UNIVERSITY PARTNER

UNIVERSITY OF WOLVERHAMPTON

HERALD COLLEGE KATHMANDU

# 4MM013 - Computational Mathematics

Mathematics Assignment-1

Full Marks: 10


University ID : 2331971

Submitted by : Pragati Bista


Submitted on : 4/13/2023

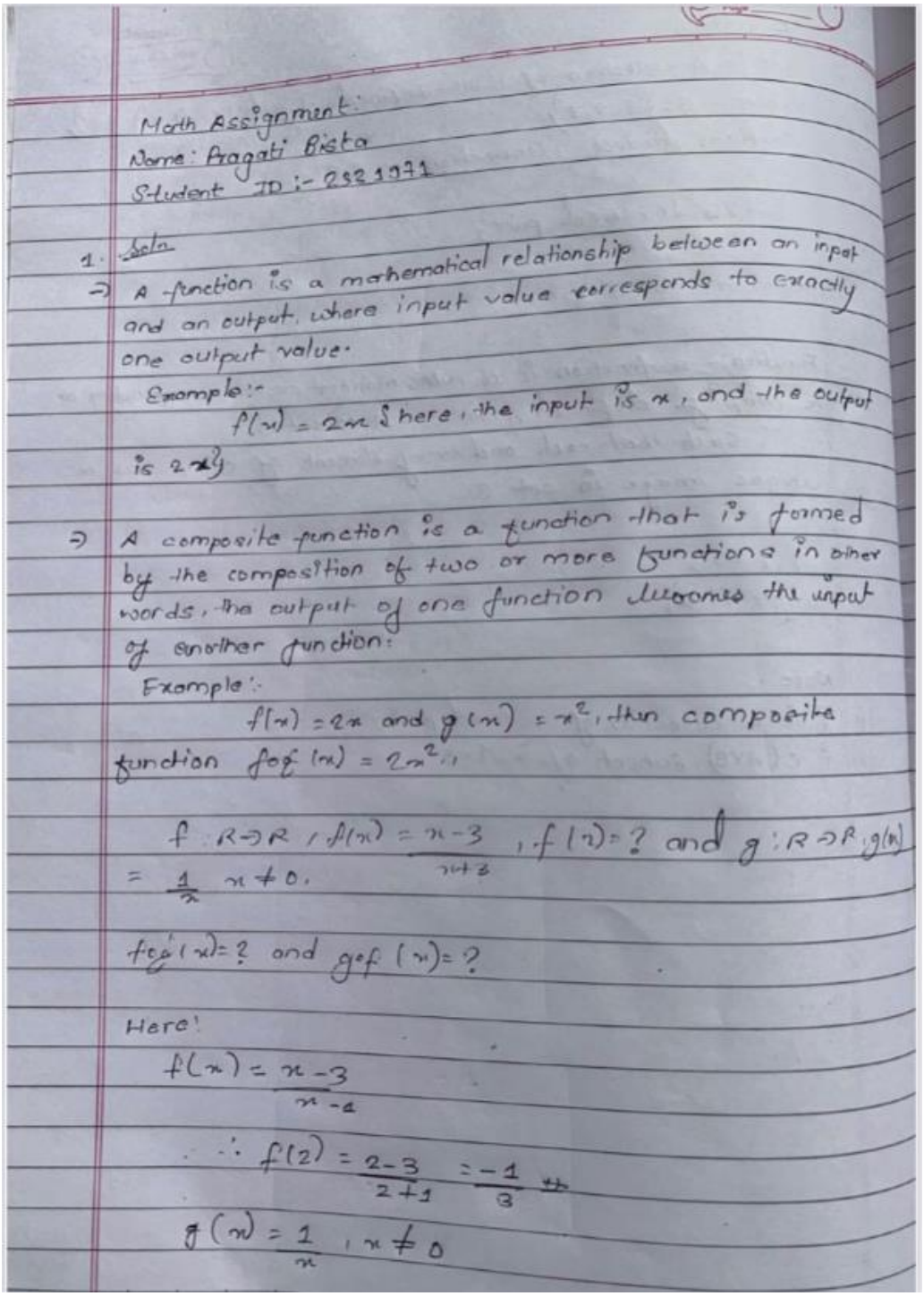
1. State the definition of a function and a composite function. **[2Marks]**

Let f and g be functions defined as follows:

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

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

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



Math Assignment
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1. Sol^n

⇒ A function is a mathematical relationship between an input and an output, where input value corresponds to exactly one output value.

