North South University

Department of Mathematics and Physics

Assignment - 1

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Course No. : MAT-120

Course Title : Calculus and Analytical Geometry I

Section : 13

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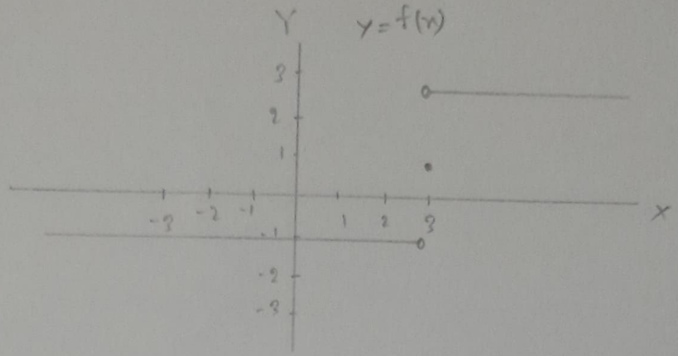
1.1

3)



a)

$$\lim_{x \to 3^-} f(x) = -1$$

b)

$$\lim_{x \to 3^+} f(x) = 3$$

c)

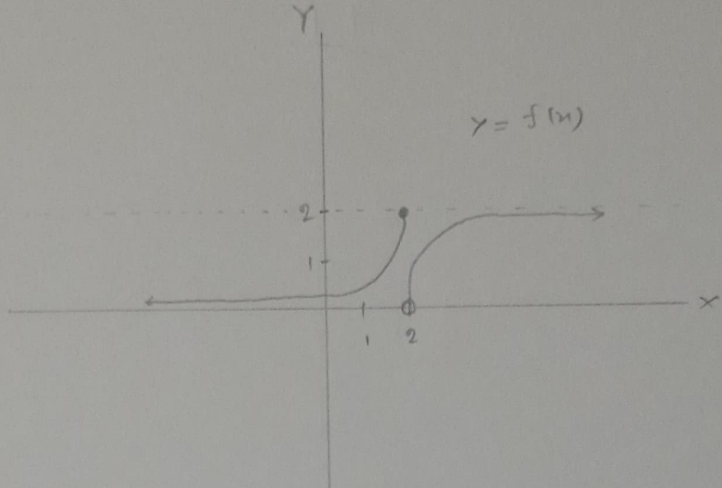
$$\lim_{x \to 3^-} f(x) \neq \lim_{x \to 3^+} f(x)$$

$\therefore \lim_{x \to 3} f(x)$ does not exist

d)

$f(3) = 1$

4)



a)

$$\lim_{x\to 2^-} f(x) = 2$$

b)

$$\lim_{x\to 2^+} f(x) = 0$$

c)

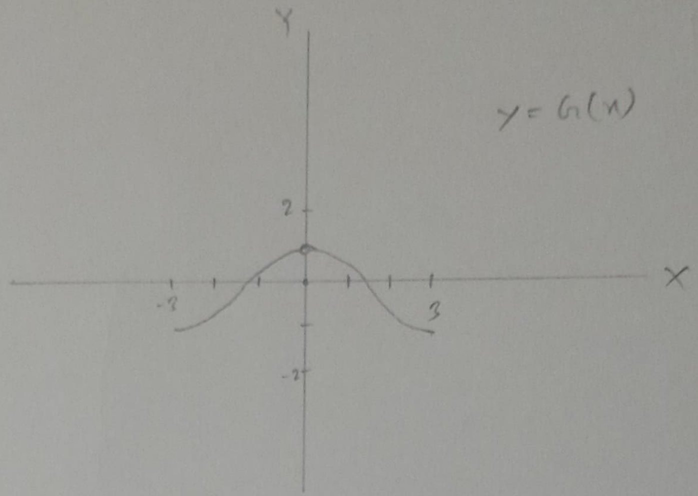
$$\lim_{x\to 2^-} f(x) \neq \lim_{x\to 2^+} f(x)$$

$\therefore \lim_{x\to 2} f(x)$ does not exist.

d)

$$f(2) = 2$$

6]



a)

$$\lim_{x \to 0^-} G(x) = 1$$

b)

$$\lim_{x \to 0^+} G(x) = 1$$

c)

