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

$f(x) = \pi$ (1)

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

$\lim_{x \to 3} f(x) = \pi$ since π is a constant

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

Using direct substitution,

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

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

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

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

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

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

$f(x)$	$a-\delta$	a	$a+\delta$	$f(x)$
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	6.00		6.00	9

Since as x approaches 6 from both sides (left and right), $f(x)$ approaches 9. We can say that $\lim_{x \to 6} f(x) = 9$.

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

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

As x approaches 3 from the right

~~Lim~~ By trying values higher than 3,

using 3.3 $\lim_{x \to 3.3} \frac{3-3.3}{|3-3.3|} = \frac{-0.3}{0.3} = -1$

using 3.2 $\lim_{x \to 3.2} \frac{3-3.2}{|3-3.2|} = \frac{-0.2}{0.2} = -1$

using 3.1 $\lim_{x \to 3.1} \frac{3-3.1}{|3-3.1|} = \frac{-0.1}{0.1} = -1$

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

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

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

Taking the limit as x approaches 3 from the left

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

using 2.9, $\lim_{x \to 3^-} \frac{2.9-3}{|2.9-3|} = \frac{-0.1}{0.1} = -1$

Taking the limit as x approaches 3 from the right

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

using 3.1, $\lim_{x \to 3^+} \frac{3.1-3}{|3.1-3|} = \frac{0.1}{0.1} = 1$

Since the left hand limit and the right hand limit are not equal

The limit does not exist

Also, by using direct substitution

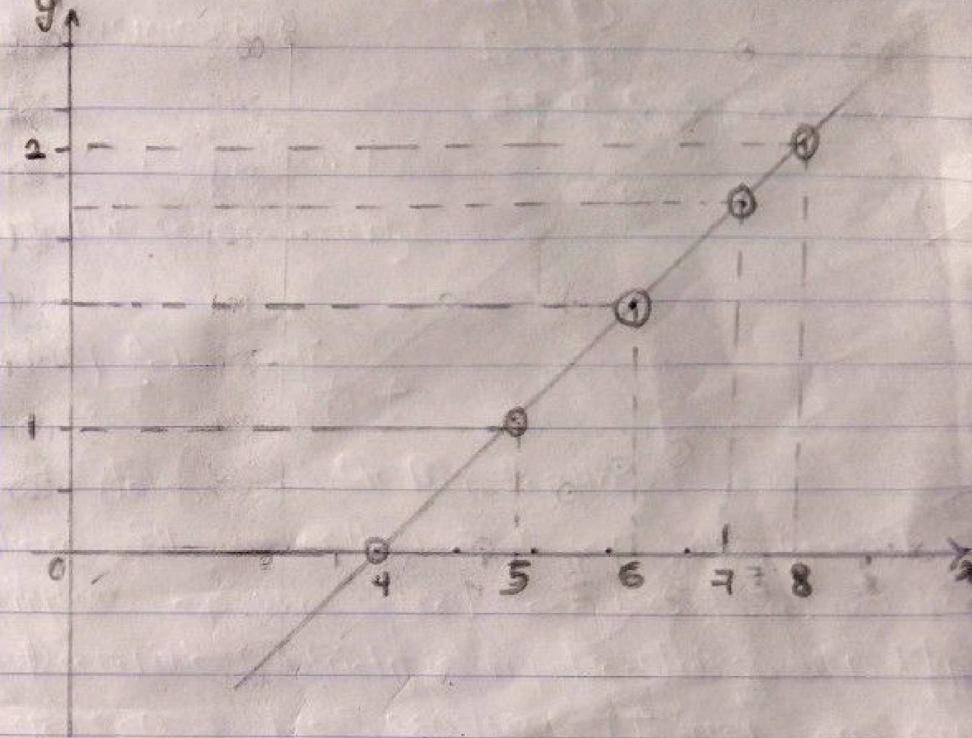
$$\lim_{x \to 3} \frac{x-3}{|x-3|} = \frac{3-3}{|3-3|} = \frac{0}{0}$$

$\frac{0}{0}$ is an UNDEFINED value

$\therefore$ The limit does not exist.

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

x	$f(x)$
4	$\sqrt{4-4} = 0$
5	$\sqrt{5-4} = \sqrt{1} = 1$
6	$\sqrt{6-4} = \sqrt{2} = 1.41$
7	$\sqrt{7-4} = \sqrt{3} = 1.73$
8	$\sqrt{8-4} = \sqrt{4} = 2$



Since $f(x)$ is defined and there is no point of discontinuity in the straight line graph, $f(x) = \sqrt{x-4}$ is continuous on the interval $[4, 8]$. The function $f(x)$ is defined at every point in the interval.

Proof, $\lim_{x \to 4^+} f(x) = \sqrt{4-4} = 0$ and $\lim_{x \to 8^-} f(x) = \sqrt{8-4} = \sqrt{4} = 2$.

therefore, f is continuous from the right at 4 and continuous from the left at 8. Certainly, the function is continuous on the interval $[4, 8]$