

PROBLEM 1

$$(1) y = |x^2 - 1|$$

Putting $x = 1$

$$y = (1-1) = 0$$

Putting $x = 2$

$$y = (2^2 - 1) = 120 - 1 = 119$$

We are getting unique value of y for every value of x . So, eqⁿ defines y as a function of x .

$$(2) x = |y - 13|$$

$$x = (y - 13)$$

$$y = x + 13$$

x	1	2
y	14	15

We are getting a unique value of y for every value of x . Hence, eqⁿ defines y as a function of x .

March 2017							April 2017						
30	31	1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31									

May 2017							June 2017						
31	1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28	29	30	31										

$$(3) x^3 + 5y^5 = 13$$

$$5y^5 = 13 - x^3$$

$$y^5 = \frac{13 - x^3}{5}$$

$$y = \left(\frac{13 - x^3}{5} \right)^{1/5}$$

x	0	1
y	$(13/5)^{1/5}$	$(12/5)^{1/5}$

We are getting a unique value of y for every value of x . Hence, eqⁿ defines y as a function of x .

$$(4) x = 20 - y^2$$

$$y^2 = 20 - x$$

$$y = \sqrt{20 - x}$$

x	4	11
y	± 4	± 3

We are not getting a unique value of y for every value of x . Hence, eqⁿ doesn't define y as a function of x .

Problem 2

$$(1) f(x) = 5x - 3 \quad = 15 - 3 = 12$$

$$f(3) = 5 \cdot 3 - 3 = 15 - 3 = 12$$

$$f(x+2) = 5(x+2) - 3 = 5x + 10 - 3 = 5x + 7$$

$$\frac{f(x+h) - f(x)}{h}$$

$$\text{So, } f(x+h) = 5(x+h) - 3$$

$$\Rightarrow \frac{f(x+h) - f(x)}{h} = \frac{[5(x+h) - 3] - [5x - 3]}{h}$$

$$= \frac{5x + 5h - 3 - 5x + 3}{h}$$

$$\frac{f(x+h) - f(x)}{h} = \frac{5h}{h} = 5$$

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April 2017						
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29	30					

May 2017						
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June 2017						
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29	30					

$$(2) f(x) = x^2 - 4x + 1$$

$$f(3) = (3)^2 - 4(3) + 1 = 9 - 12 + 1 = -2$$

$$\begin{aligned} f(x+2) &= (x+2)^2 - 4(x+2) + 1 \\ &= x^2 + 4 + 4x - 4x - 8 + 1 \\ &= x^2 - 4 + 1 = x^2 - 3 \end{aligned}$$

$$\frac{f(x+h) - f(x)}{h}$$

$$\Rightarrow \frac{f(x+h) - f(x)}{h} = \frac{[(x+h)^2 - 4(x+h) + 1] - [x^2 - 4x + 1]}{h}$$

$$\Rightarrow \frac{[x^2 + h^2 + 2xh - 4x - 4h + 1 - x^2 + 4x - 1]}{h}$$

$$\Rightarrow \frac{h^2 + 2xh - 4h - 1}{h}$$

Answer.

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Problem 3

$$(1) f(x) = 2x^3 + 7x$$

$$f(-x) = 2(-x)^3 + 7(-x)$$

$$= -2x^3 - 7x$$

$$f(x) \neq f(-x)$$

So, function is odd.

$$(2) f(x) = 6x^3 - 3x^4 + x^2 - 2$$

$$f(-x) = 6(-x)^3 - 3(-x)^4 + (-x)^2 - 2$$

$$= -6x^3 - 3x^4 + x^2 - 2$$

$$f(x) \neq f(-x)$$

Hence, function is ~~odd~~
neither even nor odd

because change in sign is in
random form.

$$(3) f(x) = \frac{6x^5}{3x^3 + 7x}$$

$$f(-x) = \frac{6(-x)^5}{3(-x)^3 + 7(-x)}$$

$$= \frac{-6x^5}{-3x^3 - 7x} = \frac{-1}{-1} \left[\frac{6x^5}{3x^3 + 7x} \right]$$

$$f(x) = f(-x)$$

But $f(x) \neq f(x)$

So the function is ~~odd~~ Even

$$(4) f(x) = \frac{4x^3}{x^2 + 1}$$

$$f(-x) = \frac{4(-x)^3}{(-x)^2 + 1} = \frac{-4x^3}{x^2 + 1}$$

$$f(x) = -f(-x)$$

So, function is odd.

