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MECHATRONICS ENGINEERING

ENG 281 (MATHEMATICS)

2) The model of a system has been developed by an Engineer to be as given in the equation $f(x) = 5x - 2x^2$. Given that $h = 0.1$ and using a step of 0.01 , demonstrate in a tabular form the limit of the model as $x \rightarrow 6$ is equal to 9.

$f(x)$	$x=5$	$x=6$	$x=6+h$	$f(x)$
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 values are defined both on the L.H.S and R.H.S we can be said the limit is read and thus exists

(3) Find the limit of the model question given below

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

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

7.00	5.99 6.00	6.01 6.00	7.05 7.00
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Since the limits are defined both on the L.H.S and R.H.S
it can be said the limit is real and thus exists

(3) Find the limit of the model question given below

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

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

4) Evaluate the limit of the model given limit

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

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

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

$(3+\delta)$ and $(3-\delta)$ for x

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

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

Therefore since the R.H.S and L.H.S limits do not equal the limit of $\frac{x-3}{|x-3|}$ as the equation reads to 3

L'Hôpital's rule

2) Given a function $f(x) = \pi$. Find $\lim_{x \rightarrow 3} f(x)$

Since there is no function to substitute this limit

of π , we can say that $f(x) = \pi$

$$\pi = \pi$$

$$\therefore \underline{\underline{3.147}}$$

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

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

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

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

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

$$4 \quad 0$$

$$5 \quad 1.0$$

$$6 \quad 1.41$$

$$7 \quad 1.73$$

$$8 \quad 2$$