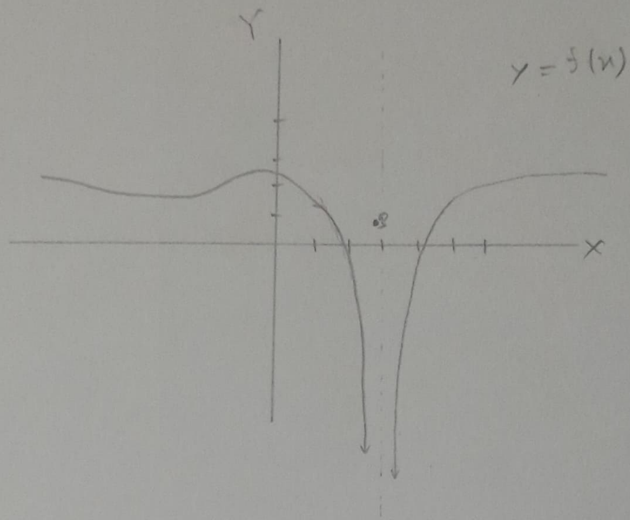
$$\lim_{x \to 0^-} G(x) = \lim_{x \to 0^+} G(x)$$

$$\therefore \lim_{x \to 0} G(x) = 1$$

d)

$$G(0) = 0$$

7]



a)

$$\lim_{x \to 3^-} f(x) = -\infty$$

b)

$$\lim_{x \to 3^+} f(x) = -\infty$$

c)

$$\lim_{x \to 3^-} f(x) = \lim_{x \to 3^+} f(x)$$

$$\therefore \lim_{x \to 3} f(x) = -\infty$$

d)

$f(3) = 1$

1·2

3|

Given that,

$$\lim_{x\to 2} x(x-1)(x+1)$$

$$= \lim_{x\to 2} x \cdot \lim_{x\to 2} (x-1) \cdot \lim_{x\to 2} (x+1)$$

$$= 2\cdot(2-1)\cdot(2+1)$$

$$= 2\cdot 1\cdot 3$$

$$= 6$$

Therefore, $\lim_{x\to 2} x(x-1)(x+1) = 6$.

4|

Given that,

$$\lim_{x\to 3} x^3 - 3x^2 + 9x$$

$$= (3)^3 - 3\cdot(3)^2 + 9\cdot 3$$

$$= 27 - 27 + 27$$

$$= 27$$

Therefore, $\lim_{x\to 3} x^3 - 3x^2 + 9x = 27$.

5|

Given that,

$$\lim_{x \to 3} \frac{x^2-2x}{x+1}$$

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

$$= \frac{3^2-2\cdot 3}{3+1}$$

$$= \frac{9-6}{4}$$

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

Therefore,

$$\lim_{x \to 3} \frac{x^2-2x}{x+1} = \frac{3}{4}.$$

6|

Given that,

$$\lim_{x \to 0} \frac{6x-9}{x^3-12x+3}$$

$$= \frac{\lim_{x \to 0} (6x-9)}{\lim_{x \to 0} (x^3-12x+3)}$$

$$= \frac{6\cdot 0-9}{0^3-12\cdot 0+3}$$

$$= \frac{-9}{3}$$

$$= -3$$

Therefore,

$$\lim_{x \to 0} \frac{6x-9}{x^3-12x+3} = -3$$

7]

Given that,

$$\lim_{x \to 1^+} \frac{x^4-1}{x-1}$$

$$= \lim_{x \to 1^+} \frac{(x^2+1)(x^2-1)}{(x-1)}$$

$$= \lim_{x \to 1^+} \frac{(x^2+1)(x+1)(x-1)}{(x-1)}$$

$$= \lim_{x \to 1^+} (x^2+1)(x+1)$$

$$= \lim_{x \to 1^+} (x^2+1) \cdot \lim_{x \to 1^+} (x+1)$$

$$= 2 \cdot 2$$

$$= 4$$

Therefore,

$$\lim_{x \to 1^+} \frac{x^4-1}{x-1} = 4.$$

8)

