MATHS

BOOKS - MODERN PUBLISHERS MATHS (HINGLISH)

LIMITS AND DERIVATIVES

Illustration

1. Consider the function $f(x) = x^3$. To find the limit as $x \to 1$.

A. 1

B. -1

C. 2

D. -2

Answer: A

2. Consider the constant function f(x) = 2. To find the limit of f(x) as $x \to 3$.

A. 0

B. 1

C. -1

D. 2

Answer: D

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3. Consider the function $f(x) = \sin x$. We are interested in $\lim_{x \to \frac{\pi}{2}} \sin x$,where the angle is measured in radians.

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4. Consider the function $f(x) = \frac{1}{x^2}$ for $x > 0$. To find $\lim_{x \to 0} f(x)$.

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5. Consider the function :

$$f(x) = \begin{cases} x - 2, & x < 0 \\ 0, & x = 0 \\ x + 2, & x > 0. \end{cases}$$

To find $\lim_{x \to 0} f(x)$.

A. -2

B. 2

C. limit does not exist

D. none of these

Answer: C

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6. Consider the function :

$$f(x) = \begin{cases} x+2, & x \neq 1 \\ 0, & x = 1. \end{cases}$$

To find $\lim_{x \to 1} f(x)$.

A. 1

B. 2

C. does not exist

D. none of these

Answer: B

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Illustrative Examples

1. Evaluate left-handed limit of the function :

$$f(x) = \begin{cases} \frac{|x-3|}{x-3}, & x \neq 3 \\ 0, & x = 3 \end{cases}$$ at x = 3.

A. 1

B. -1

C. 2

D. 0

Answer: B

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2. Evaluate right-handed limit of the function :

$$f(x) = \begin{cases} \frac{|x-3|}{x-3}, & x \neq 3 \\ 0, & x = 3 \end{cases}$$ at x = 3.

A. 1

B. -1

C. 0

D. 2

Answer: A

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3. Find the derivatives of each of the following functions :

$f(x) = 7$

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4. Find the derivatives of each of the following functions :

$f(x) = 8x^4$

A. $30x^2$

B. $32x^3$

C. $32x$

D. इनमे से कोई नहीं

Answer: B

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5. For each of the following fuctions, evaluate the derivative at the indicated value (s) :

$s = 4 \cdot 9t^2, t = 1, t = 5$

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6. For each of the following fuctions, evaluate the derivative at the indicated value (s) :

$g(x) = 4x^8, x = -\frac{1}{2}, x = \frac{1}{2}$

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7. Given : $V = \frac{4}{3}\pi r^3$, find $\frac{dV}{dr}$ and hence $\left.\frac{dV}{dr}\right]_{r=2}$.

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8. Find $\frac{dy}{dx}$ when :

$y = 6x^{100} - x^{55} + x$

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9. Find $\frac{dy}{dx}$ when :

$y = \frac{x^8}{8} - \frac{x^6}{6} + \frac{x^4}{4} - 2$

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10. Find the derivative of :

$f(x) = x + x^2 + x^3 + \ldots\ldots + x^{50}$ at x = 1.

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11. Find the derivatives of the following :

$$G(x) = \left(\sqrt{2}x^3 + x^5\right)\left(\sqrt{3}x^2 + \frac{1}{5}x^5\right)$$

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12. Find the derivatives of the following :

$$f(x) = \left(x^3 - 3x^2 + 4\right)\left(4x^5 + x^2 - 1\right).$$

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13. Find the derivative of :

$$g(x) = x(x - 3)\left(x^2 + x\right).$$

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14. Find the derivatives of the following :

$$g(x) = \frac{3x^2 - 2}{x^2 + 7}$$

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15. Find the derivatives of the following :

$$f(x) = \frac{3x + 2}{(x + 5)(2x + 1) + 3}$$

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16. it is known for $x \neq 1$ that $1 + x + x^2 + \ldots\ldots + x^{n-1} = \frac{1 - x^n}{1 - x}$, hence find the sum of the series $S = 1 + 2x + 3x^2 + \ldots\ldots + (n + 1)x^n$.

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Frequently Asked Questions

1. $\left(\lim\right)_{x \to 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}, a + b + c \neq 0$

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2. Evaluate the following limits by the Method of Factors :

$\lim_{x \to 1} \frac{x^2 - 1}{x - 1}.$

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3. Evaluate :

$\lim_{x \to 2} \frac{x^{10} - 1024}{x^4 - 16}$, by using Formula.

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4. Find all possible values of a if $\lim_{x \to a} \frac{x^9 - a^9}{x - a} = 9$.

