VEM MAKPLANG SLAS
18/ENGOS/066
Mechatronics.

Assignment

a Show that the limit of the function given in Equation (1.1) as $x$ approaches 0 is $a/b$

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

Soln

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

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

Using L'hopital's rule

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

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

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

b The model of a system has been developed to be as given in equ. (1.2)

$$f(x) = 5x - 2.1$$

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

Soln

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

$6 - 0.1 = 5.9$ {left hand side}

$6 + 0.1 = 6.1$ {right hand side}

$9 - 0.5 = 8.5$ {left hand side}

$9 + 0.5 = 9.5$ {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 |

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

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

Soln

$x \longrightarrow -5$

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

$= 0$

$x \longrightarrow -4$

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

$= 3$

$x \longrightarrow -3$

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

$= 4$

$x \longrightarrow -2$

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

$= 4.58$

$x \longrightarrow -1$

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

$= 4.89$

$x \to 0$

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

$= 5$

$x = 1$

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

$= 4.89$

$x = 2$

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

$= 4$

$x \to 3$

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

$= 4$

$x \to 4$

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

$= 3$

$x \to 5$

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

$= 0$

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