Given that,

$$\lim_{t \to -2} \frac{t^3+8}{t+2}$$

$$= \lim_{t \to -2} \frac{t^3+2^3}{t+2}$$

$$= \lim_{t \to -2} \frac{(t+2)(t^2-2t+4)}{t+2}$$

$$= \lim_{t \to -2} (t^2-2t+4)$$

$$= (-2)^2 - 2\cdot(-2) + 4$$

$$= 4+4+4$$

$$= 12$$

Therefore,

$$\lim_{t \to -2} \frac{t^3+8}{t+2} = 12$$

9)

$$\lim_{x \to -1} \frac{x^2+6x+5}{x^2-3x-4}$$

$$= \lim_{x \to -1} \frac{(x+5)(x+1)}{(x+1)(x-4)}$$

$$= \lim_{x \to -1} \frac{x+5}{x-4}$$

$$= \frac{\lim_{x \to -1} (x+5)}{\lim_{x \to -1} (x-4)}$$

$$= \frac{-1+5}{-1-4}$$

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

Therefore,

$$\lim_{x \to -1} \frac{x^2+6x+5}{x^2-3x-4} = -\frac{4}{5}$$

10)

Given that,

$$\lim_{x \to 2} \frac{x^2-4x+4}{x^2+x-6}$$

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

$$= \lim_{x \to 2} \frac{x+2}{x+3}$$

$$= \frac{\lim_{x \to 2} (x+2)}{\lim_{x \to 2} (x+3)}$$

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

$$= \frac{0}{5}$$

$$= 0$$

Therefore,

$$\lim_{x\to 2} \frac{x^2-4x+4}{x^2+x-6} = 0$$

11)

Given that,

$$\lim_{x\to -1} \frac{2x^2+x-1}{x+1}$$

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

$$= \lim_{x\to -1} (2x-1)$$

$$= 2\cdot(-1)-1$$

$$= -2-1$$

$$= -3$$

Therefore,

$$\lim_{x\to -1} \frac{2x^2+x-1}{x+1} = -3$$

12)

Given that,

$$\lim_{x\to 1} \frac{3x^2-x-2}{2x^2+x-3}$$

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

$$= \lim_{x \to 1} \frac{3x+2}{2x+3}$$

$$= \frac{\lim_{x \to 1} (3x+2)}{\lim_{x \to 1} (2x+3)}$$

$$= \frac{3 \cdot 1+2}{2 \cdot 1+3}$$

$$= \frac{5}{5}$$

$$= 1$$

Therefore,

$$\lim_{x \to 1} \frac{3x^2-x-2}{2x^2+x-3} = 1.$$

13)

Given that,

$$\lim_{t \to 2} \frac{t^3+3t^2-12t+4}{t^3-4t}$$

$$= \lim_{t \to 2} \frac{(t-2)(t^2+5t-2)}{t(t^2-4)}$$

$$= \lim_{t-2} \frac{(t-2)(t^2+5t-2)}{t(t+2)(t-2)}$$

$$= \lim_{t-2} \frac{t^2+5t-2}{t^2+2t}$$

$$= \frac{\lim_{x\to 2}(x^2+5x-2)}{\lim_{x\to 2}(x^2+2x)}$$

$$= \frac{2^2+5\cdot 2-2}{2^2+2\cdot 2}$$

$$= \frac{12}{8}$$

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

Therefore,

$$\lim_{x\to 2}\frac{x^3+3x^2-12x+4}{x^3-4x} = \frac{3}{2}$$

14)

Given that,

$$\lim_{x\to 1}\frac{x^3+x^2-5x+3}{x^3-3x+2}$$

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

$$= \lim_{x\to 1}\frac{x+3}{x+2}$$

$$= \frac{\lim_{x\to 1}(x+3)}{\lim_{x\to 1}(x+2)}$$

$$= \frac{1+3}{1+2}$$

$= \frac{4}{3}$

Therefore,

$$\lim_{t \to 1} \frac{t^3+t^2-5t+3}{t^2-3t+2} = \frac{4}{3}.$$

15)

Given that,

$$\lim_{x \to 3^+} \frac{x}{x-3}$$

Since the numerator is positive and the denominator $(x-3)$ approaches zero and is greater than zero for x near 3 to the right, the function increases without bound.

Therefore,

$$\lim_{x \to 3^+} \frac{x}{x-3} = +\infty$$

16/

Given that,

$$\lim_{x\to 3^-} \frac{x}{x-3}$$

Since the numerator is positive and the denominator $(x-3)$ approaches zero and is less than zero for x near 3 to the left, the function decreases without bound.

