

18/ENG02/086

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Engineering Maths

a Show that the function given in equation (1.2) as x approaches 0 is a/b

$$f(x) = \frac{\sin ax}{b(x)}$$

Solution

$$f(x) = \frac{\sin ax}{b(x)} = \frac{\sin a(0)}{b(0)} = \frac{0}{0}$$

$$f(x) = \frac{\sin ax}{b(x)} \text{ is undefined}$$

Applying L'Hopital's rule

$$f(x) = \frac{\sin ax}{bx}$$

$$= \frac{a \cos ax}{b}$$

$$f(x) = \frac{a \cos a(0)}{b} = \frac{a}{b}$$

b The model of a system has been developed to be as given in equation (1.2). $F(x) = 5x - 21$
Given that $\delta = 0.1$ and $\Delta \delta = 0.01$, demonstrate in a tabular form that the limit of the model as $x \rightarrow 6$ is equal to 9

Solution

$$\delta = 0.1, \Delta \delta = 0.01, \epsilon = 0.05$$

$$6 - 0.1 = 5.9 \text{ (left hand side)}$$

$$6 + 0.1 = 6.1 \text{ (right hand side)}$$

$$9 - 0.5 = 8.5 \text{ (left hand side)}$$

$$9 + 0.5 = 9.5 \text{ (Right hand side)}$$

$$x \rightarrow 1$$

$$f(x) = (25 - (1)^2)^{1/2} \\ = 4.89$$

$$x \rightarrow 2$$

$$f(x) = (25 - (2)^2)^{1/2} \\ = 4$$

x

$$x \rightarrow 3$$

$$f(x) = (25 - (3)^2)^{1/2} \\ = 4$$

$$x \rightarrow 4$$

$$f(x) = (25 - (4)^2)^{1/2} \\ = 3$$

$$x \rightarrow 5$$

$$f(x) = (25 - (5)^2)^{1/2} \\ = 0$$

The function on the interval $[-5, 5]$ is continuous.

x	$f(x)$	x	$f(x)$
5.9	8.5	6.1	9.5
5.91	8.55	6.09	9.45
5.92	8.60	6.08	9.40
5.93	8.65	6.07	9.35
5.94	8.70	6.06	9.30
5.95	8.75	6.05	9.25
5.96	8.80	6.04	9.20
5.97	8.85	6.03	9.15
5.98	8.90	6.02	9.10
5.99	8.95	6.01	9.05
6.00	9.00	6.00	9.00

c). Show whether the function given in the equation below is continuous on the interval $[-5, 5]$

$$f(x) = (25 - x^2)^{1/2}$$

Solution

$$x \rightarrow -5$$

$$f(x) = (25 - (-5)^2)^{1/2} \\ = 0$$

$$x \rightarrow -4$$

$$f(x) = (25 - (-4)^2)^{1/2} \\ = 3$$

$$x \rightarrow -3$$

$$f(x) = (25 - (-3)^2)^{1/2} \\ = 4$$

$$x \rightarrow -2$$

$$f(x) = (25 - (-2)^2)^{1/2} \\ = 4.58$$

$$x \rightarrow -1$$

$$f(x) = (25 - (-1)^2)^{1/2} = 4.89$$

$$x \rightarrow 0$$

$$f(x) = (25 - (0)^2)^{1/2} \\ = 5$$