MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2015/2016

PMT0101 – MATHEMATICS I

(Foundation in Information Technology)

(*SOLUTION*)

JUNE 2016

(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**.

No calculators are allowed.
You are required to write proper steps.

QUESTION 1 Solution

(a) $\dfrac{3x^5y^{-3}}{(2x^3y)^3} = \dfrac{3x^5y^{-3}}{2^3x^9y^3} = \dfrac{3x^{5-9}y^{-3-3}}{8} = \dfrac{3x^{-4}y^{-6}}{8} = \dfrac{3}{8x^4y^6}$ or equivalent.

[0.5+0.5+0.5+0.5]

(b)

$$\frac{6}{\sqrt{11}-3} = \frac{6}{\sqrt{11}-3}\cdot\frac{\sqrt{11}+3}{\sqrt{11}+3} = \frac{6(\sqrt{11}+3)}{11-9} = \frac{6(\sqrt{11}+3)}{2} = 3(\sqrt{11}+3) \text{ or } 3\sqrt{11}+9$$

[0.5+0.5+0.5+0.5]

(c) $\dfrac{3-i}{2+i} = \dfrac{3-i}{2+i}\cdot\dfrac{2-i}{2-i} = \dfrac{6-3i-2i+i^2}{4+1}$

$= \dfrac{5-5i}{5} = 1-i$ [0.5+0.5+0.5+0.5]

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

[1+0.5+0.5]

(e) $$\frac{5}{(x+2)(x-3)} - \frac{6}{(x+2)^2} = \frac{5(x+2)-6(x-3)}{(x+2)^2(x-3)}$$
$$= \frac{5x+10-6x+18}{(x+2)^2(x-3)}$$
$$= \frac{-x+28}{(x+2)^2(x-3)}$$

[0.5+0.5+0.5+0.5]

QUESTION 2 Solution

(a) (i) $2x^2+9x+7=18$

$2x^2+9x-11=0$

$(2x+11)(x-1)=0$

$2x+11=0$ or $x-1=0$

$x=-\frac{11}{2}$ $x=1$

[0.5+0.5+0.5]

(ii) $2x^2+9x-11<0$, i.e. $(2x+11)(x-1)<0$ [0.5]

	$-\frac{11}{2}$		1	
Sign of $(2x+11)$	−−	+	+	[0.5]
Sign of $(x-1)$	−−	−−	+	[0.5]
Sign of $(2x+11)(x-1)$	+	−−	+	[0.5]

OR equivalent

Hence the solution set is $\left(-\frac{11}{2},\ 1\right)$ [0.5]

(iii)For domain of $g(x)=\sqrt{2x^2+9x-11}$, we want $2x^2+9x-11\geq 0$

Based on the answer from (i),

the domain of g is $(-\infty,-\frac{11}{2}]\cup[1,\infty)$ [0.5+0.5]

(b) $|2x-3|=4$, $2x-3=4$ or $2x-3=-4$ [0.5+0.5]

$2x=7$ $2x=-1$

$x=\frac{7}{2}$ or $x=-\frac{1}{2}$ [0.5+0.5]

(c) $1-x=\sqrt{3x+1}$

$(1-x)^2=3x+1$

$x^2-5x=0$

$x(x-5)=0$

$x=0$ or $x=5$

[0.5+0.5+0.5]

Checking:

When $x=0$, LHS = 1, RHS = $\sqrt{3(0)+1}=\sqrt{1}=1$ √

When $x=5$, LHS = –4, RHS = $\sqrt{3(5)+1}=\sqrt{16}=4$ ×

[0.5+0.5]

Conclusion: $x=0$ [0.5]

QUESTION 3 Solution

(a) The domain is $(-3,4]$; the range is $[-1,1)\cup[3,4]$.
The function is NOT one-to-one. [0.5+(0.5+0.5)+0.5]

(b) (i) $(f\circ g)(1) = f(g(1)) = f\left(\frac{1}{4+12}\right) = f\left(\frac{1}{16}\right)$ [0.5+0.5]

$= \sqrt{\frac{1}{16}+3} = \sqrt{\frac{49}{16}} = \frac{7}{4}$ [0.5]

(ii) Let $y = \sqrt{x+3}$. Need to solve for x in terms of y.