Therefore,

$$\lim_{x\to 3^-} \frac{x}{x-3} = -\infty$$

17/

Given that,

$$\lim_{x\to 3} \frac{x}{x-3}$$

L.H.L :

$$\lim_{x\to 3^-} \frac{x}{x-3} = -\infty$$

R.H.L. :

$$\lim_{x\to 3^+} \frac{x}{x-3} = +\infty$$

L.H.L $\neq$ R.H.L.

Hence, $\lim_{x\to 3} \frac{x}{x-3}$ does not exist.

18|

Given that,

$$\lim_{x \to 2^+} \frac{x}{x^2-4}$$

Since, the numerator is positive and the denominator (x^2-4) approaches zero and is greater than zero for x near 2 to the right, the function increases without bound.

Therefore,

$$\lim_{x \to 2^+} \frac{x}{x^2-4} = +\infty$$

19|

Given that,

$$\lim_{x \to 2^-} \frac{x}{x^2-4}$$

Since the numerator is positive and the denominator (x^2-4) approaches zero and is less than zero for x near 2 to the left, the function decreases without bound.

Therefore,

$$\lim_{x \to 2^-} \frac{x}{x^2-4} = -\infty$$

20)

$$\lim_{x\to 2} \frac{x}{x^2-4}$$

L.H.L:

$$\lim_{x\to 2^-} \frac{x}{x^2-4} = -\infty$$

R.H.L.:

$$\lim_{x\to 2^+} \frac{x}{x^2-4} = +\infty$$

$\therefore$ L.H.L $\neq$ R.H.L.

Therefore,

$$\lim_{x\to 2} \frac{x}{x^2-4} \text{ does not exist.}$$

21)

Given that,

$$\lim_{y\to 6^+} \frac{y+6}{y^2-36}$$

$$= \lim_{y\to 6^+} \frac{y+6}{(y+6)(y-6)}$$

$$= \lim_{y\to 6^+} \frac{1}{y-6}$$

Since, the numerator is positive and the denominator $(y-6)$ approaches zero and is greater than zero for y near 6 to the right, the function increases without bound.

Therefore,

$$\lim_{y \to 6^+} \frac{y+6}{y^2-36} = +\infty$$

22|

$$\lim_{y \to 6^-} \frac{y+6}{y^2-36}$$

$$= \lim_{y \to 6^-} \frac{1}{y-6}$$

Since the numerator is positive and the denominator $(y-6)$ approaches zero and is less than zero for y near ~~to~~ 6 to the left, the function decreases without bound.

Therefore,

$$\lim_{y \to 6^-} \frac{y+6}{y^2-36} = -\infty$$

23|

Given that,

$$\lim_{y \to 6} \frac{y+6}{y^2-36}$$

$$= \lim_{y \to 6} \frac{1}{y-6}$$

L.H.L:

$$\lim_{y - 6^-} \frac{1}{y-6} = -\infty$$

R.H.L.:

$$\lim_{y \to 6^+} \frac{1}{y-6} = +\infty$$

$\therefore$ L.H.L $\neq$ R.H.L

Therefore,

$$\lim_{y \to 6} \frac{y+6}{y^2-36} \text{ does not exist.}$$

24)

Given that,

$$\lim_{x \to 4^+} \frac{3-x}{x^2-2x-8}$$

$$= \lim_{x \to 4^+} \frac{3-x}{(x-4)(x+2)}$$

Since the numerator is negative and the denominator $(x-4)(x-2)$ approaches zero and is greater than zero, for x near 4 to the right, the function decreases without bound.

Therefore,

$$\lim_{x \to 4^+} \frac{3-x}{x^2-2x-8} = -\infty$$

25|

Given that,

$$\lim_{x \to 4^-} \frac{3-x}{x^2-2x-8}$$

$$= \lim_{x \to 4^-} \frac{3-x}{(x-4)(x+2)}$$

Since the numerator is negative and the denominator $(x-4)(x+2)$ approaches zero and is less than zero for x near 4 to the left, the function increases without bound.

