

# Unit-5: Limit

<b>5.</b>	<b>L37 TO L42</b>	<p><b>Limit</b></p> <p><b>Course Outcome (CO e):</b> Demonstrate the ability to analyze and illustrate the Function using the concept of Limit.</p>
	<b>37</b>	<p>Definition of limit of function with illustration</p> <p>Meaning of <math>\lim f(x)</math></p>
	<b>38</b>	<p>Working rules of limit (without proof)</p> <p>1. <math>\lim_{x \rightarrow a} C f(x) = C \lim_{x \rightarrow a} f(x)</math></p> <p>2. <math>\lim_{x \rightarrow a} [f(x) \pm g(x)] = \lim_{x \rightarrow a} f(x) \pm \lim_{x \rightarrow a} g(x)</math></p> <p>3. <math>\lim_{x \rightarrow a} [f(x) g(x)] = \lim_{x \rightarrow a} f(x) \lim_{x \rightarrow a} g(x)</math></p> <p>4. <math>\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)}</math></p> <p>5. <math>\lim_{x \rightarrow a} f[g(x)] = f\left(\lim_{x \rightarrow a} g(x)\right)</math></p> <p>Examples of evaluating limit of function on above rules</p>
	<b>39</b>	<p>Evaluation of limit of simple algebraic functions and trigonometric limits</p> <p>1. <math>\lim_{x \rightarrow a} x = a</math>.</p> <p>2. <math>\lim_{x \rightarrow a} x^n = a^n</math>.</p> <p>3. <math>\lim_{x \rightarrow a} \sqrt[n]{x} = \sqrt[n]{a}</math>.</p> <p>4. <math>\lim_{x \rightarrow a} \sin x = \sin a</math>.</p> <p>5.. <math>\lim_{x \rightarrow a} \cos x = \cos a</math></p> <p>Examples of evaluating limit of function on above rules</p>

<b>40 TO 42</b>	<p>6.. <math>\lim_{x \rightarrow \infty} \frac{K}{x^n} = 0, n &gt; 0.</math></p> <p>7.. <math>\lim_{x \rightarrow \infty} x^n = \infty, n &gt; 0.</math></p> <p>8. <math>\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = n \cdot a^{n-1}, n \in R.</math></p> <p>9. <math>\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1</math>      <math>\lim_{x \rightarrow 0} \frac{\sin kx}{kx} = 1</math></p> <p>10. <math>\lim_{\theta \rightarrow 0} \frac{\tan \theta}{\theta} = 1</math>      <math>\lim_{x \rightarrow 0} \frac{\tan kx}{kx} = 1</math></p> <p>Other method to evaluate limit of function</p> <p>Examples of evaluating limit of function on above rules</p>
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### Unit - 05 Limit

**Course Outcome:** CO e) Demonstrate the ability to analyze and illustrate the Function using the concept of Limit.

➤ **01 Mark**

- 1)  $\lim_{x \rightarrow \pi} \left( \frac{\sin x}{x} \right) = \underline{\hspace{2cm}}$   
 (a) 0    (b) 1    (c) -1                      (d)  $1/\pi$
- 2)  $\lim_{n \rightarrow -1} \frac{2n+3}{3n+2} = \underline{\hspace{2cm}}$   
 (a) 0    (b)  $2/3$     (c)  $3/2$                       (d) 1
- 3)  $\lim_{x \rightarrow 0} \frac{2^x - 1}{x} = \underline{\hspace{2cm}}$   
 (a) 0    (b)  $\log_2 e$     (c)  $\log_e 2$                       (d) 1
- 4)  $\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x} = \underline{\hspace{2cm}}$   
 (a) 0    (b)  $\frac{180}{\pi}$     (c)  $\frac{\pi}{180}$                       (d) 1
- 5)  $\lim_{x \rightarrow 0} \frac{x}{\tan 5x} = \underline{\hspace{2cm}}$   
 (a) 0    (b)  $\frac{1}{5}$     (c) 5                      (d) 1
- 6)  $\lim_{x \rightarrow 0} (1-x)^{\frac{1}{x}} = \underline{\hspace{2cm}}$

- (a) 0 (b)  $e$  (c)  $\frac{1}{e}$  (d) 1

Answers: - 1) a 2) b 3) c 4) c 5) b 6) c

➤ **03 Marks**

- 1) Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{x^2 + 3x + 5}{x + 2} \right)$  (Ans: -5/2)
- 2) Evaluate:  $\lim_{\theta \rightarrow 0} \left( \frac{\sin 4\theta}{\tan 5\theta} \right)$  (Ans: -4/5)
- 3) Evaluate:  $\lim_{x \rightarrow \infty} \left( 1 + \frac{2}{x} \right)^{5x}$  (Ans: -  $e^{10}$ )
- 4) Evaluate  $\lim_{x \rightarrow 0} \frac{a^x + \sin x - 1}{x}$  (Ans: -  $\log_e a + 1$ )
- 5) Evaluate:  $\lim_{x \rightarrow 0} \left( 1 + \frac{5x}{7} \right)^{\frac{1}{2x}}$  (Ans: -  $e^{\frac{5}{14}}$ )
- 6) Evaluate:  $\lim_{x \rightarrow 0} (1 + 9x)^{\frac{1}{3x}}$  (Ans: -  $e^3$ )
- 7) Evaluate:  $\lim_{x \rightarrow 2} \frac{x^2 - x - 2}{x - 2}$  (Ans: -3)
- 8) Evaluate:  $\lim_{x \rightarrow \infty} \left( 1 + \frac{2}{3x} \right)^{2x}$  (Ans: -  $e^{\frac{4}{3}}$ )

➤ **04 Marks**

- 1) Evaluate:  $\lim_{x \rightarrow 3} \frac{\sqrt{x+5} - \sqrt{8}}{\sqrt{x-1} - \sqrt{2}}$  (Ans: -1/2)
- 2) Evaluate:  $\lim_{x \rightarrow \infty} \frac{x(x+1)}{x^2 + 5x + 6}$  (Ans: -1)
- 3) Evaluate:  $\lim_{\theta \rightarrow 0} \frac{\operatorname{cosec} \theta - \cot \theta}{\theta}$  (Ans: -1/2)
- 4) Evaluate:  $\lim_{x \rightarrow 0} \frac{3 \sin x - \sin 3x}{x^3}$  (Ans: -4)
- 5) Evaluate:  $\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$  (Ans: -  $\log_e \frac{a}{b}$ )
- 6) Evaluate:  $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x^3 - 8}$  (Ans: -8/3)
- 7) Evaluate:  $\lim_{x \rightarrow 0} \frac{\sqrt{9+x} - 3}{x}$  (Ans: -1/6)
- 8) Evaluate:  $\lim_{n \rightarrow \infty} \sqrt{3n} (\sqrt{n+1} - \sqrt{n})$  (Ans: -  $\sqrt{3}/2$ )
- 9) Evaluate:  $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + \dots + n^2}{n^3 + 1}$  (Ans: -1/3)
- 10) Evaluate:  $\lim_{x \rightarrow 2} \frac{x^3 - 3x^2 + 5x - 6}{x^3 - 8}$  (Ans: -5/12)
- 11) Evaluate:  $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$  (Ans: -1/2)