

UNIVERSITY PARTNER



## **4MM013 - Computational Mathematics**

### Mathematics Assignment-1

Full Marks: 10

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Submitted on	: 4/13/2023

1. State the definition of a function and a composite function.

[2Marks]

Let  $f$  and  $g$  be functions defined as follows:

$$f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = \frac{x-3}{x+1}, f(2) = ? \text{ and}$$

$$g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = \frac{1}{x}, x \neq 0$$

Calculate  $(f \circ g)(x)$  and  $(g \circ f)(x)$ .

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ans:

Function: Function is a <sup>rule</sup> that defines/determines the value of the dependent variable based on the values/variables or values of the independent variables. It can be depicted in several methods to be including a table, a formula or a graph.

Composite function: It is a function which is within another function. One function is substituted as the input to another function.

$f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = \frac{x-3}{x+1}, f(2) = ?$

$g(x) = \frac{1}{x}, x \neq 0$

$f \circ g(x) = ?$   $g \circ f(x) = ?$

$f(2) = ?$

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

Ans:

$g \circ f(x) = ?$

$g(f(x)) = g\left(\frac{x-3}{x+1}\right) = \frac{1}{\frac{x-3}{x+1}} = \frac{x+1}{x-3}$

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$$g(f(x)) = \frac{(x+1)}{x-3}$$

$$f(g(x)) = f\left(\frac{1}{x}\right)$$

$$= \frac{x-3}{x+1}$$

$$= \frac{\frac{1}{x} - 3}{\frac{1}{x} + 1}$$

$$= \frac{\frac{1-3x}{x}}{\frac{1+x}{x}}$$

$$= \frac{1-3x}{1+x}$$

2. Solve the following using the inverse matrix method:

[ 2 Marks]

$$6x - y = 0$$

$$2x - 4y = 1$$

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2.

Q. 2.

$$\begin{aligned} 6x - y &= 0 \\ 2x - 4y &= 1 \end{aligned}$$

$$AX = B$$

$$\begin{bmatrix} 6 & -1 \\ 2 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$AX = B$$

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

Determinant  $|A| = \begin{vmatrix} 6 & -1 \\ 2 & -4 \end{vmatrix} = -24 + 2 = -22$

Adjoint of  $A = \begin{bmatrix} -4 & 1 \\ -2 & 6 \end{bmatrix}$

Now,

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

~~Inverse~~

$$A^{-1} = \frac{1}{|A|} \times \text{Adj } A$$

$$= \frac{1}{-22} \begin{bmatrix} -4 & 1 \\ -2 & 6 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{-4}{-22} & \frac{1}{-22} \\ \frac{-2}{-22} & \frac{6}{-22} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{4}{22} & \frac{1}{-22} \\ \frac{1}{11} & \frac{6}{-22} \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \frac{4}{22} & \frac{1}{-22} \\ \frac{1}{11} & \frac{6}{-22} \end{bmatrix} \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{-22} \\ -\frac{3}{11} \end{bmatrix}$$

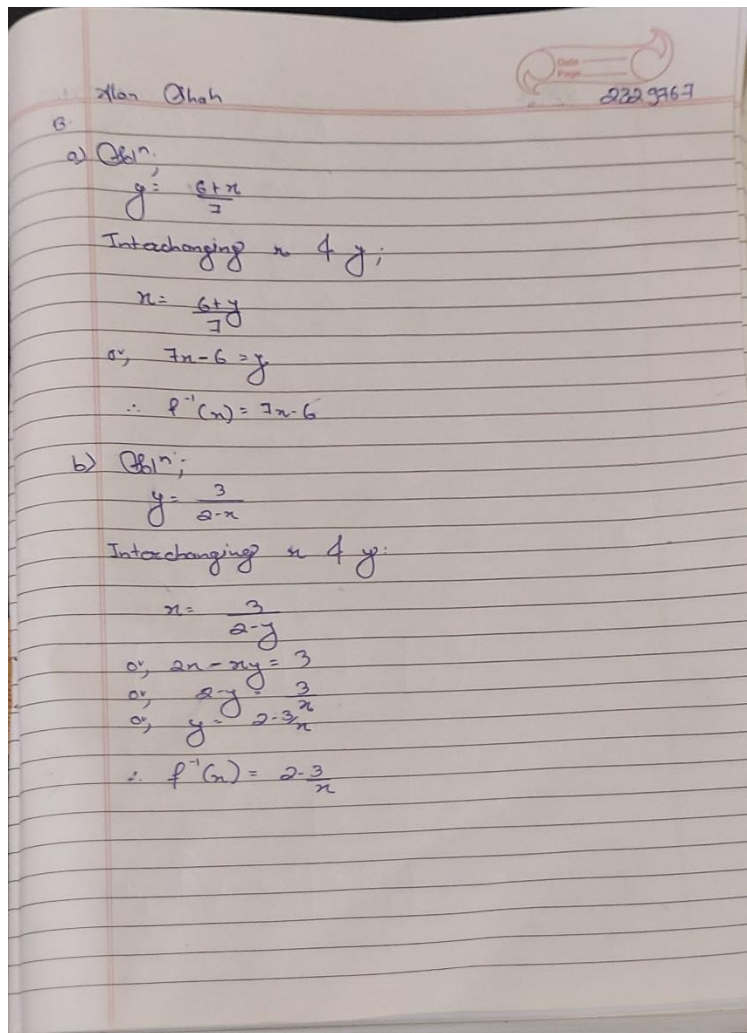
$$\therefore x = \frac{1}{-22} \quad \& \quad y = -\frac{3}{11}$$