Therefore,

$$\lim_{x \to 4^-} \frac{3-x}{x^2-2x-8} = +\infty$$

26|

Given that,

$$\lim_{x \to 4} \frac{3-x}{x^2-2x-8}$$

$$= \lim_{x \to 4} \frac{3-x}{(x-4)(x+2)}$$

L.H.L.:

$$\lim_{x \to 4^-} \frac{3x}{(x-4)(x+2)} = +\infty$$

R.H.L:

$$\lim_{x\to 4^+} \frac{3-x}{(x-4)(x+2)} = -\infty$$

$\therefore$ L.H.L $\neq$ R.H.L.

Therefore,

$$\lim_{x\to 4} \frac{3-x}{x^2-2x-8} \text{ does not exist.}$$

271

Given that,

$$\lim_{x\to 2^+} \frac{1}{|2-x|}$$

Here,

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

$$= \begin{cases} \frac{1}{2-x} & 2-x \geq 0 \\ \frac{1}{x-2} & 2-x < 0 \end{cases}$$

$$= \begin{cases} \frac{1}{2-x} & x \leq 2 \\ \frac{1}{x-2} & x > 2 \end{cases}$$

$$\therefore \lim_{x\to 2^+} \frac{1}{|2-x|} = \lim_{x\to 2^+} \frac{1}{x-2}$$

$$= +\infty$$

Therefore, $\lim_{x\to 2^+} \frac{1}{|2-x|} = +\infty$

28/

Given that,

$$\lim_{x \to 3^-} \frac{1}{|x-3|}$$

Since the numerator is positive and the denominator $|x-3|$ approaches zero and is greater than zero for x near 3 to the left, the function increases without bound.

Therefore,

$$\lim_{x \to 3^-} \frac{1}{|x-3|} = +\infty$$

29/

Given that,

$$\lim_{x \to 9} \frac{x-9}{\sqrt{x}-3}$$

$$= \lim_{x \to 9} \frac{(\sqrt{x})^2 - 3^2}{\sqrt{x}-3}$$

$$= \lim_{x \to 9} \frac{(\sqrt{x}+3)(\sqrt{x}-3)}{(\sqrt{x}-3)}$$

$$= \lim_{x \to 9} (\sqrt{x}+3)$$

$$= \lim_{x \to 9} \sqrt{x} + \lim_{x \to 9} 3$$

$$= \sqrt{\lim_{x\to 9} x} + 3$$

$$= \sqrt{9} + 3$$

$$= 3+3$$

$$= 6$$

Therefore,

$$\lim_{x\to 9} \frac{x-9}{\sqrt{x}-3} = 6$$

30|

Given that,

$$\lim_{y\to 4} \frac{4-y}{2-\sqrt{y}}$$

$$= \lim_{y\to 4} \frac{2^2-(\sqrt{y})^2}{2-\sqrt{y}}$$

$$= \lim_{y\to 4} \frac{(2+\sqrt{y})(2-\sqrt{y})}{(2-\sqrt{y})}$$

$$= \lim_{y\to 4} (2+\sqrt{y})$$

$$= \lim_{y\to 4} 2 + \lim_{y\to 4} \sqrt{y}$$

$$= 2 + \sqrt{\lim_{y\to 4} y}$$

$$= 2 + \sqrt{4}$$

$$= 2+2 = 4$$

Therefore,

$$\lim_{y\to 4} \frac{4-y}{2-\sqrt{y}} = 4$$

31/

Given that,

$$f(x) = \begin{cases} x-1, & x \le 3 \\ 3x-7, & x > 3 \end{cases}$$

a)

$$\lim_{x\to 3^-} f(x) = \lim_{x\to 3^-} x-1$$

$$= 3-1$$

$$= 2$$

Therefore,

$$\lim_{x\to 3^-} f(x) = 2$$

b)

$$\lim_{x\to 3^+} f(x) = \lim_{x\to 3^+} (3x-7)$$

$$= 3\cdot 3-7$$

$$= 9-7$$

$$= 2$$

Therefore,

$$\lim_{x\to 3^+} f(x) = 2$$

c)

L.H.L.:

$$\lim_{x \to 3^-} f(x) = 2$$

R.H.L.:

$$\lim_{x \to 3^+} f(x) = 2$$

$\therefore$ L.H.L. = R.H.L.

