UNIVERSITY PARTNER

UNIVERSITY OF WOLVERHAMPTON

HERALD COLLEGE KATHMANDU

4MM013 – Computational-Mathematics

Final Examination

University ID	: 2227486
Submitted by	: Nayan Raj Khanal
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Nayan Raj Khanal
2227486

Math Assignment 1:

1. Given,

$$f(x) = \frac{x-3}{x+1} \quad \text{and} \quad g(x) = \frac{1}{x+7}$$

i) $f \circ g(x) \Rightarrow \dfrac{\left(\frac{1}{x+7}\right) - 3}{\left(\frac{1}{x+7}\right) + 1}$

$$\Rightarrow \frac{\frac{1-3(x+7)}{\cancel{x+7}}}{\frac{1+x+7}{\cancel{x+7}}}$$

$$\Rightarrow \frac{1-3x-21}{x+8} \Rightarrow \frac{-3x-20}{x+8} =$$

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ii) $g \circ f(7) \Rightarrow g \circ f(x) = g(f(x))$

$$\Rightarrow \frac{1}{f(x)+7}$$

$$\Rightarrow \frac{1}{\frac{x-3}{x+1}+7}$$

$$\Rightarrow \frac{1}{\frac{x-3+7x+7}{x+1}}$$

$$\Rightarrow \frac{x+1}{x+7x+4} = \frac{x+1}{8x+4}$$

Hence,

$$g \circ f(7) \Rightarrow \frac{7+1}{8(7)+4} \Rightarrow \frac{8}{60} \Rightarrow \frac{2}{15} =$$

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iii) $gog(2) = g(g(x))$

$$\Rightarrow \frac{1}{\frac{1}{2+7}+7}$$

$$\Rightarrow \frac{1}{\frac{64}{9}}$$

$$\Rightarrow \frac{9}{64} =$$

iv) $fof(5) \Rightarrow \frac{\frac{5-3}{5+1}-3}{\frac{5-3}{5+1}+1}$

$$\Rightarrow \frac{\frac{1}{3}-3}{\frac{1}{3}+3}$$

$$\Rightarrow \frac{-\frac{8}{3}}{\frac{4}{3}} \quad \Rightarrow -2 =$$

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2. A function $f(x) = y$, is a relationship between x and y such that there is only one value of y for every value of x. Hence, we cannot construct a function using the one-to-many rule.

a) $y = x^4$

⇒ This is one-to-one function as every element of the domain has a unique image of the specified function.

b) $y = 3x - 1$

⇒ This is a linear function as this function's domain and range are both real numbers and its graph is a straight line with equation $y = mx + c$ as its representation.

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3. a) $\frac{x^2-4}{x+2} = 7x$

~~$\Rightarrow x^2-4 = 7x \times x-2$~~

$\Rightarrow x^2-4 = 7x^2+14$

$\Rightarrow 6x^2+14x+4 = 0$

$\Rightarrow 6x + (12+2)x + 4 = 0$

$\Rightarrow 6x + (x+2) + 2(x+2) = 0$

$\Rightarrow (6x+2)(x+2) = 0$

Hence,

$6x+2=0$ or, $x+2=0$

$\Rightarrow x = -\frac{1}{3}$ $\Rightarrow x = -2$

∴ The function has power greater than 1 and also it displays multiple value of x. It also doesn't make a straight line when plotted in graph.

b) $x = 5$

As its power is 1 and when plotted in graph it makes a straight line. Hence, this is a linear function.

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c) $9x^2 - 6x + 1 = 16$

$\Rightarrow 9x^2 - 6x + 1 - 16 = 0$

$\Rightarrow 3x^2 - 2x - 5 = 0$

$\Rightarrow 3x^2 - (5-3)x - 5 = 0$

$\Rightarrow x(3x-5) + 1(3x-5) = 0$

$\Rightarrow (x+1)(3x-5) = 0$

Hence,

$x + 1 = 0$ or, $3x - 5 = 0$

$\Rightarrow x = -1$ $\Rightarrow x = 5/3$

∴ The function has power greater than 1 and also it displays multiple value of x. It also doesn't make a straight line when plotted in graph.