Example:-

$f(x) = 2x$ ; here, the input is $x$, and the output is $2x$

⇒ A composite function is a function that is formed by the composition of two or more functions in other words, the output of one function becomes the input of another function.

Example:-

$f(x) = 2x$ and $g(x) = x^2$, then composite function $fog(x) = 2x^2$.

$f: R \to R$ , $f(x) = \frac{x-3}{x+3}$ , $f(2) = ?$ and $g: R \to R$, $g(x) = \frac{1}{x}$ $x \neq 0$.

$fog(x) = ?$ and $gof(x) = ?$

Here:

$f(x) = \frac{x-3}{x-a}$

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

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

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Now,

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

$$\therefore fog(x) = \frac{1-3x}{1+x}$$

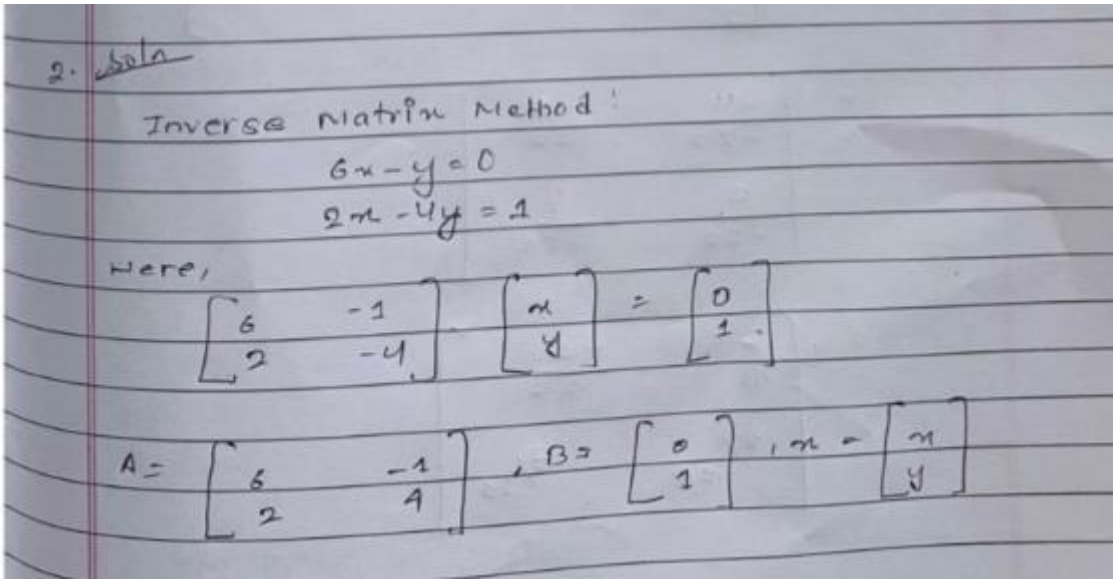
$$\therefore gof(x) = g(f(x))$$
$$= g\left(\frac{x-3}{x+1}\right)$$
$$= 1 \Big/ \left(\frac{x-3}{x+1}\right)$$

$$\therefore gof(a) = \frac{x+1}{x-3} \quad \text{Ans}$$

2. Solve the following using the inverse matrix method: **[ 2 Marks]**

$$6x - y = 0$$

$$2x - 4y = 1$$



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We know,

$AX = B$

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

we have,

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

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

$= [6 \times (-4) - 2 \times (-1)]$

$= -22$

Now

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

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

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

$= \begin{bmatrix} \frac{2}{11} & \frac{-1}{22} \\ \frac{1}{-11} & \frac{3}{11} \end{bmatrix}$