$y^2 = x+3$,

$x = y^2 - 3$ [0.5+0.5]

$f^{-1}(x) = x^2 - 3$ [0.5] or equivalent

(c) (i) Degree = 4 [0.5]

(ii) Zeros of f: -2, 2 and $\frac{5}{2}$

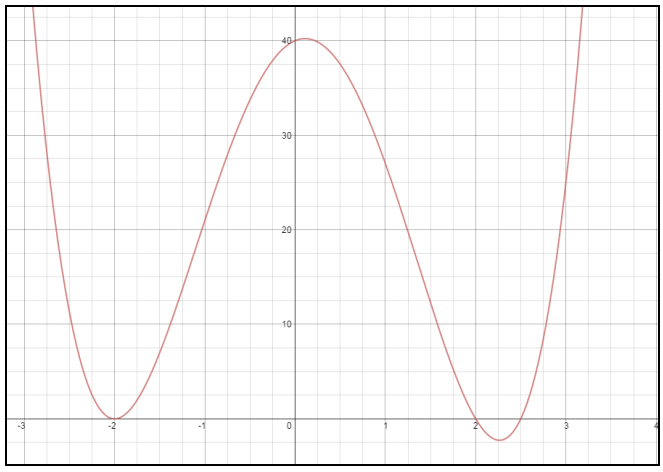
Zeros	Multiplicities	Cross/Touch
-2	2	Touch
2	1	Cross
$\frac{5}{2}$	1	Cross
[0.5]	[0.5]	[0.5]

(iii) y-intercept, $f(0) = 40$. [0.5]

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

As $x \to \infty$, $y \to \infty$ [0.5]

(v) Sketch the graph:



Shows all intercepts [0.5]

Proper end behaviour [0.5]

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

QUESTION 4 Solution

(a)
$$\begin{array}{r} 6x+5 \\ x^2+2 \;\overline{)\,6x^3+5x^2-2x+1} \\ \underline{6x^3 \qquad +12x} \\ 5x^2-14x+1 \\ \underline{5x^2 \qquad +10} \\ -14x-9 \end{array}$$

[0.5] [0.5] [0.5]

Quotient $= 6x+5$

Remainder $= -14x-9$ [0.5+0.5]

(b) $2\log_{10}5-\log_{10}9+\log_{10}36$

$=\log_{10}5^2-\log_{10}9+\log_{10}36$

$=\log_{10}\left(\dfrac{25\times36}{9}\right)$

$=\log_{10}100$

$=\log_{10}10^2=2\log_{10}10=2$ [0.5+0.5+0.5+0.5]

(c) $3^{x-1}=7$

$\log 3^{x-1}=\log 7$

$(x-1)\log 3=\log 7$

$x-1=\dfrac{\log 7}{\log 3}$

$x=\dfrac{\log 7}{\log 3}+1$ [0.5+0.5+0.5+0.5]

(d) $f(-1)=-1$

$-1=Ae^{-1+1}-3$

$-1+3=Ae^0 \qquad A=2$ [0.5+0.5]

(e) (i) $f(x)=2^{-x+1}$ [1]

(ii) $h(x)=\log_2(x+1)$ [1]

QUESTION 5 Solution

(a)(i) $x+3y+1=0$ $\quad 3y=-x-1$

$$y=-\frac{1}{3}x-\frac{1}{3} \qquad [0.5]$$

$$\therefore m_{BC}=-\frac{1}{3} \qquad [0.5]$$

(ii) $m_{AB}\times m_{BC}=-1$ $\quad m_{AB}\times\left(-\frac{1}{3}\right)=-1$ $\quad m_{AB}=3$ $\quad [0.5]$

For the equation of the straight line passing through A and B,
$y-5=3(x+6)$ or $y=3x+23$ or equivalent. [0.5+0.5]

(iii) For B, the intersection of $y-5=3(x+6)$ with $x+3y+1=0$

From $y-5=3(x+6)$, $y=3(x+6)+5$

Using $x+3y+1=0$,

$x+3[3(x+6)+5]+1=0$

$x+9x+54+15+1=0$

$10x=-70 \quad x=-7$ [0.5+0.5+0.5] or equivalent

$y=3(-7+6)+5 \quad y=2$ [0.5]

$\therefore B(-7.\ 2)$ [0.5]

(b) $PA = 2$ $\quad \sqrt{(x+6)^2+(y-5)^2}=2$ or $(x+6)^2+(y-5)^2=2^2$ [0.5+0.5]

$x^2+12x+36+y^2-10y+25=4$

$x^2+y^2+12x-10y+57=0$ [0.5+0.5]

(c) (i) $m=\frac{20-5}{5-0}=\frac{15}{5}=3$; Y-intercept is 5 . [0.5+0.5]

(ii) From $y=\frac{a}{x}+b$,

$yx=a+bx$

leading to the linear form $Y=mx+c$, where c is the Y-intercept.

. [0.5+0.5]

So $b=m=3$ [0.5]

and $a=c=5$. [0.5]

End of Page