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d) $x^2+2x+3=0$

Comparing the above equation with $ax^2+bx+c=0$, we get

$a=1$

$b=2$

$c=3$

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$= \frac{-2 \pm \sqrt{2^2-4\cdot1\cdot3}}{2\cdot1}$$

$$= \frac{-2 \pm \sqrt{-8}}{2}$$

Hence,

$$x = \frac{-2+\sqrt{-8}}{2} \quad \text{or} \quad x = \frac{-2-\sqrt{-8}}{2}$$

∴ The function has power greater than 1 and it also displays multiple value of x. It also doesn't make a straight line when plotted in graph.

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4. Given system of equations,

$$5x - y = 13 \quad \rightarrow ①$$
$$x + 2y = 14 \quad \rightarrow ②$$

This can be written as,

$$AX = B$$

$$A = \begin{bmatrix} 5 & -1 \\ 1 & 2 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}, \quad B = \begin{bmatrix} 13 \\ -4 \end{bmatrix}$$

Now, to find A^{-1}

$$|A| = 10 + 1$$
$$\Rightarrow 11 \neq 0$$

Hence, A^{-1} exists

Now, Adj. of $A = \begin{bmatrix} 2 & 1 \\ -1 & 5 \end{bmatrix}$

Now, $A^{-1} = \frac{\text{Adj. } A}{|A|}$

$$A^{-1} = \frac{1}{11}\begin{bmatrix} 2 & 1 \\ -1 & 5 \end{bmatrix}$$

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Finally,

$$X = A^{-1}B$$

$$X = \frac{1}{11}\begin{bmatrix} 2 & 1 \\ -1 & 5 \end{bmatrix} \times \begin{bmatrix} 13 \\ -4 \end{bmatrix}$$

$$= \frac{1}{11}\begin{bmatrix} 26 & -4 \\ -13 & -20 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{22}{11} \\ \frac{-33}{11} \end{bmatrix}$$

$$= \begin{bmatrix} 2 \\ -3 \end{bmatrix}$$

$\therefore x = 2$ and $y = -3$

Putting these values in eq (2), we have

$$x + 2y = -4$$

$$2 + 2(-3) = -4$$

$$-4 = -4$$

Hence, proved

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5. $y = \begin{cases} x^2 + x + 1 & \text{for } -5 \le x < 0 \\ x & \text{for } x \ge 0 \end{cases}$ $-5 \le x \le 5$; interval of 0.5

Case-I : $(y = x^2 + x + 1)$

When,

~~$x = 2$~~ $x = -2$

$y = -2^2 - 2 + 1 \Rightarrow 3$

When,

$x = -2.5$

$y = -2.5^2 - 2.5 + 1 \Rightarrow 4.75$

When,

$x = -3$

$y = -3^2 - 3 + 1 \Rightarrow 7$

When,

$x = -3.5$

$y = -3.5^2 - 3.5 + 1 \Rightarrow 9.75$

When,

$x = -4$

$y = -4^2 - 4 + 1 \Rightarrow 13$

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x	-2	-2.5	-3	-3.5	-4
y	3	4.75	7	9.75	13

Case - II : $(y = x)$.

When,
$x = 1$
$y = 1$ =

When,
$x = 2$
$y = 2$ =

When,
$x = 3$
$y = 3$ =

When,
$x = 4$
$y = 4$ =

When,
$x = 5$
$y = 5$ =

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x	1	2	3	4	5
y	1	2	3	4	5

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$y^2 = x^2 + x + 1$ for $-5 \leq x < 0$