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Here,

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

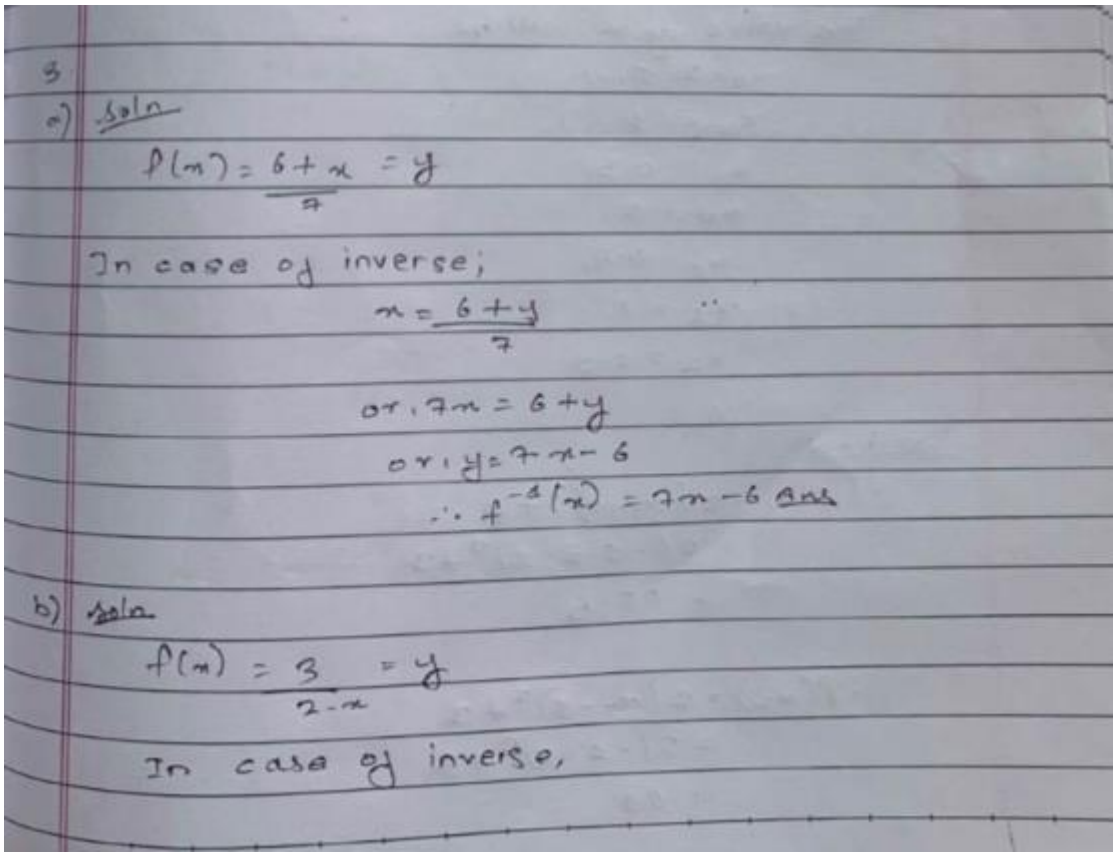
$$= \begin{bmatrix} 2/11 & -1/22 \\ -3/11 & -3/11 \end{bmatrix} \times \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