A. $a = \pm 1$

B. $a = \pm 2$

C. $a = 0$

D. none of the above

Answer: A

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5. Evaluate $\lim_{h \to 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$

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6. Evaluate $\lim_{x \to 0} \frac{(1+x)^4 - 1}{x}$

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7. $\lim_{x \to 1} \frac{\left(x + x^2 + x^3 + \vdots + x^n\right) - n}{x - 1}$

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8. Find $\lim_{x \to 1} f(x)$, where

$$f(x) = \begin{cases} x^2 - 1 & x \leq 1 \\ -x^2 - 1 & x > 1 \end{cases}$$

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9. Evaluate : $\lim_{x \to 0} f(x) = \begin{cases} \frac{|x|}{x}, & x \neq 0 \\ 0, & x = 0. \end{cases}$

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10. Let $a_1, a_2, \ldots, a_n$ be fixed real numbers and let

$$f(x) = (x - a_1)(x - a_2)(x - a_3)\ldots(x - a_n).$$

Find $\lim_{x \to a_1} f(x)$.

If $a \neq a_1, a_2, \ldots, a_n$, *Compute* $\lim_{x \to a} f(x)$.

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11. $\lim_{x \to 0} \frac{\sin x - 2\sin 3x + \sin 5x}{x}$

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12. $\lim_{x \to 0} \frac{\text{cosec}x - \cot x}{x}$ is equal to

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13. Evaluate the following limits:

$\lim_{x \to 0} \frac{(1 - \cos 3x)}{x^2}$

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14. Evaluate the following limits:

$$\lim_{x \to 0} \frac{(1 - \cos x)}{\sin^2 x}$$

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15. Evaluate, $\lim_{x \to (\pi/4)} \frac{\sin x - \cos x}{x - \frac{\pi}{4}}$

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16. $\lim_{x \to \pi/6} \frac{\sqrt{3} \sin x - \cos x}{x - \frac{\pi}{6}}$

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17. $\lim_{x \to \frac{\pi}{4}} \frac{\sec^2 x - 2}{\tan x - 1}$

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18. Evaluate : $\lim_{x \to 0} \frac{\sqrt{5} - \sqrt{4 + \cos x}}{3 \sin^2 x}$.

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19. Evaluate : $\lim_{x \to 0} \frac{1 - \cos x \cos 2x \cos 3x}{\sin^2 2x}$

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20. Evaluate:

$$\lim_{x \to 0} \frac{8}{x^8} \left\{ 1 - \frac{\cos\left(x^2\right)}{2} - \frac{\cos\left(x^2\right)}{4} + \frac{\cos\left(x^2\right)}{2} \frac{\cos\left(x^2\right)}{4} \right\}$$

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21. Evaluate : $\lim_{x \to 0} \frac{a^x - 1}{b^x - 1}$.

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22. Evaluate $\lim_{x \to 1} \frac{a^{x-1} - 1}{\sin \pi x}$.

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23. $\lim_{x \to 0} \left(\frac{e^{3x} - e^{2x}}{x} \right)$

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24. Evaluate : $\lim_{x \to 0} \frac{3^x + 3^{-x} - 2}{x^2}$.

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25. Evaluate $\lim_{x \to 0} \frac{e^x + e^{-x} - 2}{x^2}$

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26. Evaluate $\lim_{x \to 0} \frac{x(e^x - 1)}{1 - \cos x}$ is equal to

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27. $\lim_{x->0} \frac{1-\cos x\sqrt{\cos 2x}}{(e^x \hat{} 2-1)}$

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28. Evaluate : $\lim_{x\to 0} \frac{\log(1+x)}{\sin x}$.

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29. $\lim_{x->0} \left(\frac{\log\left(1+x^3\right)}{\sin^3 x}\right.$

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30. Evaluate : $\lim_{x \to 0} \frac{e^x - 1}{\sqrt{1 - \cos x}}$.

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31. Find the derivative of $f(x) = 10x$ at $x = 10$.

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32. Find the derivative of $f(x) = 3$ at $x = 0$ and at $x = 3$.

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33. If for the function 'f', given by :

$f(x) = kx^2 + 7x + 4$, $f'(5) = 97$, find 'k'.

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34. Find the derivative of $\backslash f(x) = 2x^2 + 3x - 5 \backslash a r t \backslash x = -1$. Also, prove that fprime^(0) + 3fprime^(− 1) = 0.

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35. Given $f(x) = 2x^3$, find $f'(x)$ by delta method.

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36. Given $f(x) = \frac{1}{\sqrt{x}}, x > 0$, find $f'(x)$ by delta method.