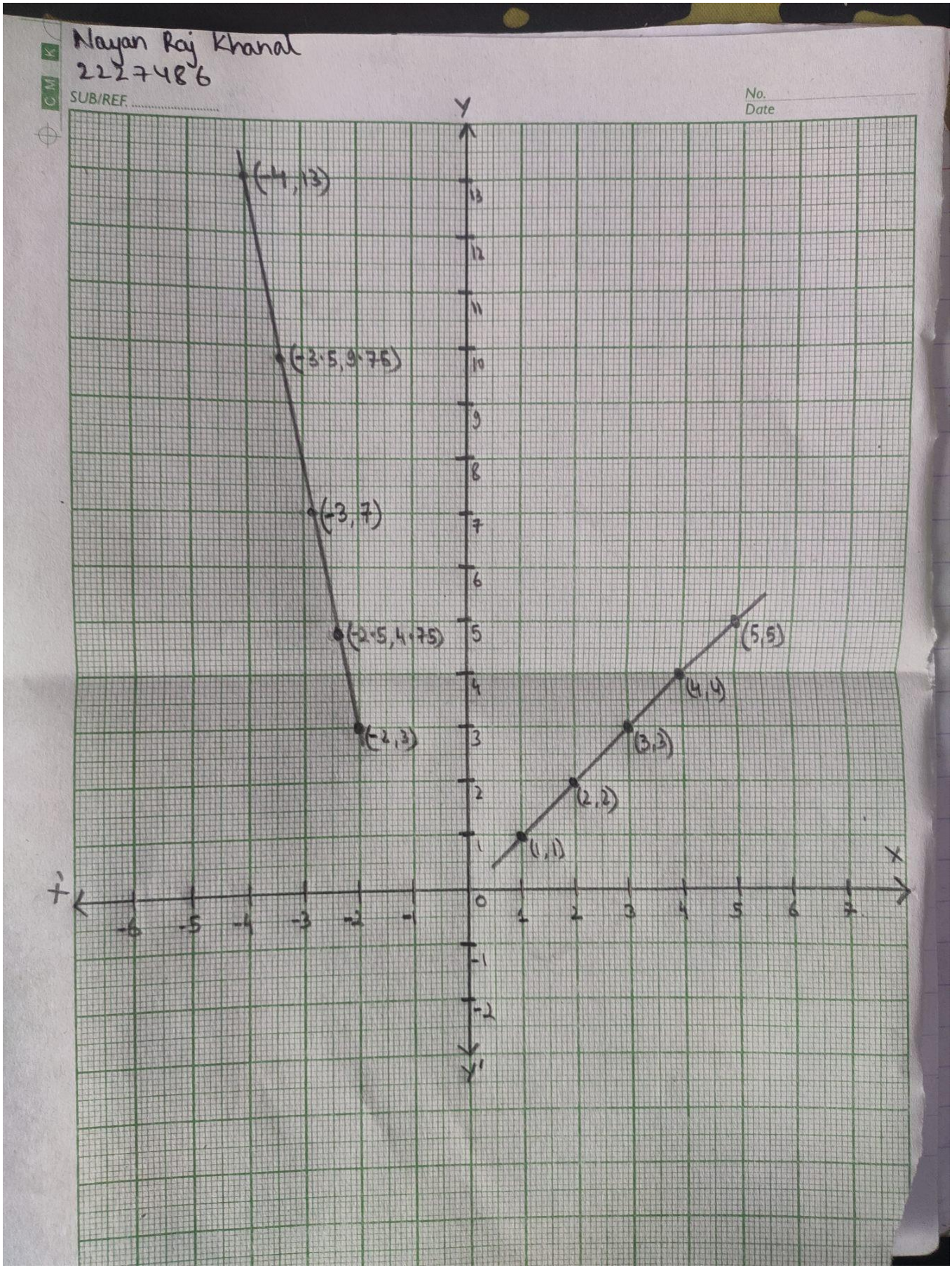
Domain = $[-5, 0]$

Range = $[0.75, 21]$

$x = y$ for $x \geq 0$

Domain = $[0, \infty]$

Range = $[0, \infty]$


Nayan Raj Khanal
2227486
SUB/REF.
No.
Date
Y
X
X'
Y'
(-4, 13)
(-3.5, 9.75)
(-3, 7)
(-2.5, 4.75)
(-2, 3)
(1, 1)
(2, 2)
(3, 3)
(4, 4)
(5, 5)

The End