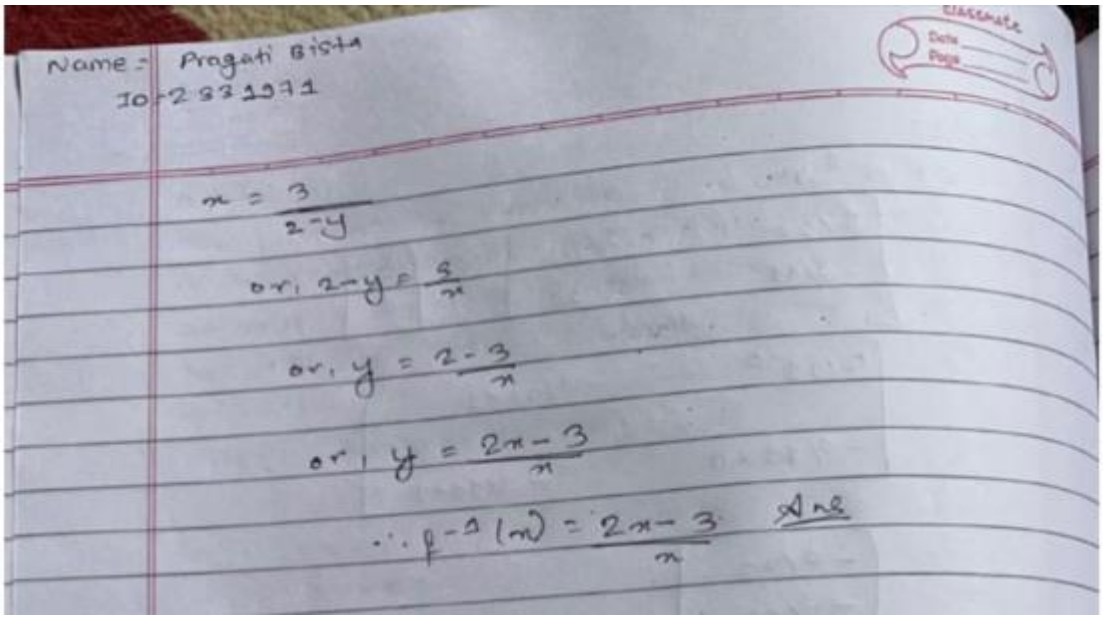
$$= \begin{bmatrix} 2/11 \times 0 & -1/22 \times 1 \\ -3/11 \times 0 & -3/11 \times 1 \end{bmatrix}$$

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

