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MECHANICAL ENGINEER

MECH 406/085

ENG 28.

ASSIGNMENT

$$f(x) = x$$

$$\lim_{x \rightarrow 6} f(x) = 6$$

The model of a system has been developed by an engineer to be as given in the equation  $f(x) = 5x - 21$

Given that  $\delta = 0.1$ , and using a step of 0.01.

Demonstrate in tabular form, that the limit of the model as  $x \rightarrow 6$  is equal to 9.

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

Since the limits are defined both on the LHS and RHS so it can be said that the limit is real and thus, exists.

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

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

$$\begin{aligned} \lim_{x \rightarrow 3} \frac{3-x}{|3-x|} &= \frac{3-(3+\delta)}{|3-(3+\delta)|} = \frac{3-3-\delta}{|3-3-\delta|} \\ &= \frac{-\delta}{|-\delta|} = \frac{-\delta}{\delta} = -1 \end{aligned}$$

4 Evaluate the limit of the model given  $\lim_{x \rightarrow 3} \frac{x-3}{|x-3|}$

$$\lim_{x \rightarrow 3} \frac{x-3}{|x-3|} = \frac{(3)-3}{|(3)-3|} = \frac{0}{0} \text{ undefined}$$

Since the  $\lim_{x \rightarrow 3} \frac{x-3}{|x-3|}$  is undefined, we substitute

$$\begin{aligned} &(3+\delta) \text{ and } (3-\delta) \text{ for } x \\ \lim_{x \rightarrow 3^+} \frac{x-3}{|x-3|} &= \frac{(3+\delta)-3}{|(3+\delta)-3|} = \frac{\delta}{\delta} = 1 \end{aligned}$$

$$\lim_{x \rightarrow 3^-} \frac{x-3}{|x-3|} = \frac{(3-\delta)-3}{|(3-\delta)-3|} = \frac{-\delta}{\delta} = -1$$

Therefore, since the RHS and LHS limits do not correlate, the limit of  $\frac{x-3}{|x-3|}$  as the equation trends to 3 doesn't exist.

5 Show that the function given in equation  $f(x) = \sqrt{x-4}$  is continuous on the interval  $(4, 8)$

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

$$\text{Substituting } 4 \text{ for } x, f(x) = \sqrt{(4)-4} = \sqrt{0} = 0$$

$$\text{Substituting } 8 \text{ for } x, f(x) = \sqrt{(8)-4} = \sqrt{4} = 2$$

$x$	$f(x) = \sqrt{x-4}$
4	0
5	1.0
6	1.4
7	1.7
8	2