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37. find the derivatives of the following :

$\cos 3x$

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38. Use delta method to find the derivatives of the following :

$\cot(2x+1)$

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39. Use delta method to find the derivatives of the following :

$x \sin x$

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40. Find the derivative of the following :

$x^3 \sin x + 2x \cos x - 2x \sin x$

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41. $\frac{d}{dx}\left(\frac{\sec x + \tan x}{\sec x - \tan x}\right) =$

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42. Find the derivative of the following :

$$\frac{1-\cos x}{1+\cos x}.$$

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43. Evaluate the derivative of the following function at indicated point :

$$\frac{1-\sin x}{1+\cos x}, x=\frac{\pi}{2}.$$

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Exercise 13 A

1. Evaluate the following limits, if they exist :

$$\lim_{x \to 2} 4$$

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2. Evaluate the following limits, if they exist :

$$\lim_{r \to 1} \pi r^2$$

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3. $\operatorname{Lim}_{x \to \pi} \left(x - \frac{22}{7} \right)$

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4. Evaluate the following limits, if they exist :

$$\lim_{x \to 2} (3 - x)$$

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5. Evaluate the following limits, if they exist :

$$\lim_{x \to 1} (x^3 - x^2 + 1)$$

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6. Evaluate the following limits, if they exist :

$$\lim_{x \to 3} [x(x + 1)]$$

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7. Evaluate the following limits, if they exist :

$$\lim_{x \to 0} \frac{3x + 1}{x + 3}$$

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8. $\lim_{x \to 0} \frac{ax + b}{cx + 1}$

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9. Evaluate the following limits, if they exist :

$$\lim_{x \to 1} \frac{x^2 + 1}{x + 100}$$

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10. Evaluate the following limits, if they exist :

$$\lim_{x \to 3} \frac{x^2 - 4x}{x - 2}$$

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11. Evaluate the following limits, if they exist :

$$\lim_{x \to 2} \frac{x^3 - 4x^2 + 4x}{x^2 - 4}$$

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12. Evaluate: $\lim_{x \to 2} \frac{x^2 - 4}{x^3 - 4x^2 + 4x}$

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13. Evaluate the following limits, if they exist :

$$\lim_{x \to 3} \frac{x^3 - 4x - 15}{x^3 + x^2 - 6x - 18}.$$

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14. Evaluate the following limits, if they exist :

$$\lim_{x \to 0} \left((x-1)^2 + 5 \right)$$

A. 6

B. 5

C. 4

D. 3

Answer: A

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15. Evaluate the following limits, if they exist :

$$\lim_{x \to -1} \left[1 + x + x^2 + \ldots\ldots + x^{10}\right].$$

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16. Evaluate the following limits :

$$\lim_{x \to 1} \frac{x - 1}{x + 1}$$

A. 0

B. 1

C. 2

D. 3

Answer: A

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17. Evaluate the following limits :

$$\lim_{x \to -2} \frac{\frac{1}{x} + \frac{1}{2}}{x + 2}$$

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18. Evaluate following limits :

$$\lim_{x \to -1} \frac{x^2 - 1}{x + 1}$$

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19. Evaluate the following limits :

$$\lim_{x \to 1} \frac{x^3 - 1}{x - 1}$$

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20. Evaluate the following limits :

$$\lim_{n \to 2} \frac{n^3 - 8}{n^2 - 4}$$

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21. Evaluate the following limits :

$$\lim_{x \to 2} \frac{x^3 - 2x^2}{x^2 - 5x + 6}$$

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22. Find the value of the limit given below

$$\lim_{n \to \frac{1}{2}} \frac{4n^2 - 1}{2n - 1}$$

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23. Evaluate the following limits :

$$\lim_{x \to 5} \frac{x^2 - 9x + 20}{x^2 - 6x + 5}$$

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{5}$

D. none of these

Answer: B

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24. Evaluate the following limits :

$$\lim_{x \to 1} \left[\frac{x-2}{x^2-x} - \frac{1}{x^3-3x^2+2x} \right]$$

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25. Evaluate the following limits :

$$\lim_{x \to -1} \frac{x^3+1}{x+1}.$$

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26. If $\left(\lim \right)_{x \to -a} \frac{x^9+a^9}{x+a} 9$, find the real value of a.

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27. Evaluate the left-hand and right-hand limits of the following function at x = 1 :

$$f(x) = \begin{cases} 5x - 4, & \text{if } 0 < x \leq 1 \\ 4x^2 - 3x, & \text{if } 1 < x < 2. \end{cases}$$

Does $\lim_{x \to 1} f(x)$ exist ?

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28. Find 'k' so that :

$\lim_{x \to 2} f(x)$ exists, where :

$$f(x) = \begin{cases} 2x + 3, & \text{if } x \leq 2 \\ x + k, & \text{if } x > 2 \end{cases}$$

A. 3

B. 4

C. 5

D. 6

Answer: C

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29. Find 'k' so that :

$\lim_{x \to 2} f(x)$ exists, where :

$$f(x) = \begin{cases} 2x + 3, & \text{if } x \leq 2 \\ x + 2k, & \text{if } x > 2 \end{cases}$$

A. $\frac{5}{2}$

B. 5

C. 2

D. $\frac{1}{2}$

Answer: A

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30. Find 'k' so that :

$\lim_{x \to 2} f(x)$ exists, where :

$$f(x) = \begin{cases} 2x + 3, & \text{if } x \leq 2 \\ x + 3k, & \text{if } x > 2 \end{cases}$$

