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17/ENG06/045
Mechanical Engineering
ENG 281

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

$f(x) = \pi$

Solution

$\therefore \lim_{x \to 3} \pi = \pi$

2) $f(x) = 5x - 21$

Solution

$\delta = 0.1$ Step : 0.01

$5(6.1) - 21 = 9.5$
$5(6.01) - 21 = 9.05$
$5(6.001) - 21 = 9.005$
$5(6.0001) - 21 = 9.0005$
$5(6.00001) - 21 = 9.00005$
$5(6.000001) - 21 = 9.000005$
$5(6.0000001) - 21 = 9.0000005$

x	$F(x)$
6.1	9.5
6.01	9.05
6.001	9.005
6.0001	9.0005
6.00001	9.00005
6.000001	9.000005
6.0000001	9.0000005

$\therefore [f(x) = 5x - 21]$ tends towards 9 as $x \to 6$

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

Solution

$$\therefore \lim_{x \to 3^+} \frac{3-x}{|3-x|} = \frac{3-(3+h)}{3-(3+h)} = \frac{3-3-h}{3-3-h}$$

$$= \frac{0-h}{0-h} = \frac{h}{h} \text{ where } h = 0 = \frac{0}{0}$$

$\therefore$ the limit is indeterminate at the right hand limit

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

Solution

at $x < 0$

$\lim_{\substack{x \to 3 \\ \text{where } h \to 0}} \left[\frac{(3-h)-3}{(3-h)-3}\right] = \frac{0}{0}$ ∴ indeterminate form

at $x \geq 0$

$\lim_{x \to 3^+} \left[\frac{(3+h)-3}{(3+h)-3}\right]$ where $h \to 0$ $= \frac{3-3}{3-3} = \frac{0}{0}$ ∴ indeterminate form

∴ The limits do not exist from both left hand and right hand limit

5) Show that $f(x) = \sqrt{x-4}$ is continuous on interval $[4, 8]$.

Solution

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

$x \to 4 = \sqrt{4-4} = \sqrt{0} = 0$

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

at $x \to 8 = \sqrt{8-4}$

$= \sqrt{4} = 2$

$\therefore f(x)$ is continuous at $(4, 8)$