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 18/ENGG06/012  
 MECHANICAL ENGINEERING  
 ENG 281: ENGINEERING MATHS I  
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① Show that the limit of the function given in equation (1.1) as  $x$  approaches 0 is  $a/b$ .

Eqn (1.1) =  $f(x) = \frac{\sin ax}{bx}$

Solution

$x \rightarrow 0 \quad \sin a(0) = 0$

$b(0) = 0$

Using L'Hopital's Rule =  $\frac{\sin ax}{bx}$

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

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

② 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  $\Delta \delta = 0.01$ , demonstrates in a tabular form, that the limit of the model as  $x \rightarrow 9$  is equal to 9.

Solution

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

$6 - 0.1 = 5.9$  (Left hand Rule)

$6 + 0.1 = 6.1$  (Right hand Rule)

$9 - 0.5 = 8.5$  (Left hand Rule)

$9 + 0.5 = 9.5$  (Left hand Rule)

$x$	$f(x)$	$x$	$f(x)$
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
6.0	9.0	6.00	9.00

③ Show whether the function given in equation (1.3) is continuous on the interval  $(-5, 5)$

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

$$\textcircled{a} -5$$

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

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

$$= (0)^{1/2}$$

$$= 0$$

$$\textcircled{b} -4$$

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

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

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

$$= 3$$

$$\textcircled{c} -3$$

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

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

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

$$= 4$$

$$\textcircled{d} -2$$

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

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

$$= (21)^{1/2}$$

$$= 4.58$$

$$\textcircled{e} -1$$

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

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

$$= (24)^{1/2}$$

$$= 4.89$$

$$\textcircled{f} 0$$

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

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

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

$$= 5$$

$$\textcircled{g} 1$$

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

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

$$= (24)^{1/2}$$

$$= 4.89$$

$$\textcircled{h} 2$$

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

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

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

$$= (21)^{1/2}$$

$$= 4.58$$

$$\textcircled{i} 3$$

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

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

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

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

$$= 4$$

$$\textcircled{j} 4$$

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

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

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

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

$$= 3$$

$$\textcircled{k} 5$$

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

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

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

$$= (0)^{1/2}$$

$$= 0$$

$\therefore$  The function is continuous.