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31. Evaluate the following limits :

$$\lim_{x \to 1} \frac{x^{15} - 1}{x^{10} - 1}$$

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32. Evaluate the following limits :

$$\lim_{x \to 0} \frac{(x+1)^5 - 1}{x}$$

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33. Prove that $\lim_{x \to 0} \frac{(1+x)^n - 1}{x} = n.$

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34. If

$$(\lim)_{x \to 2} \frac{x^n - 2^n}{x - 2} = 80 amdm \in N, then f \in dthevalueofn$$

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35. $\lim_{x \to 3} \frac{x^3 - 7x^2 + 15x - 9}{x^4 - 5x^3 + 27x - 27}$ is equal to:

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36. Evaluate:

$$\left(\lim \right)_{x \to \sqrt{2}} \frac{x^9 - 3x^8 + x^6 - 9x^4 - 4x^2 - 16x + 84}{x^5 - 3x^4 - 4x + 12}$$

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37. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$$

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38. Evaluate the following limit:

$$(\lim)_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{2x}$$

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39. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{\sqrt{2-x} - \sqrt{2+x}}{x} \right)$$

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40. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{1+3x} - \sqrt{1-3x}}{x}$$

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41. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{1+x}-1}{x}$$

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42. Evaluate the following limits :

$$\lim_{x \to 2} \frac{2-x}{\sqrt{2+x}-2}.$$

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43. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{x+2}-\sqrt{2}}{x}$$

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44. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{1-x^2} - \sqrt{1+x^2}}{2x^2}$$

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45. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{a^2+x^2} - \sqrt{a^2-x^2}}{x^2}.$$

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46. Evaluate the following limits :

$$\lim_{h \to 0} \frac{1}{h}\left[\frac{1}{x+h} - \frac{1}{x}\right]$$

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47. $\lim_{x \to 2} \left[\frac{1}{x-2} - \frac{2(2x-3)}{x^3 - 3x^2 + 2x} \right]$

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48. Find all possible values of 'a', if :

$$\lim_{x \to a} \frac{x^9 - a^9}{x - a} = \lim_{x \to 5} (4 + x)$$

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49. If $\left(\lim \right)_{x \to a} \frac{x^3 - a^3}{x - a} = \left(\lim \right)_{x \to 1} \frac{x^4 - 1}{x - 1}$, find all possible value o a.

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50. $\lim_{z \to 1} \frac{2^{1/3} - 1}{z^{1/6} - 1}$

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51. Prove that :

$\lim_{x \to 0} \frac{|x|}{x}$ does not exist

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52. Prove that :

$\lim_{x \to 0} \frac{x}{|x|}$ does not exist

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53. Prove that :

$$\lim_{x \to 0^+} \frac{x}{|x|} = 1$$

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54. Prove that :

$$\lim_{x \to 0^-} \frac{x}{|x|} = -1.$$

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55. If the function f(x) satisfies $\lim_{x \to 1} \frac{f(x) - 2}{x^2 - 1} = \pi$, then $\lim_{x \to 1} f(x)$ is equal to

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56. Find $\lim_{x \to 0} f(x)$, where $f(x) = |x| - 5$.

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57. Evaluate $\lim_{x \to 0} f(x)$, where :

$$f(x) = \begin{cases} \frac{x}{|x|}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

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Exercise 13 B

1. $\lim_{x \to 0} \frac{\cos x}{\pi - x}$

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2. Evaluate the following :

$$\lim_{\theta \to 0} \frac{1 - \cos \theta}{2\theta^2}$$

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3. Evaluate $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$

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4. Evaluate the following limit: $\left(\lim \right)_{x \to 0} \frac{1 - \cos 4x}{x^2}$

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5. $\lim_{x \to 0} \frac{\cos 2x - 1}{\cos x - 1}$

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6. Evaluate, $\lim_{x \to 0} \frac{1 - \cos mx}{1 - \cos nx}$

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7. Evaluate the following limit: $\left(\lim \right)_{x \to 0} \frac{1 - \cos 5x}{1 - \cos 6x}$

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8. Evaluate the following :

$\lim_{\theta \to 0} \frac{1 - \cos \theta}{1 - \cos 3\theta}$

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9. Evaluate the following :

$$\lim_{x \to 0} \frac{1 - \cos^2 x}{3 \tan^2 x}$$

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10. Evaluate the following limits:

$$\lim_{x \to 0} \frac{(1 - \cos 2x)}{\sin^2 2x}$$

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11. $\lim_{x \to 0} \frac{2 \sin x - \sin 2x}{x^3}$

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12. Evaluate the following :

$$\lim_{x \to 0} \frac{\sin x^{\circ}}{x}$$

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13. $\lim_{x \to 0} \frac{\sin ax}{bx}$