3. Calculate the inverse of the following functions:

[ 2 Marks]

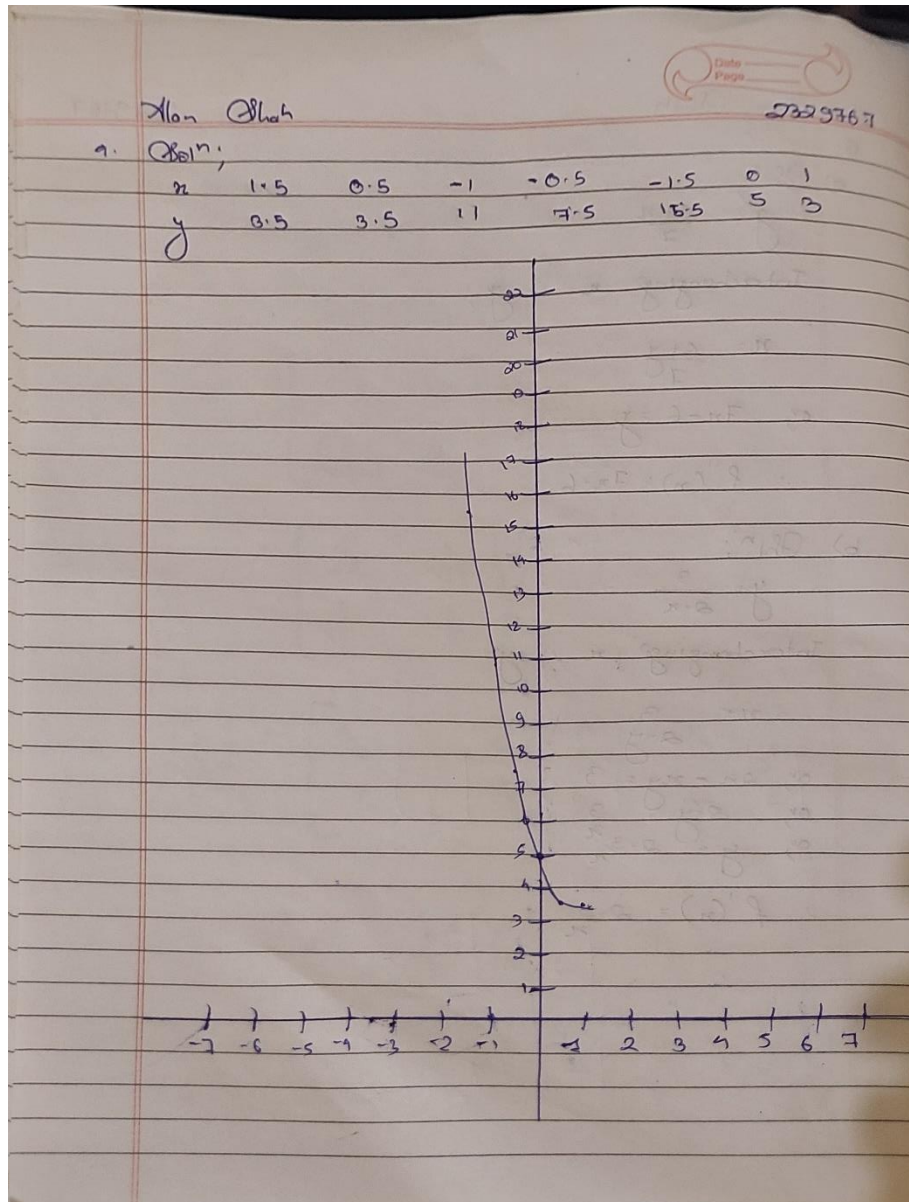
a.  $f(x) = \frac{6+x}{7}$

b.  $f(x) = \frac{3}{2-x}$



4. Sketch the graph of the following functions: [ 2 Marks]  
 $f(x) = 2(x - 1)^2 + 3$ ,  $-2 < x < 2$  In the interval of  $x=0.5$





5.

a. Define gradient of a function. State the gradient and intercept of :

$$2y + 8 = 6x$$

[2 Marks]

b. Solve the following equations:

$$x^2 + \frac{17}{6}x + 2 = 0$$

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5.

a) Ans;

The gradient of a function is the direction of rate of change of that function.

Gradient & intercept of:

$$2y + 8 = 6x$$

$$\text{or, } y = 3x - 4$$

$$\text{or, } y = 3x - 4 \quad \text{--- (1)}$$

Comparing the eqn (1) with  $y = mx + c$

So,

$$m = 3 \quad \{\text{slope of function}\}$$

$$c = -4 \quad \{\text{intercept}\}$$

b) Q61<sup>n</sup>;

$$\text{Comparing } x^2 + 17/6 x + 2 = 0$$

Comparing above eqn with  $ax^2 + bx + c = 0$

$$a = 1, b = 17/6 \text{ and } c = 2$$

Now,

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

$$= \frac{-17/6 \pm \sqrt{(17/6)^2 - 4 \times 1 \times 2}}{2 \times 1}$$

$$= \frac{-17/6 \pm \frac{1}{6}}{2}$$

Taking +ve;

$$x = \frac{-17/6 + 1/6}{2} = -4/3$$

$$\text{Taking -ve:}$$
$$x = \frac{-17/6 - 1/6}{2}$$
$$= -3/2$$

$$\therefore x = -4/3 \text{ or } -3/2$$

The End