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PROBLEM 4

$$(1) f(x) = 5x - 2 \quad \text{if } x \leq -2$$

$$f(-2) = 5(-2) - 2 \\ = -10 - 2 = -12$$

$$(2) f(x) = x^2 \quad \text{if } -2 < x \leq 3$$

$$f(3) = (3)^2 = 9$$

$$(3) f(x) = |x - 1| \quad \text{if } x > 3$$

$$f(4) = |4 - 1| = 3$$

PROBLEM 5

(1) The function $f(x)$ is increasing

in $(-\infty, -1) \cup (0, 1)$

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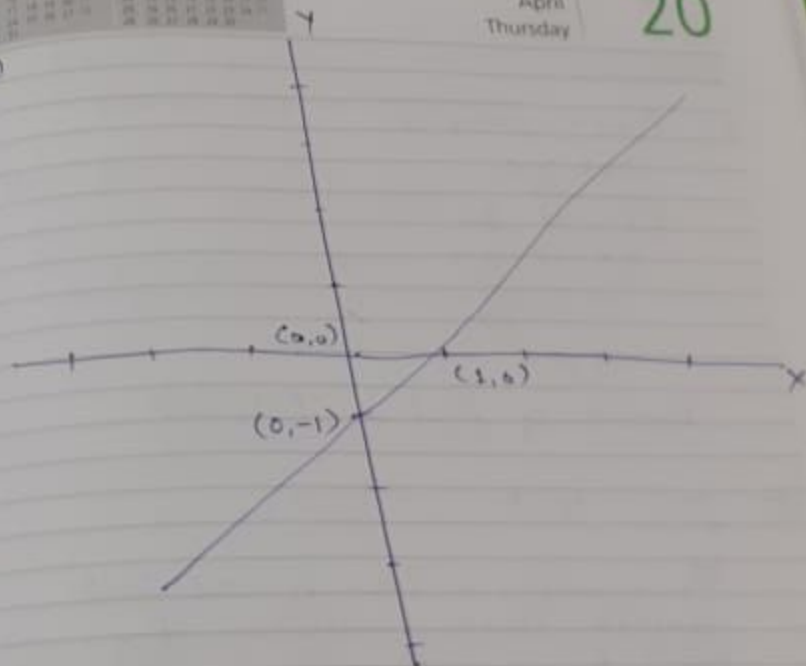
the function decreasing in

$(-1, 0) \cup (1, \infty)$

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(2)



Problem 6

$$(1) f(x) = \sqrt{2x-18}$$

$$f(x) \geq 0$$

$$\sqrt{2x-18} \geq 0$$

$$2x-18 \geq 0$$

$$x \geq 18/2$$

$$x \geq 9$$

Domain of $f(x)$ is $[9, \infty)$

$$(2) f(x) = 7x^4 - 2x^3 - 4x^2 + x - 10$$

The equation is valid for all real numbers. Hence domain of $f(x)$ is $(-\infty, \infty)$

$$(3) f(x) = \frac{x-2}{x^2-4x-21}$$

We can't have zero in denominator.

$$x^2 - 4x - 21 = 0$$

$$x^2 - 7x + 3x - 21 = 0$$

$$x(x-7) + 3(x-7) = 0$$

$$(x-7)(x+3) = 0$$

$$x = 7, -3$$

Domain of $f(x)$ is all real numbers except for $x = 7, -3$

$$(4) f(x) = \frac{1}{\sqrt{x^2+5x+24}}$$

$$x^2 + 5x + 24 > 0$$

$$x^2 + 8x - 3x - 24 > 0$$

$$x(x+8) - 3(x+8) > 0$$

$$(x+8)(x-3) > 0$$

$$x > 3 \quad x < -8$$

$$x > 3$$

$$x < -8$$

Domain of $f(x)$ is all real numbers except for $x > 3$ & $x < -8$

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PROBLEM 4

$$(1) f(x) = 5x - 3 \quad ; \quad g(x) = 4x - 7$$

$$f+g = 5x-3+4x-7 = 9x-10$$

$$f-g = 5x-3-4x+7 = x+4$$

$$\begin{aligned} f \cdot g &= (5x-3)(4x-7) \\ &= 20x^2 + 35x - 12x + 21 \\ &= 20x^2 + 23x + 21 \end{aligned}$$

$$\frac{f}{g} = \frac{(5x-3)}{(4x-7)}$$

$$(2) f(x) = (x-5) \quad ; \quad g(x) = x^2 - 9x + 20$$

$$\begin{aligned} f+g &= x-5+x^2-9x+20 \\ &= x^2-8x+15 \end{aligned}$$

$$\begin{aligned} f-g &= x-5-x^2+9x-20 \\ &= -x^2+10x-25 \end{aligned}$$

$$\begin{aligned} f \cdot g &= (x-5)(x^2-9x+20) \\ &= x^3-9x^2+20x-5x^2+45x-100 \\ &= x^3-14x^2+65x-100 \end{aligned}$$

$$\frac{f}{g} = \frac{(x-5)}{(x^2-9x+20)} = \frac{(x-5)}{(x-5)(x-4)} = \frac{1}{(x-4)}$$