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14. Evaluate the following :

$$\lim_{x \to 0} \frac{x}{\tan x}$$

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15. Evaluate the following :

$$\lim_{x \to 0} \frac{\sin^2 x}{2x}$$

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16. Evaluate the following :

$$\lim_{x \to 0} \frac{x^2}{\sin x^2}$$

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17. Evaluate the following :

$$\lim_{x \to 0} \frac{\sin x^2}{x}$$

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18. $\lim_{x \to 0} \frac{\sin 4x}{\sin 2x}$

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19. $\left(\lim \right)_{x \to \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$

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20. Evaluate the following :

$\lim_{x \to 0} \frac{\sin 5x}{\sin 3x}$

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21. Evaluate the following :

$$\lim_{\theta \to 0} \frac{\sin 4\theta}{\tan 3\theta}$$

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22. Evaluate the following :

$$\lim_{\theta \to 0} \frac{\sin a\theta}{\sin b\theta}$$

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23. Evaluate the following :

$$\lim_{x \to 0} \frac{\tan 2x}{x}$$

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24. Evaluate the following limits:

$$\lim_{x \to 0} (x \cot 2x)$$

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25. Evaluate the following :

$$\lim_{x \to 0} x \sec x$$

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26. Evaluate the following :

$$\lim_{x \to \infty} \frac{\cos x}{x}$$

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27. Evaluate the following :

$$\lim_{x \to 0} \frac{x \tan 4x}{1 - \cos 4x}$$

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28. Evaluate the following :

$$\lim_{x \to \pi} \frac{1 + \cos x}{\tan^2 x}$$

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29. $\lim_{x \to 0} \frac{\sin(2 + x) - \sin(2 - x)}{x}$

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30. $\lim_{x \to 0} \frac{\cos ax - \cos bx}{x^2}$ is equal to

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31. $\lim_{h \to 0} \frac{\sin^2(x+h) - \sin^2 x}{h}$

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32. $\lim_{x \to 0} \frac{(a+x)^2 \sin(a+x) - a^2 \sin a}{x}$

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33. Evaluate the following limits:

$$\lim_{x \to \frac{\pi}{4}} \frac{(\operatorname{cosec}^2 x - 2)}{(\cot x - 1)}$$

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34. Evaluate the following (10-17) limits :

$$\lim_{x \to 0} \frac{\sin 3x - \sin x}{\sin x}$$

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35. Evaluate the following limits :

$$\lim_{\theta \to 0} \frac{\sin 5\theta - \sin 3\theta}{\sin \theta}.$$

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36. Evaluate the following limits:

$$\lim_{x \to 0} \frac{(\tan x - \sin x)}{\sin^3 x}$$

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37. Evaluate $\lim_{x \to 0} \frac{\tan x - \sin x}{x^3}$.

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38. Evaluate the following limits :

$$\lim_{x \to \frac{\pi}{2}} \frac{\cot x - \cos x}{\cos^3 x}$$

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39. Evaluate $\lim_{x \to 0} \frac{\tan 3x - 2x}{3x - \sin^2 x}$

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40. Evaluate the following (10-17) limits :

$\lim_{x \to 0} \frac{\sin 2x + 3x}{4x - \sin 5x}$

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41. $\lim_{x \to 0} \frac{\sin 2x + 3x}{2x + \tan 3x}$

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42. $\lim_{x -> 0} \frac{\tan 2x - \sin 2x}{x^3}$

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43. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sin 4x - \tan 4x}{x^3}$$

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44. Evaluate the following (10-17) limits :

$$\lim_{x \to \pi/2} \frac{\cos^2 x}{1 - \sin^2 x}.$$

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45. Evaluate the following (10-17) limits :

$$\lim_{y \to 0} \frac{(x+y)\sec(x+y) - x \sec x}{y}.$$

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46. Evaluate the following limits:

$$\lim_{x \to \frac{\pi}{4}} \frac{\left(\cos ec^2 x - 2\right)}{\left(\cot x - 1\right)}$$

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47. Evaluate the following (10-17) limits :

$$\lim_{x \to 0} \frac{\tan 3x + x}{2x + \sin 4x}$$

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48. Evaluate the following limits :

$$\lim_{\theta \to 0} \left(\frac{\cos ec\theta - \cot \theta}{\theta} \right)$$

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49. Evaluate the following (10-17) limits :

11. $\lim_{x \to 1} \frac{1 + \cos \pi x}{(1 - x)^2}$

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50. $\lim_{x \to \frac{\pi}{2}} \frac{1 + \cos 2x}{(\pi - 2x)^2}$

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51. Evaluate the following limits :

$$\lim_{\theta \to \frac{\pi}{2}} \frac{\tan 2\theta}{\theta - \frac{\pi}{2}}$$

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52. $\lim_{x \to \pi} \left(\frac{\sin 3x - 3 \sin x}{(\pi - x)^3} \right)$

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53. Evaluate the following (10-17) limits :

$$\lim_{x \to \frac{\pi}{2}} \frac{\cot x}{\frac{\pi}{2} - x}$$

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54. Evaluate $\lim_{x \to \frac{\pi}{2}} \frac{\cos x}{\left(\frac{\pi}{2} - x\right)}$.