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

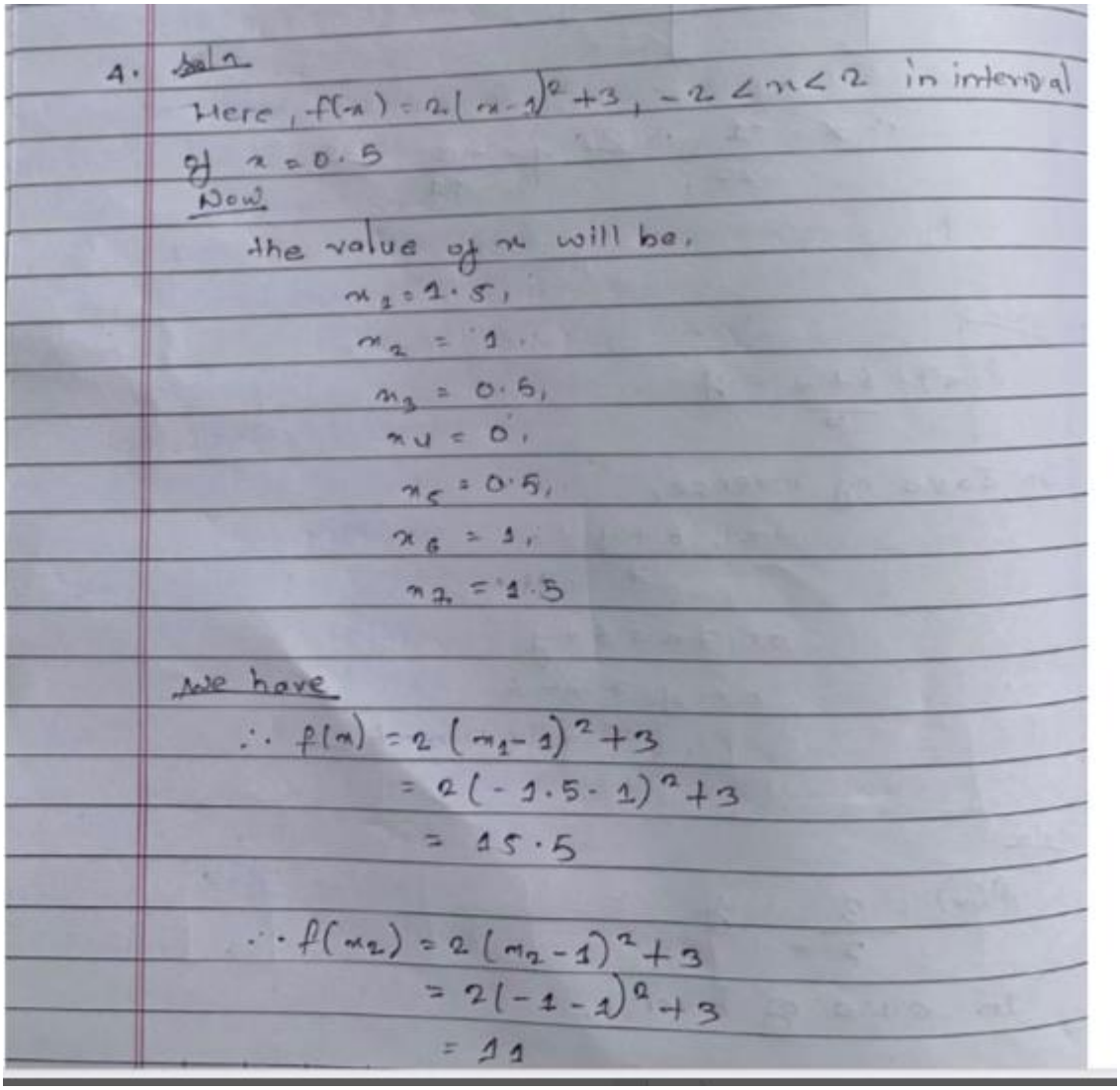
3. Calculate the inverse of the following functions: **[ 2 Marks]**
   a. $f(x) = \frac{6+x}{7}$
   b. $f(x) = \frac{3}{2-x}$



