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(1)(a) Show that the limit of the function given in Equation (1.1) as x approaches

0 is $\dfrac{a}{b}$ $f(x) = \dfrac{\sin ax}{bx}$

Solution

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

$x \to 0$

$$f(x) = \frac{\sin ax \cdot 0}{b \times 0} = \frac{0}{0} - \text{undefined}$$

Differentiate $f(x)$

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

$x \to 0$

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

$$= \frac{a \times 1}{b} = \frac{a}{b}$$

2.

(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 tabular form, that the

limit of the model as $x \to b$ is equal to q

Solution

for $\delta = 0.1$ we from b (LHS) $6 - 0.1 = 5.9$

for the RHS we have $6 + 0.1 = 6.1$

where $a = b$ $L =$

$L-\varepsilon$	$a-\delta$	a	$a+\delta$	$L+\varepsilon$
8.50	5.9	b	6.1	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
9.00	6.00		6.00	9

(C) Show whether the function given in Equation (1.3) is Continuous on the interval $[-5, 5]$. $f(x) = (25 - x^2)^{1/2}$

Solution.

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

when $x = -5$

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

$= (25 - 25)^{1/2} = \sqrt{0}$

$= 0$

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

when $x = -4$

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

$= (25 - 16)^{1/2} = \sqrt{9}$

$= 3$

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

when $x = -3$

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

$= (25 - 9)^{1/2} = 16^{1/2}$

$= \sqrt{16}$

$= 4$

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

When $x = -2$

$$f(x) = (25 - (-2)^2)^{1/2}$$
$$= 25 - 4 = 21^{1/2}$$
$$= \sqrt{21} = 4.58$$

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

When $x = -1$

$$f(x) = (25 - (-1)^2)^{1/2}$$
$$= (25 - 1)^{1/2} = 24^{1/2}$$
$$= \sqrt{24}$$
$$= 2\sqrt{6}$$
$$= 4899$$
$$= ~~5.0~~$$

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

when $x = 0$

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

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

Then $x = 1$

$$f(x) = (25 - (1)^2)^{1/2}$$
$$= (25 - 1)^{1/2} = 24^{1/2}$$
$$= \sqrt{24}$$
$$= 2\sqrt{6} = 4.899$$

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

$x = 2$

$$f(x) = (25 - 2^2)^{1/2}$$
$$= (25 - 4)^{1/2} = 21^{1/2} = \sqrt{21}$$
$$= 4.58$$

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

When $x = 3$

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

$= (25 - 9)^{1/2}$

$= 16^{1/2} = \sqrt{16}$

$= 4$

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

When $x = 4$

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

$= (25 - 16)^{1/2}$

$= 9^{1/2} = \sqrt{9}$

$= 3$

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

when $x = 5$

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

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

$= 0^{1/2} = \sqrt{0}$

$= 0$