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$$(a) f(n) = \frac{1}{(4n+1)} \quad ; \quad g(n) = \frac{1}{(3n-2)}$$

$$\begin{aligned} f+g &= \frac{1}{(4n+1)} + \frac{1}{(3n-2)} = \frac{3n-2+4n+1}{(4n+1)(3n-2)} \\ &= \frac{(6n-1)}{(4n+1)(3n-2)} \end{aligned}$$

$$\begin{aligned} f-g &= \frac{1}{(4n+1)} - \frac{1}{(3n-2)} = \frac{3n-2-4n-1}{(4n+1)(3n-2)} \\ &= \frac{-(n+3)}{(4n+1)(3n-2)} \end{aligned}$$

$$\frac{f}{g} = \frac{1}{(4n+1)} \times (3n-2) = \frac{(3n-2)}{(4n+1)}$$

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PROBLEM 8

$$(1) f(x) = x^2 + 2x - 10$$

$$g(x) = 3x - 1$$

$$\begin{aligned} f \circ g &= (3x-1)^2 + 2(3x-1) - 10 \\ &= 9x^2 + 1 - 6x + 6x - 2 - 10 \\ &= 9x^2 - 11 \end{aligned}$$

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

$$g(x) = \frac{2x-1}{x-2}$$

$$f \circ g = \frac{\left[\left(\frac{2x-1}{x-2} \right) - 3 \right]}{\left[\left(\frac{2x-1}{x-2} \right) + 2 \right]}$$

$$= \frac{(2x-1-3x+6)}{(x-2)}$$

$$= \frac{(2x-1+2x-4)}{(x-2)}$$

$$= \frac{-x+5}{4x-5}$$

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PROBLEM 9

$$(1) f(x) = 7x - 10$$

$$\text{Let } f(x) = y$$

$$y = 7x - 10$$

$$x = \frac{y+10}{7}$$

$$f^{-1}(y) = \frac{y+10}{7}$$

$$\text{So, } f^{-1}(x) = \frac{x+10}{7}$$

$$(2) f(x) = \frac{8x-2}{3x+7}$$

$$\text{Let } f(x) = y$$

$$y = \frac{(8x-2)}{(3x+7)}$$

$$3xy + 7y = 8x - 2$$

$$3xy - 8x = -7y - 2$$

$$x(3y-8) = -(7y+2)$$

$$x = \frac{-(7y+2)}{(3y-8)}$$

$$f^{-1}(y) = \frac{-(7y+2)}{(3y-8)} \quad \left| \quad f^{-1}(x) = \frac{-(7x+2)}{(3x-8)} \right.$$

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1	2	3	4	5	6	7
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PROBLEM 10

(1) $(f^{-1} \circ g \circ f)(3)$

$f(3) = 4$

$g(4) = 2$

$f^{-1}(2) = ?$

$f^{-1}(2) = g(2)$ [∵ They are
compositional
inverse]

So $f^{-1}(2) = 4$

(2) $(g \circ g^{-1} \circ f^{-1})(4)$

$f^{-1}(4) = g(4) = 2$ { Compositional

$g^{-1}(2) = f(2) = 1$ { Inverse

$g(1) = 3$

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PROBLEM 11

 $f(n) + g(n)$ both are odd

$f(-n) = -f(n)$

$g(-n) = -g(n)$

$h(n) = f(n) \cdot g(n)$

$h(-n) = f(-n) \cdot g(-n)$

$= [-f(n)] \cdot [-g(n)]$

$= h(n)$

So h is even.

PROBLEM 12

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PROBLEM 12

$f(x)$ & $g(x)$ both are odd.

$$f(-x) = -f(x)$$

$$g(-x) = -g(x)$$

$$h(x) = \frac{f(x) + g(x)}{f(x) \cdot g(x)}$$

$$h(x) = \frac{f(-x) + g(-x)}{f(-x) \cdot g(-x)}$$

$$= \frac{[-f(x)] + [-g(x)]}{[-f(x)] \cdot [-g(x)]}$$

$$= \frac{-f(x) - g(x)}{f(x) \cdot g(x)}$$

$$= - \left[\frac{f(x) + g(x)}{f(x) \cdot g(x)} \right]$$

$$= -h(x)$$

So

So, $h(x)$ is an odd function.

PROBLEM 13

$$(1) f(x) =$$

For even function $f(x) = f(-x)$

$$\text{So, } f(3) = f(-3)$$

$$f(x) = x^2 + 1 \quad \text{if } 0 \leq x < 3$$

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

$$= 10$$

$$\therefore f(3) = f(-3)$$

$$\text{So, } f(-3) = 10$$

$$(2) \text{ For odd function } f(x) = -f(-x)$$

$$\text{So, } f(-7) = -f(7)$$

$$f(x) = 3x + 1 \quad \text{if } x > 5$$

$$f(-7) = -[3(-7) + 1]$$

$$= -[-21 + 1]$$

$$= -[-20]$$

$$= 20$$

$$\text{So, } f(-7) = 20$$

Sunday 07