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MAT NO | 18/ENG08/007
DEPT | BIOMEDICAL ENGINEERING
COURSE | ENG 281, ENGINEERING MATHEMATICS I

ASSIGNMENT 1

1(a) Show that the limit of the function given in $f(x) = \frac{\sin ax}{bx}$ as $x$ approaches 0 is $\frac{a}{b}$.

Solution

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

$$\lim_{x \to 0} \frac{\sin ax}{bx} = \frac{\sin a(0)}{b(0)} = \frac{0}{0}$$

Now using L'Hospitals rule.

$$\lim_{x \to 0} \frac{\sin ax}{bx} = \frac{a \cos ax}{b} = \frac{a \cos a(0)}{b} = \frac{a \cos 0}{b}$$

$$= \frac{a(1)}{b} = \frac{a}{b}$$

$$\therefore \lim_{x \to 0} \frac{\sin ax}{bx} = \frac{a}{b}$$

1(b) The Model of a system has been developed to be given in;

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

Given that $\sigma = 0.1$ and $\Delta\sigma = 0.01$,

HARDING -UDOH TITANIA B. 18/ENG08/007

demonstrate in tabular form, that the Limit of the Model as $x \to 6$ is equal to 9.

Solution

$$\boxed{\lim_{x \to a} f(x) = L}$$

$f(x) = 5x - 21$

Showing that $\lim_{x \to 6} f(x) = 9$.

$$\lim_{x \to 6} (5x - 21) = 9.$$

Using.

$6 - \delta < x < 6 + \delta$ then $9 - \varepsilon < f(x) < 9 + \varepsilon$

~~where $\delta = 0.1$ & $\varepsilon = \Delta\delta = 0.01$~~

for $\delta$ we start from the (LHS). $6 - 0.1 = 5.9$.

$6 + 0.1 = 6.1$

and for $\varepsilon$ we start from the (RHS). ~~6~~ $9 - 0.5 = 8.5$

$9 + 0.5 = 9.5$

| $x$ | | | $f(x)$ | | |
|---|---|---|---|---|---|
| $6 - \delta$ | $6 + \delta$ | a | $9 - \varepsilon$ | $9 + \varepsilon$ | L |
| 5.90 | 6.10 | 6 | 8.5 | 9.5 | 9 |
| 5.91 | 6.09 | | 8.55 | 9.45 | |
| 5.92 | 6.08 | | 8.60 | 9.40 | |
| 5.93 | 6.07 | | 8.65 | 9.35 | |
| 5.94 | 6.06 | | 8.70 | 9.30 | |
| 5.95 | 6.05 | | 8.75 | 9.25 | |
| 5.96 | 6.04 | | 8.80 | 9.20 | |
| 5.97 | 6.03 | | 8.85 | 9.15 | |
| 5.98 | 6.02 | | 8.90 | 9.10 | |
| 5.99 | 6.01 | | 8.95 | 9.05 | |
| 6.00 | 6.00 | | 9.00 | 9.00 | |

HARDING - YOUTH TITANIA S. 18/ENG08/007

(3) Show whether the function given below is continuous on the Interval [-5, 5].

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

Solution

~~Substituting~~

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

when $x = -5$.

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

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

when $x = -4$

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

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

$= \sqrt{9} = 3$

when $x = -3$

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

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

$= \sqrt{16} = 4$

when $x = -2$

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

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

$= 21^{1/2} = \sqrt{21} = 4.58$

when $x = -1$

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

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

$= 24^{1/2} = \sqrt{24} = 2\sqrt{6}$ or $4.899$

when $x = 0$

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

$= 25^{1/2} = \sqrt{25} = 5$

HARDING-NOOH TITANIA B. 18/ENG08/007

when $x = 1$

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

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

$= 4.899$

when $x = 2.$

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

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

when $x = 3$

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

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

$= \sqrt{16} = 4$

when $x = 4.$

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

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

$= \sqrt{9} = 3_{//}$

when $x = 5$

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

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

$= 0_{//}$

Comment; $f(x) = (25-x^2)^{1/2}$ is continous on Interval $[-5, 5]$ because the Limit of the function, ~~it's~~ is defined, it exists and is equal to the value of the function at $x = [-5, 5]$.