Therefore,

$$\lim_{x \to 3} f(x) = 2$$

1.3

9)

Given that,

$$\lim_{x \to +\infty} (1 + 2x - 3x^5)$$

$$= \lim_{x \to +\infty} (-3x^5 + 2x +)$$

$$= \lim_{x \to +\infty} -3x^5$$

$$= -3 \cdot \lim_{x \to +\infty} x^5$$

$$= -\infty$$

Therefore,

$$\lim_{x \to +\infty} (1 + 2x - 3x^5) = -\infty$$

10)

Given that,

$$\lim_{x \to +\infty} (2x^3 - 100x + 5)$$

$$= \lim_{x \to +\infty} 2x^3$$

$$= 2 \cdot \lim_{x \to +\infty} x^3$$

$$= \infty$$

Therefore,

$$\lim_{x \to +\infty} (2x^3 - 100x + 5) = +\infty$$

11)

Given that,

$$\lim_{x \to +\infty} \sqrt{x}$$

$$= \sqrt{\lim_{x \to +\infty} \cdot x}$$

$$= +\infty$$

Therefore,

$$\lim_{x \to +\infty} \sqrt{x} = +\infty.$$

12)

Given that,

$$\lim_{x \to -\infty} \sqrt{5-x}$$

$$= \sqrt{\lim_{x \to -\infty} (5-x)}$$

$$= \sqrt{\lim_{x \to -\infty} 5 - \lim_{x \to -\infty} x}$$

$$= \sqrt{5 + \infty}$$

$$= +\infty$$

Therefore,

$$\lim_{x \to -\infty} \sqrt{5-x} = +\infty$$

13)

Given that,

$$\lim_{x \to +\infty} \frac{3x+1}{2x-5}$$

$$= \lim_{x \to +\infty} \frac{3x}{2x}$$

$$= \lim_{x \to +\infty} \frac{3}{2}$$

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

Therefore,

$$\lim_{x \to +\infty} \frac{3x+1}{2x-5} = \frac{3}{2}$$

14)

Given that,

$$\lim_{x \to +\infty} \frac{5x^2-4x}{2x^2+3}$$

$$= \lim_{x \to +\infty} \frac{5x^2}{2x^2}$$

$$= \lim_{x \to +\infty} \frac{5}{2} = \frac{5}{2}$$

Therefore,

$$\lim_{x \to +\infty} \frac{5x^2-4x}{2x^2+3} = \frac{5}{2}$$

15)

Given that,

$$\lim_{y \to -\infty} \frac{3}{y+4}$$

$$= 3 \cdot \lim_{y \to -\infty} \frac{1}{y+4}$$

$$= 3 \cdot 0$$

$$= 0$$

Therefore,

$$\lim_{y \to -\infty} \frac{3}{y+4} = 0$$

16)

Given that,

$$\lim_{x \to +\infty} \frac{1}{x-12}$$

$$= \lim_{x \to +\infty} \frac{\frac{1}{x}}{\frac{x-12}{x}}$$

$$= \frac{\lim_{x \to +\infty} \frac{1}{x}}{\lim_{x \to +\infty} 1-\frac{12}{x}}$$

$$= \frac{0}{1-12\cdot 0}$$

$$= 0$$

Therefore,

$$\lim_{x \to +\infty} \frac{1}{x-12} = 0$$

17)

Given that,

$$\lim_{x \to -\infty} \frac{x-2}{x^2+2x+1}$$

$$= \lim_{x \to -\infty} \frac{x}{x^2}$$

$$= \lim_{x \to -\infty} \frac{1}{x}$$

$$= 0$$

Therefore,

$$\lim_{x \to -\infty} \frac{x-2}{x^2+2x+1} = 0$$

18)

Given that,

$$\lim_{x \to +\infty} \frac{5x^2+7}{3x^2-x}$$

$$= \lim_{x \to +\infty} \frac{5x^2}{3x^2}$$

$$= \lim_{x \to +\infty} \frac{5}{3}$$

$$= \frac{5}{3}$$

Therefore,

$$\lim_{x \to +\infty} \frac{5x^2+7}{3x^2-x} = \frac{5}{3}$$

19)

