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18TEN604/074

Electrical/Electronics Engineering

a) Show that the limit of the function given in the equation as  $x$  approaches 0 is  $\frac{a}{b}$ .

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

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$$= \frac{\sin a(0)}{b(0)} = \frac{0}{0} \text{ (undefined)}$$

using l'Hopital's rule

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

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

b) The model of a system has been developed to be a given in equ. (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

solu

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

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

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

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

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

| $x$  | $f(x)$ | $x$  | $f(x)$ |
|------|--------|------|--------|
| 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   |

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

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

soln

$$x \rightarrow -5$$

$$f(x) = [25 - (-5)^2]^{1/2}$$

$$= 0$$

$$x \rightarrow -4$$

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

$$= 3$$

$$x \rightarrow -3$$

$$f(x) = [25 - (-3)^2]^{1/2}$$

$$= 4$$

$$x \rightarrow -2$$

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

$$= 4.58$$

$$x \rightarrow -1$$

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

$$= 4.89$$

$$x \rightarrow 0$$

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

$$x = 1$$

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

$$x = 2$$

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

$$x = 3$$

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

$$x = 4$$

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

$$x = 5$$

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

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