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



4. Sol:

Here, $f(x) = 2(x-1)^2 + 3, \ -2 < x < 2$ in interval of $x = 0.5$

Now,

the value of $x$ will be,

$x_1 = 1.5,$

$x_2 = 1,$

$x_3 = 0.5,$

$x_4 = 0,$

$x_5 = 0.5,$

$x_6 = 1,$

$x_7 = 1.5$

We have

$\therefore f(x) = 2(x_1 - 1)^2 + 3$

$= 2(-1.5 - 1)^2 + 3$

$= 15.5$

$\therefore f(x_2) = 2(x_2 - 1)^2 + 3$

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

$= 11$

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$\therefore f(x_3) = 2(x_3 - 1)^2 + 3$
$= 2(0.5 - 1)^2 + 3$
$= 7.5$

$\therefore f(x_4) = 2(x_4 - 1)^2 + 3$
$= 2(0 - 1)^2 + 3$
$= 5$

$\therefore f(x_5) = 2(x_5 - 1)^2 + 3$
$= 2(0.5 - 1)^2 + 3$
$= 3.5$

$\therefore f(x_6) = 2(x - 1)^2 + 3$
$= 2(1 - 1)^2 + 3$
$= 3$

$\therefore f(x_7) = 2(x_7 - 1)^2 + 3$
$= 2(1.5 - 1)^2 + 3$
$= 3.5$

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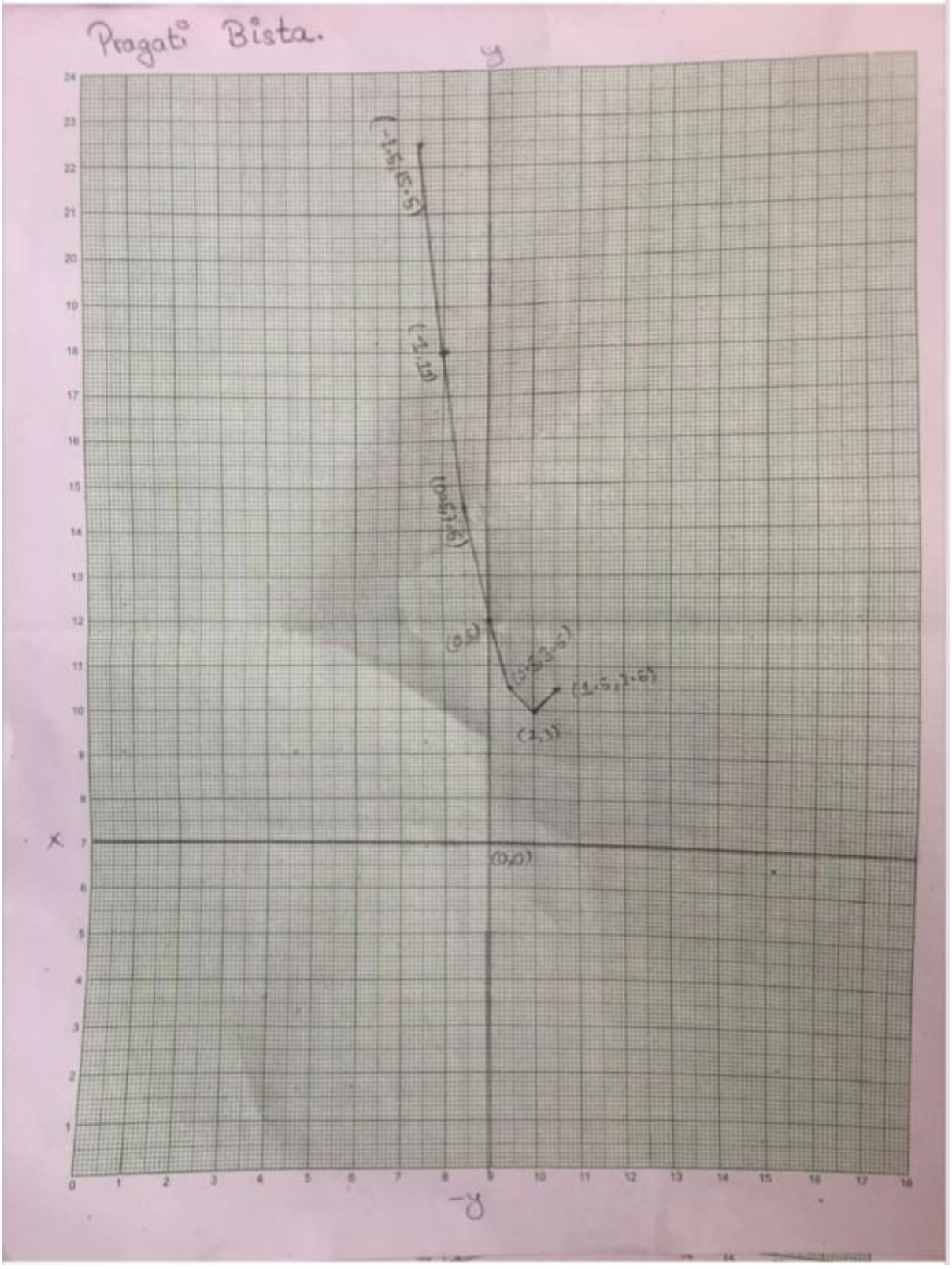