Given that,

$$\lim_{x \to +\infty} \frac{7-6x^5}{x+3}$$

$$= \lim_{x \to +\infty} \frac{-6x^5+7}{x+3}$$

$$= \lim_{x \to +\infty} \frac{-6x^5}{x}$$

$$= \lim_{x \to +\infty} -6x^4$$

$$= -6 \cdot \lim_{x \to +\infty} x^4$$

$$= -\infty$$

Therefore,

$$\lim_{x \to +\infty} \frac{7-6x^5}{x+3} = -\infty$$

20|

Given that,

$$\lim_{x \to -\infty} \frac{5-2x^3}{x^2+1}$$

$$= \lim_{x \to -\infty} \frac{-2x^3+5}{x^2+1}$$

$$= \lim_{x \to -\infty} \frac{-2x^3}{x^2}$$

$$= \lim_{x \to -\infty} -2x$$

$$= -2 \cdot \lim_{x \to -\infty} x$$

$$= +\infty$$

Therefore,

$$\lim_{x \to -\infty} \frac{5-2x^3}{x^2+1} = +\infty$$

21|

Given that,

$$\lim_{x \to +\infty} \frac{6-x^3}{7x^3+3}$$

$$= \lim_{x \to +\infty} \frac{-x^3+6}{7x^3+3}$$

$$= \lim_{x \to +\infty} \frac{-x^3}{7x^3}$$

$$= \lim_{x \to +\infty} \frac{-1}{7}$$

$$= -\frac{1}{7}$$

Therefore,

$$\lim_{x \to +\infty} \frac{6 - x^3}{7x^3 + 3} = -\frac{1}{7}$$

22|

Given that,

$$\lim_{x \to -\infty} \frac{x + 4x^3}{1 - x^2 + 7x^3}$$

$$= \lim_{x \to -\infty} \frac{4x^3}{7x^3}$$

$$= \lim_{x \to -\infty} \frac{4}{7}$$

$$= \frac{4}{7}$$

Therefore,

$$\lim_{x \to -\infty} \frac{x + 4x^3}{1 - x^2 + 7x^3} = \frac{4}{7}$$

23)

Given that,

$$\lim_{x \to +\infty} \sqrt[3]{\frac{2+3x-5x^2}{1+8x^2}}$$

$$= \sqrt[3]{\lim_{x \to +\infty} \frac{2+3x-5x^2}{1+8x^2}}$$

$$= \sqrt[3]{\lim_{x \to +\infty} \frac{-5x^2}{8x^2}}$$

$$= \sqrt[3]{\lim_{x \to +\infty} \frac{-5}{8}}$$

$$= \sqrt[3]{\frac{-5}{8}}$$

$$= -\frac{\sqrt[3]{5}}{2}$$

Therefore,

$$\lim_{x \to +\infty} \sqrt[3]{\frac{2+3x-5x^2}{1+8x^2}} = -\frac{\sqrt[3]{5}}{2}$$

24)

Given that,

$$\lim_{s \to +\infty} \sqrt[3]{\frac{3s^7-4s^5}{2s^7+1}}$$

$$= \sqrt[3]{\lim_{s \to +\infty} \frac{3s^7-4s^5}{2s^7+1}}$$

$$= \sqrt[3]{\lim_{s \to +\infty} \frac{3s^7}{2s^7}}$$

$$= \sqrt[3]{\lim_{s \to +\infty} \frac{3}{2}}$$

$$= \sqrt[3]{\frac{3}{2}}$$

Therefore,

$$\lim_{s \to +\infty} \sqrt[3]{\frac{3s^7 - 4s^5}{2s^7 + 1}} = \sqrt[3]{\frac{3}{2}}$$

25|

Given that,

$$\lim_{x \to -\infty} \frac{\sqrt{5x^2 - 2}}{x + 3}$$

$$= \lim_{x \to -\infty} \frac{\frac{\sqrt{5x^2-2}}{|x|}}{\frac{x+3}{|x|}}$$

$$= \lim_{x \to -\infty} \frac{\sqrt{\frac{5x^2-2}{x^2}}}{\frac{x+3}{-x}}$$

$$= \lim_{x \to -\infty} \frac{\sqrt{5 - \frac{2}{x^2}}}{-1 - \frac{3}{x}}$$

$$= \frac{\sqrt{\lim_{x \to -\infty} 5 - 2 \lim_{x \to -\infty} \frac{1}{x^2}}}{\lim_{x \to -\infty} -1 - 3 \cdot \lim_{x \to -\infty} \frac{1}{x}}$$