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Course: ENG281 (Assignment)
Level: 200L

1) Given a function to be as Equation (1)

$f(x) = \pi$

find $\lim_{x \to 3} f(x)$

Solution

$f(x) = \pi x^0$

$$\lim_{x \to 3} f(x) = \pi(3^0)$$

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

NOTE: $\pi = 3.14$

$$\therefore \lim_{x \to 3} f(x) = 3.14$$

2) The model of a system to been developed by an Engineer to be as given in Equation (2)

$f(x) = 5x - 21$

Given that $\delta = 0.1$ and using a step of 0.01, demonstrate, in tabular form, the limit of the model as $x \to 6$ is equal to 9

Solution

Substituting directly into Eqn (1)

$f(x) = 5x - 21$

$$\lim_{x \to 6} f(x) = 5(6) - 21$$

$$\lim_{x \to 6} f(x) = 30 - 21$$

$$\lim_{x \to 6} f(x) = 9$$

$\delta = 0.1$

$f(x)$	$x-\delta$	$f(x)$	$x+\delta$
8.50	5.90	9.50	6.10
8.55	5.91	9.45	6.09
8.60	5.92	9.40	6.08
8.65	5.93	9.35	6.07
8.70	5.94	9.30	6.06
8.75	5.95	9.25	6.05
8.80	5.96	9.20	6.04
8.85	5.97	9.15	6.03
8.90	5.98	9.10	6.02
8.95	5.99	9.05	6.01
9.00	6.00	9.00	6.000

$\therefore$ The limits are defined on both $x-\delta$ and $x+\delta$ in the table, so the equation exist.

(3) Find limit of the model equation given Equation (3)

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

Solution

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

$$= \frac{3-(3+h)}{|3-(3+h)|} = \frac{\cancel{3}-\cancel{3}-h}{|\cancel{3}-\cancel{3}-h|}$$

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

(4) Evaluate the limit of the model given in equation (4) if it exists

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

Solution

$$\lim_{x \to 3} \frac{x-3}{|x-3|} = \frac{3-3}{|3-3|} = \frac{0}{|0|} = \frac{0}{0} = \text{undefined}$$

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

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

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

$\therefore$ Equation(4) do not exist

(5) Show that the function given in Equation (5)

$f(x) = \sqrt{x-4}$

is continuous on the internal $[4, 8]$

solution

$f(x) = \sqrt{x-4}$

when $x = 4$

$f(4) = \sqrt{4-4} = \sqrt{0} = 0$ - - - (1)

when $x = 8$

$f(8) = \sqrt{8-4} = \sqrt{4} = 2$ - - - - (2)

$$f(x) = f(a+h) \quad h \to 0$$

$$\lim_{x \to 4^+} f(4+h) = \sqrt{\cancel{4}+h-\cancel{4}}$$

$$= \sqrt{h}$$

$$\lim_{h \to 0} f(4+h) = \sqrt{0} = 0 \quad \ldots \text{(3)}$$

$$\lim_{x \to 8^+} f(8+h) = \lim \sqrt{8+h-4}$$

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

$$\lim_{h \to 0} (8+h) = \sqrt{4+0} = \sqrt{4} = 2 \quad \ldots \text{(4)}$$

$\therefore$ From eqn (1) and (3)

$f(x) = f(4) = 0$. It is continous

From eqn (2) and (4)

$f(x) = f(8) = 2$. It is continous