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55. Select the correct alternatives out of given four alternatives in each.

$\lim_{x \to \pi} \frac{\sin x}{x - \pi}$ is-

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56. $\lim_{x \to \frac{\pi}{4}} \frac{\tan^3 x - \tan x}{\cos\left(x + \frac{\pi}{4}\right)}$

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57. Evaluate the following $\lim_{t \to 1} \frac{1 - \frac{1}{t}}{\sin[\pi(t-1)]}$

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58. Evaluate the following limits: $\lim_{x \to \frac{\pi}{2}} \left(\frac{\pi}{2} - x\right) \tan x$

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59. Let $f(x) = \begin{cases} \cos x & \text{if} \quad x \geq 0 \\ x + k & \text{if} \quad x < 0. \end{cases}$

Find the value of the constant k, given that $\lim_{x \to 0} f(x)$ exists.

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Exercise 13 C

1. Evaluate the following limits :

$$\lim_{x \to 0} e^x$$

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2. Evaluate the following limits :

$$\lim_{x \to -\infty} e^x$$

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3. Evaluate the following limits :

$$\lim_{x \to \infty} e^{-x}$$

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4. Evaluate the following limits :

$$\lim_{x \to -\infty} 2^x$$

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5. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{e^{4x} - 1}{x} \right)$$

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6. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{2^x - 1}{x} \right)$$

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7. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{3^{2+x} - 9}{x} \right)$$

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8. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{e^{2+x} - e^{2}}{x} \right)$$

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9. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{e^x - x - 1}{x} \right)$$

Watch Video Solution

10. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^x - \sin x - 1}{x}$$

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11. Evaluate the following limits:

$$\lim_{x \to 0} \frac{\left(e^{3+x} - \sin x - e^3\right)}{x}$$

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12. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^x - e^{\sin x}}{x - \sin x}$$

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13. Evaluate the following limit: $\left(\lim \right)_{x \to 5} \frac{e^x - e^5}{x -}$

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14. Evaluate the following limits :

$$\lim_{x \to 2} \frac{e^x - e^2}{x - 2}$$

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15. Evaluate the limits, if exist $\left(\lim\right)_{x \to 3} \dfrac{e^x - e^3}{x - 3}$

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16. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{a^x - b^x}{x} \right)$$

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17. Evaluate the following limits:

$$\lim_{x \to 0} \left(\frac{a^x - a^{-x}}{x} \right)$$

Watch Video Solution

18. Evaluate the following limits :

$$\lim_{x \to 0} \left(e^{x} - e^{-x}\right)$$

Watch Video Solution

19. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^{x} - e^{-x}}{x}$$

Watch Video Solution

20. Evaluate the following limits :

$$\lim_{x \to 1} \frac{e^{-x} - e^{-1}}{x - 1}$$

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21. Evaluate the following limits :

$$\lim_{x \to 1} \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

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22. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^x - e^{-x}}{\sin x}.$$

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23. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^{bx} - e^{ax}}{x}, \text{ where } 0 < a < b.$$

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24. Evaluate the following limits :

$$\lim_{x \to 1} \frac{\log x}{x - 1}$$

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25. Evaluate the following limits :

$$\lim_{x \to 1} \frac{x - 1}{\log x}.$$

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26. $\lim_{x \to 0} \frac{\ln(1 + 3x)}{3^x - 1}$

Watch Video Solution

27. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\log(1+x)}{e^x - 1}.$$

Watch Video Solution

28. Evaluate the following limits :

$$\lim_{x \to 3} \frac{\log x - \log 3}{x - 3}$$

Watch Video Solution

29. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\log(3+x) - \log(3-x)}{x}.$$

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30. Evaluate the following limits : $\lim_{x \to \infty} \frac{\sin\left(\frac{a}{2^x}\right)}{\sin\left(\frac{b}{2^x}\right)}$.

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31. Evaluate the following limits :

$$\lim_{x \to 0} \left[\frac{1}{x} - \frac{\log(1+x)}{x^2}\right]$$

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32. Evaluate the following limits :

$$\lim_{x \to 2} \frac{3^x + 3^{3-x} - 12}{3^{3-x} - 3^{\frac{x}{2}}}.$$

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33. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^{\sin x} - 1}{x}$$

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34. Evaluate the following limits:

$$\lim_{x \to 0} \frac{\left(e^{\tan x} - 1\right)}{x}$$

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35. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^{\sin x} - 1}{\sin x}$$