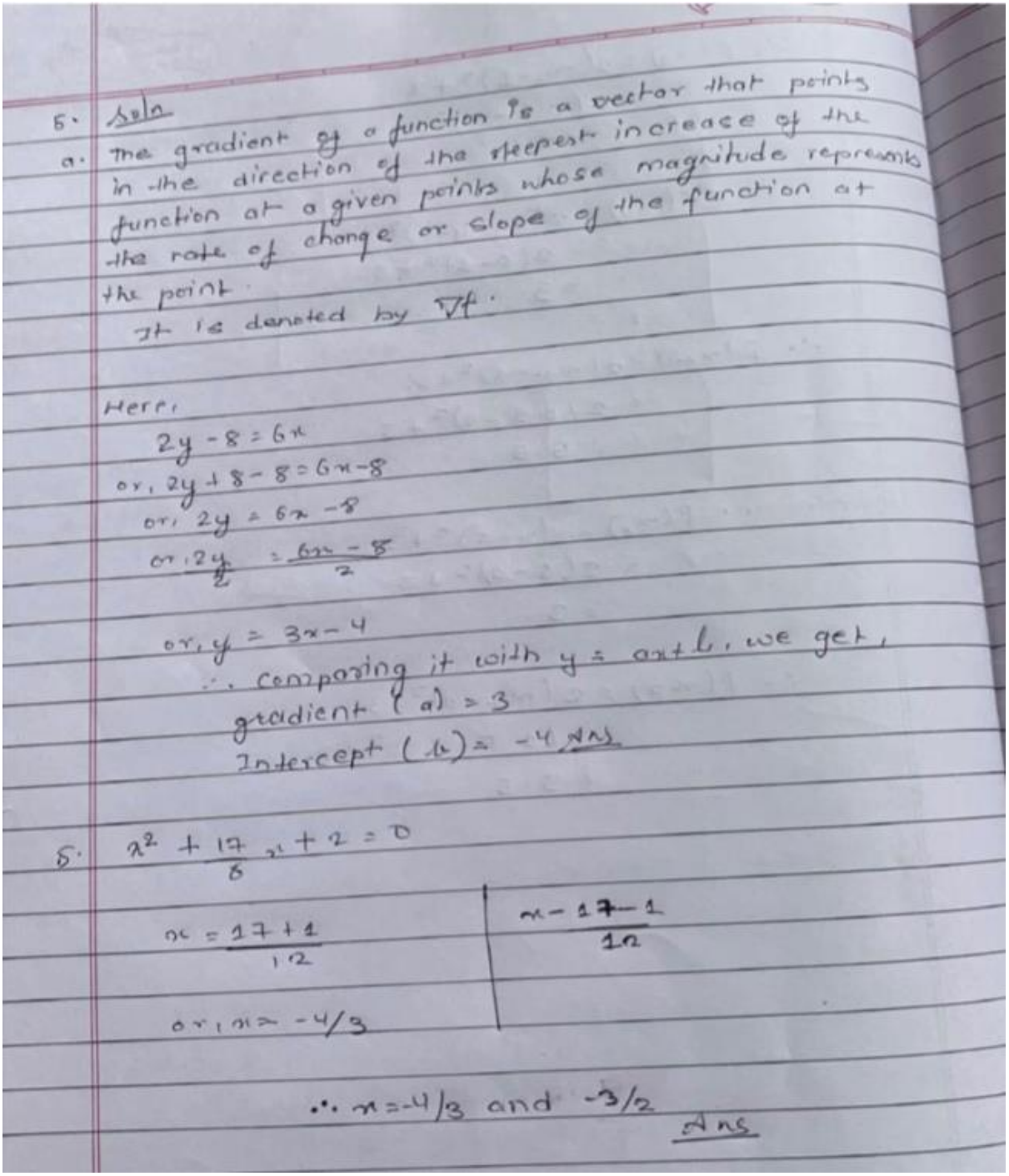
5.

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

$2y + 8 = 6x$ **[2 Marks]**

b. Solve the following equations:

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



5. Sola

a. The gradient of a function is a vector that points in the direction of the steepest increase of the function at a given points whose magnitude represents the rate of change or slope of the function at the point.
It is denoted by $\nabla f$.

Here,

$2y - 8 = 6x$

or, $2y + 8 - 8 = 6x - 8$

or, $2y = 6x - 8$

or, $\frac{2y}{2} = \frac{6x - 8}{2}$

or, $y = 3x - 4$

∴ comparing it with $y = ax + b$, we get,

gradient ($a$) = 3

Intercept ($b$) = $-4$ Ans

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

$x = \frac{17 + 1}{12}$ | $x = \frac{17 - 1}{12}$

or, $x = -4/3$

∴ $x = -4/3$ and $-3/2$

Ans

**The End**