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CIVIL ENGINEERING

17 (ENG 03/00)

ENGT 281

Question 1

Given a function to be as in equation (1)

$$f(x) = \pi$$

$$\text{Find } \lim_{x \rightarrow 3} f(x)$$

$$f(x) = \pi$$

$$\lim_{x \rightarrow 3} = \pi$$

Question 2

The model of a system has 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 a tabular form, the limit of the model as $x \rightarrow 6$ is equal to 9

Soln:-

$\delta = 0.01$		$x = 6$	
n	$n \cdot \delta$	$x - n \cdot \delta \neq 6$	$f(x) \neq x \rightarrow 6$
0	0	$6 - 0 = 6$	9
1	0.01	$6 - 0.01 = 5.99$	8.95
2	0.02	$6 - 0.02 = 5.98$	8.9
3	0.03	$6 - 0.03 = 5.97$	8.85
4	0.04	$6 - 0.04 = 5.96$	8.8
5	0.05	$6 - 0.05 = 5.95$	8.75
6	0.06	$6 - 0.06 = 5.94$	8.7
7	0.07	$6 - 0.07 = 5.93$	8.65
8	0.08	$6 - 0.08 = 5.92$	8.6
9	0.09	$6 - 0.09 = 5.91$	8.55
10	0.10	$6 - 0.10 = 5.9$	8.5

n	$n \cdot \delta$	$x+n = \sigma = v$	$F(x) \quad x \rightarrow v$
0	0	$6+0 = 6$	9
1	0.01	$6+0.1 = 6.01$	9.05
2	0.02	$6+0.2 = 6.02$	9.1
3	0.03	$6+0.3 = 6.03$	9.15
4	0.04	$6+0.4 = 6.04$	9.2
5	0.05	$6+0.5 = 6.05$	9.25
6	0.06	$6+0.6 = 6.06$	9.3
7	0.07	$6+0.7 = 6.07$	9.35
8	0.08	$6+0.8 = 6.08$	9.4
9	0.09	$6+0.9 = 6.09$	9.45
10	0.10	$6+0.10 = 6.1$	9.5

Question 3

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

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

Soln

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

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

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

Question 4

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

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

Soln

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

$$\lim_{x \rightarrow 3} = \frac{1}{1} = 1$$

Question 5

Show the function given in equation (5)

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

is continuous on the interval (4, 8)

Soln:

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

$$= (x-4)^{1/2}$$

$$y = (x-4)^{1/2}$$

$$\text{Let } u = x - 4$$

$$y = u^{1/2}$$

$$\frac{du}{dx} = 1$$

$$\frac{dy}{du} = \frac{1}{2} u^{-1/2}$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$= 1 \cdot \frac{1}{2} u^{-1/2}$$

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

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

$$= \frac{1}{2\sqrt{x-4}}$$