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36. Evaluate the following limits:

$$\lim_{x \to 0} \frac{\left(e^{\tan x} - 1\right)}{\tan x}$$

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37. Evaluate the following limits :

$$\lim_{x \to \frac{\pi}{2}} \frac{e^{\sin x} - 1}{\sin x}$$

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38. Evaluate the following limits :

$$\lim_{x \to \frac{\pi}{2}} \frac{e^{\cos x} - 1}{\cos x}$$

Watch Video Solution

39. Evaluate the following limits :

$$\lim_{x \to 0} \frac{e^{\sin 2x} - e^{\sin x}}{x}$$

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40. Evaluate the following limits :

$$\lim_{x \to 0} \left(\frac{e^{x} - e^{-x}}{\sin x} \right)$$

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41. Evaluate the following limits :

$$\lim_{x \to 0} \frac{x\left(e^{2+x} - e^{2}\right)}{1 - \cos x}$$

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42. Evaluate the following limits :

$$\lim_{x \to 0} \frac{x(2^x - 1)}{1 - \cos x}.$$

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43. Evaluate the following limits :

$$\lim_{x \to \frac{\pi}{2}} \frac{2^{-\cos x} - 1}{x\left(x - \frac{\pi}{2}\right)}$$

Watch Video Solution

44. Evaluate the following limits :

$$\lim_{x \to 0} \frac{\sqrt{1+x} - 1}{\log(1+x)}.$$

Watch Video Solution

45. Evaluate $\lim_{x \to 0} \frac{2^x - 1}{\sqrt{1+x} - 1}$.

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46. Evaluate the following limit: $\left(\lim \right)_{x \to 0} \frac{5^x - 1}{\sqrt{4+x} - 2}$

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47. $\lim_{x \to 0} \tan\left(\frac{\pi}{4} + x\right)^{\frac{1}{x}} =$

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Exercise 13 D

1. Find the derivative at x = 2 of the function $f(x) = 4x$.

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2. If $f(x) = x^2 - 19x + 18$, then find $f'(2), f'(1)$ and $f'(10)$, using limit process only once.

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3. Show that the derivative of the function f given by $f(x) = 2x^3 - 9x^2 + 12x + 9$, at $x = 1$ and $x = 2$ are equal.

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4. For the function $f, f(x) = x^2 - 4x + 7$, show that $f'(5) = 2f'\left(\frac{7}{2}\right)$.

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5. Given $f(x) = ax^2$, where 'a' is a constant, find $f'(x)$ by the delta method. Hence find $f'(2)$.

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6. Given $h(r) = \pi r^2$, use the delta method to find $h'(r)$. Hence, find $h'\left(\frac{5}{2}\right)$ and $h'(\pi)$.

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7. If y = 2x, find $\frac{dy}{dx}$ from first principles.

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8. If $f(x) = (x-1)^2$, find f' from first principles.

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9. If $f(x) = 3x^2 + 5x - 1$, find $f'(x)$

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10. Let $y = ax^2 + 3$, where 'a' is constant. Find $\frac{dy}{dx}$ by the delta method and find $\left[\frac{dy}{dx}\right]_{x=-1}$.

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11. Find, from first principles, the derivative of the following w.r.t. x :

-x

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12. Find, from first principles, the derivative of the following w.r.t. x :

$(-x)^{-1}$

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13. Find, from first principles, the derivative of the following w.r.t. x :

x^3

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14. Find, the derivative of the following w.r.t. x :

$x^{-\frac{3}{4}}$

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15. Find, from first principles, the derivative of the following w.r.t. x :

$(3x)^{-\frac{3}{2}}$

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16. Find, from first principles, the derivative of the following w.r.t. x :

$\frac{1}{x}, x \neq 0$

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17. Find, from first principles, the derivative of the following w.r.t. x :

$\sqrt{x}$

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18. Find, the derivative of the following w.r.t. x :

$$\sqrt{x} + \frac{1}{\sqrt{x}}$$

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19. Find, from first principles, the derivative of the following w.r.t. x :

$$\frac{x^2 + 2}{x + 2}$$

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20. Differentiate the following by delta method :

$(x-1)(x-2)$

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21. Differentiate the following by :

$(x+1)(x+2)(x+3)$

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22. Differentiate the following from ab-initio (or from definition) :

$x+\frac{1}{x}(x \neq 0)$

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23. Differentiate the following from ab-initio (or from definition) :

$x - \frac{1}{x}(x \neq 0)$

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24. Differentiate the following from ab-initio (or from definition) :

$\frac{x-2}{x+3}, x \neq -3$

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25. Differentiate the following from ab-initio (or from definition) :

$$\frac{x^2+1}{x}, x \neq 0$$

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26. Differentiate each of the following from first principle:

$$\frac{2x+3}{x-2}$$

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27. Differentiate the following from ab-initio (or from definition) :

$$\frac{x^2-6}{3x}, x \neq 0$$

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28. Differentiate each of the following from first principle:

