

UNIVERSITY PARTNER



4MM013 - Computational Mathematics

Mathematics Assignment-1

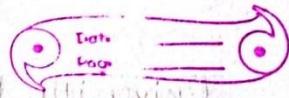
Full Marks: 10

University ID : 2332244

Submitted by : Naomi Thing

Submitted on : 2023/04/13

Computational Mathematics



University ID: 2332244

1) Function is an expression, rule or law which operates on an input, producing a single output from the provided input.

Composite function: A function which is dependent on another function is called composite function.

In other words, the formation of function through the composition of one function into the other is called composite function.

Example:

$$f(n) = x^2, g(n) = (3n)$$

$$fog(n) = f(g(n)) = f(3n) = (3n)^2 = 9n^2$$

$$gof(n) = g(f(n)) = g(n^2) = 3n^2$$

Given,

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

$$g(n) = \frac{1}{x}$$

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

We know,

$$fog(n) = f(g(n))$$

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

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

University Id: 2332244

$$\begin{aligned} \text{Let } n &= \frac{1-3x}{x} \\ &= \frac{1+x}{x} - 4 \\ &= \frac{1-3x}{1+x} \end{aligned}$$

Then, $(g \circ f)(n) = g(f(n))$

For, $f(n) = \frac{1-3x}{1+x}$

and $(g \circ f)(n) = g(f(n))$ of all above sets of

n we get $\frac{1-3x}{1+x} = g\left(\frac{x+3}{x+1}\right)$ for unique value of

x i.e. $x = -1$ which is unique value

$$= \frac{1}{(x-3/x+1)} : \text{L.H.S.} = (x-3/x+1)$$

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

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

$$= \frac{x+1}{x-3} : \text{R.H.S.} = (x-3/x+1)^2$$

$$2) 6x-y=0 \quad \text{giving } x \text{ & } y \text{ in terms of } n$$

$$2x-4y=1$$

Solving,

In form of eqns,

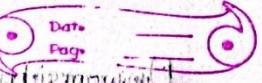
$$6x-y=0 \quad \text{--- (1)}$$

$$2x-4y=1 \quad \text{--- (2)}$$

Writing both eqns in form of matrix,

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

University ID: 233924488034112



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

then for $x = A^{-1}B$,

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

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

Then,

$$A^{-1} = \frac{\text{Ad. of } A}{|A|}$$

$$= \begin{bmatrix} -4 & 1 \\ -2 & 6 \end{bmatrix} \times \frac{1}{-22} = \begin{bmatrix} 4/22 & 1/-22 \\ 2/22 & 6/-22 \end{bmatrix}$$
$$= \begin{bmatrix} 2/11 & 1/-22 \\ 1/11 & -3/11 \end{bmatrix}$$

Now,

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

$$\text{or, } \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2/11 & 1/-22 \\ 1/11 & -3/11 \end{bmatrix} \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$\text{or, } \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2/11 \times 0 + 1/-22 \times 1 \\ 1/11 \times 0 + -3/11 \times 1 \end{bmatrix}$$

$$\text{or, } \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 + 1/-22 \\ 0 + -3/11 \end{bmatrix}$$

University ID: 23322441 (10 minutes)

or, $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1/22 \\ -3/11 \end{bmatrix}$

Then, equating the corresponding sides we get,

$$\therefore x = -1/22$$

$$\therefore y = -3/11$$

3>

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

Here,

$$\text{let, } f(n) = y = \frac{6+n}{7}$$

$$\therefore y = \frac{6+n}{7}$$

Then,

Interchanging x & y we get,

$$n = \frac{6+y}{7}$$

Now,

Solving for n and y ,

$$x = \frac{6+y}{7}$$

or, $7x = 6+y + 0$

or, $7x-6 = y + 0$

University ID: 233224432101

$$\therefore f^{-1}(n) = 7n - 6y + (1+16)^{\frac{1}{2}}(10)^{\frac{1}{2}} \quad (P)$$

