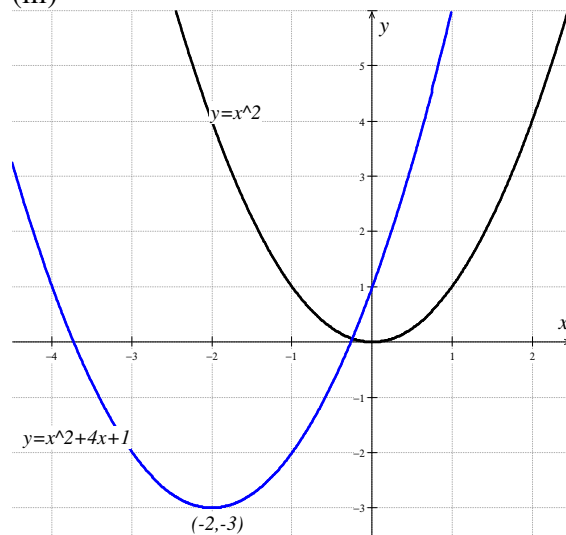
(c) (i) $f(x) = x^2 + 4x + 1 = x^2 + 4x + 4 - 4 + 1$
 $= (x+2)^2 - 3$

[0.5+0.5]

(ii) Vertex: $(-2, -3)$ y-intercept: 1

[0.5+0.5]

(iii)



[0.5+0.5]

(d)

$3x+1$

[0.5]

$x^2 + 6 \sqrt{3x^3 + x^2 + 10x + 1}$

$$\begin{array}{r} 3x^3 \quad +18x \\ \hline \end{array}$$

[0.5]

$$\begin{array}{r} x^2 - 8x + 1 \\ \hline \end{array}$$

[0.5]

$$\begin{array}{r} x^2 \quad +6 \\ \hline \end{array}$$

[0.5]

$$\begin{array}{r} -8x - 5 \\ \hline \end{array}$$

Quotient = $3x+1$

Remainder = $-8x-5$

[0.5+0.5]

QUESTION 5 Solution

$$(a) \sum_{k=2}^5 (3k-1) = (6-1) + (9-1) + (12-1) + (15-1) = 5 + 8 + 11 + 14 = 38 \quad [1+1]$$

(b) First term = 10

Common difference: $6 - 10 = -4$

[0.5]

$$\text{Sum of the first 30 terms} = 30 \left(\frac{2(10) + 29(-4)}{2} \right) = \frac{30(-96)}{2} = -1440$$

[0.5+0.5+0.5]

$$(c) \text{ The common ratio } r = \frac{-\frac{1}{3}}{\frac{1}{2}} = -\frac{2}{3} \quad [0.5+0.5]$$

$$\text{Since } |r| = \left| -\frac{2}{3} \right| = \frac{2}{3} < 1, \text{ the geometric series is convergent.} \quad [0.5+0.5]$$

Sum of series:

$$S = \frac{a}{1-r} = \frac{\frac{1}{2}}{1-(-\frac{2}{3})} = \dots = \frac{3}{10} \quad [0.5+0.5]$$

$$(d) \text{ From } 3x + 2y + 1 = 0, y = -\frac{3}{2}x - \frac{1}{2}.$$

$$\text{The line } 3x + 2y + 1 = 0 \text{ has slope } -\frac{3}{2} \quad [0.5+0.5]$$

$$\text{Equation of line } l_2: y - 2 = -\frac{3}{2}(x + 1) \quad [0.5]$$

$$2y - 4 = -3x - 3 \quad [0.5]$$

$$\text{i.e. } 3x + 2y - 1 = 0 \text{ or equivalent.} \quad [0.5+0.5]$$

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