b) $f(n) = 3$

Here,

$$\text{let, } f(n) = y = \frac{3}{2-n}$$

$$\therefore y = \frac{3}{2-n}$$

Interchanging x & y we get,

$$n = \frac{3}{2-y}$$

Solving for x and y ,

$$x = \frac{3}{2-y}$$

$$\boxed{\text{or, } 2n - ny = 3}$$

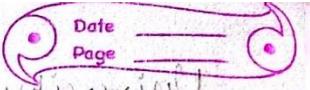
$$\text{or, } 2-y = \frac{3}{x}$$

$$\text{or, } 2 - \frac{3}{n} = y$$

$$\text{or, } \frac{2n-3}{n} = y$$

$$\therefore f^{-1}(n) = \frac{2n-3}{n}$$

University ID: 2332244



9) $f(n) = 2(n+1)^2 + 3$

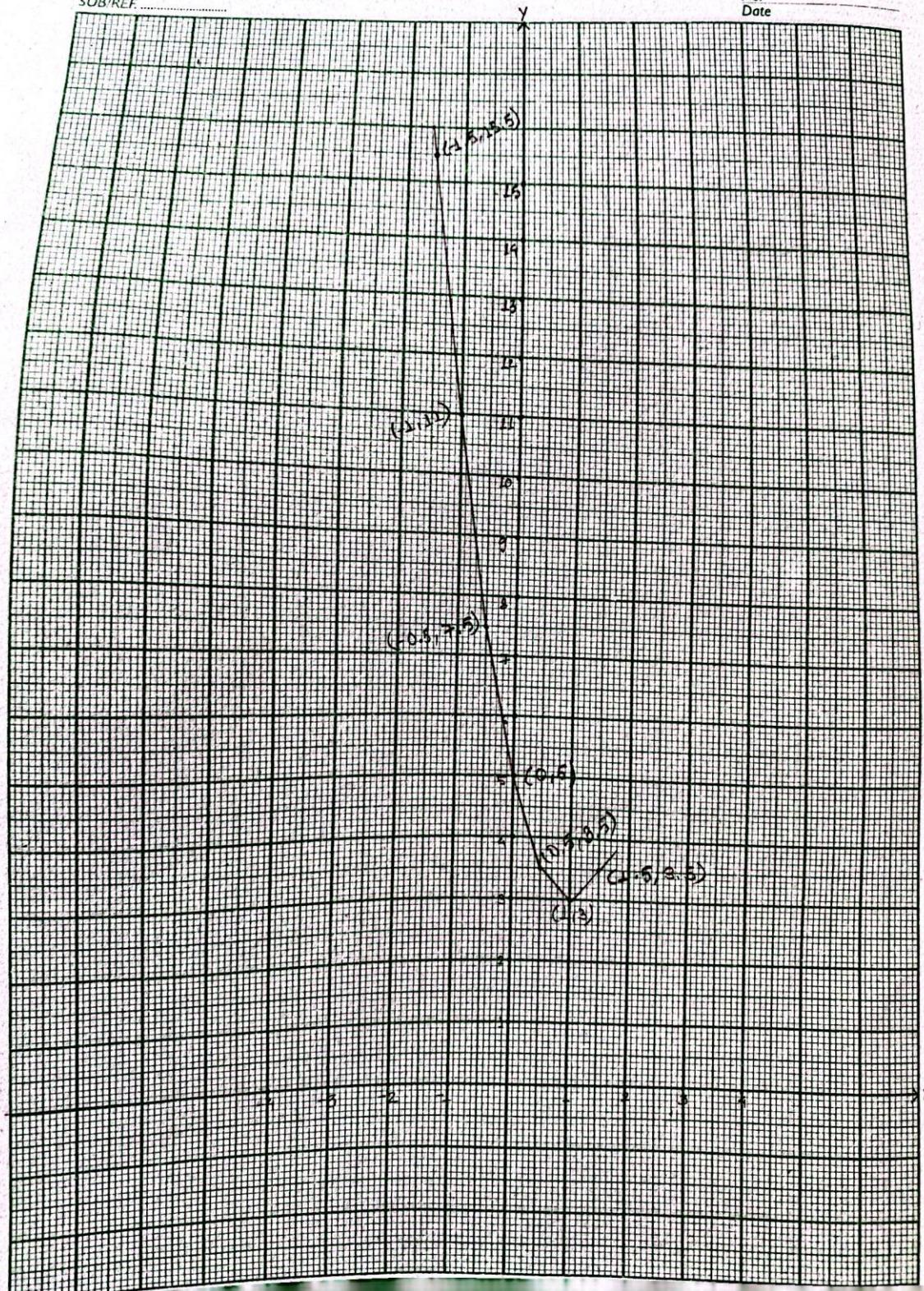
Here,

n	-1.5	-1	-0.5	0	0.5	1	1.5
y	15.5	11	7.5	5	3.5	3	3.5

4)

University Id : 2332244

SUB/REF.....

No.
Date

5). a) Gradient, also known as slope of a function is the measurement of how quickly a function changes with its input. Equation: $y = mx + c$ where, m is gradient/slope, c is y -intercept.

$$2y + 8 = 6n$$

Here,

Changing the eq into $y = mx + c$ form

$$2y = 6n - 8$$

$$\frac{2y}{2} = \frac{6n^2 - 8}{2}$$

$$y = 3n - 4$$

Comparing with $y = mx + c$ we get,
gradient slope (m) = 3

$$y\text{-intercept } (c) = -4$$

b) $n^2 + \frac{17}{6}n + 2 = 0$

Here,

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

$$\text{or, } 6n^2 + 17n + 12 = 0$$

$$\text{or, } 6n^2 + 17n + 12 = 0 \quad \text{--- ①}$$

Comparing eq ① with $an^2 + bn + c = 0$ we get,

University ID: 2332244 Q: 19 (12 marks)

$a = 6$, $b = 17$ and $c = 12$ with units (m)

Now, we will find the time taken

We know, initial velocity = 0 m/s

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

When +ve,

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

$$= \frac{-17 + \sqrt{17^2 - 4 \cdot 6 \cdot 12}}{2 \cdot 6}$$

$$= \frac{-17 + \sqrt{289 - 288}}{12}$$

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

$$= \frac{-16}{12}$$

$$= -\frac{4}{3}$$

When -ve,

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

$$= \frac{-17 - \sqrt{17^2 - 4 \cdot 6 \cdot 12}}{2 \cdot 6}$$

$$= \frac{-17 - \sqrt{289 - 288}}{12}$$

$$= -\frac{17}{12}$$

University ID: 2332244

$$= \frac{-17 - \sqrt{1}}{12}$$

$$= \frac{-17 - 1}{12}$$

$$= \frac{-18}{12}$$

$$= \frac{-3}{2}$$

$$\therefore x = \frac{-4}{3}, \frac{-3}{2}$$

//

The End