$(x+2)^3$

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Exercise 13 E

1. Find the derivatives of the following (1-3) functions :

f(x) = a

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2. Find the derivatives of the following (1-3) functions :

$f(x) = \pi$

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3. Find the derivatives of the following (1-3) functions :

f(x) = x+a

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4. Find the derivatives of the following (1-3) functions :

$f(x) = (ax + b)^n$

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5. Find the derivatives of the following (1-3) functions :

$$f(x) = 2x - \frac{3}{4}$$

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6. Find the derivatives of the following (1-3) functions :

$$f(x) = x^3 + 4x^2 + 3x + 2$$

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7. Find the derivatives of the following (1-3) functions :

$$y = x^2$$

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8. Find the derivatives of the following (1-3) functions :

$y = \frac{5}{2}x^7$

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9. For each of the following functions, evaluate the derivative at the indicated value (s) :

$f(x) = x, x = 1$

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10. For each of the following functions, evaluate the derivative at the indicated value (s) :

$f(x) = 99x, x = 100$

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11. For each of the following functions, evaluate the derivative at the indicated value (s) :

$f(x) = x^2 - 2, x = 10$

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12. For each of the following functions, evaluate the derivative at the indicated value (s) :

$f(x) = 3, x = 0, 3$

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13. Find 'a' if $f'(a) = 0$, where $f(x) = x^3 - 3x^2 + 3x - 1$

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14. If $f(x) = \alpha x^n$, prove that $\alpha = \dfrac{f'(1)}{n}$.

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15. Prove from first principles, that $\dfrac{d}{dx}(\alpha x^n) = \alpha n x^{n-1}$.

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16. Use the delta method to find the derivative of $f(x) = x^4$. Hence find $f'\left(-\frac{1}{2}\right)$ and $f'(0)$.

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17. If $y = 1 = \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + + \frac{x^n}{n!}$, show that $\frac{dy}{dx} - y + \frac{x^n}{n!} = 0$.

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Exercise 13 F

1. Find the derivatives of the following functions (1-3) at any point of their domains :

$y = \frac{ax + b}{c}, c \neq 0$

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2. Find the derivatives of the following functions (1-3) at any point of their domains :

$y = \left(x - \frac{1}{x}\right)^2$

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3. Find the derivatives of the following functions (1-3) at any point of their domains :

$y = ax^3 + bx^2 + cx + d$

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4. Find the derivatives of the following functions (1-3) at any point of their domains :

$$y = \frac{1}{7}x^7 + \frac{1}{5}x^5 - \frac{2}{3}x^3 + 5$$

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5. Find the derivatives of the following functions (1-3) at any point of their domains :

$$f(x) = x^4 + 7x^3 + 8x^2 + 3x + 2$$

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6. Find the derivatives of the following functions (1-3) at any point of their domains :

$f(x) = 3x^6 - \frac{x^4}{4}$

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7. Find the derivatives of the following functions (1-3) at any point of their domains :

$u = \frac{t^5}{5} - \frac{t^3}{3} + t$

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8. Find the derivatives of the following functions (1-3) at any point of their domains :

$G(t) = -2t^{10} + 1 - t^3 + 7t^5$

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9. Let $f(x) = 3x^3 + 7x^5$. Find $f'(2)$.

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10. Let $f(x) = \frac{x^3}{3} - \frac{x^2}{2} + x - 16$. Find $f'(0), f'(-1)$.

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11. Given $u = 7t^4 - 2t^3 - 8t - 5, \quad \text{find} \quad \frac{du}{dt}$.

Hence, find $\frac{du}{dt}$ at t = 0, 1, 2.

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12. Let $H(y) = 2y^4 - 6y^3 + 2y - 4$. Find $H'(2)$.

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13. Let $G(u) = 2 - u^3 + \frac{u^5}{5}$. Find $G'(-2)$.

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14. If $f(x) = mx + c and f(0) = f'(0) = 1$. What is $f(2)$?

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15. Find the derivative of $x^n + ax^{n-1}1 + a^2x^{n-2} + \vdots + a^{n-1}x + a^n$ for some fixed real number a.

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Exercise 13 G

1. Find the derivatives of the following at any point of their domains :

$f(x) = (x - a)(x - b)$

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2. Find the derivative of the following functions (it is to be understand that a,b,c,d,p,q,r and s are fixed non-zero constants and m and n are integers):

$(ax+b)^n(cx+d)^m$

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3. Find the derivatives of the following at any point of their domains :

$f(x)=\left(x^2-5x+6\right)\left(x^3+2\right)$

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4. Find the derivatives of the following at any point of their domains :

$G(x) = \left(5x^3 + 3x - 1\right)(x - 1)$

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5. Find the derivatives of the following at any point of their domains :

$f(x) = \left(x^2 + 2\right)^2$

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6. Find the derivatives of the following at any point of their domains :

$f(x) = (3x^2 + 2)^2$

Watch Video Solution

7. Find the derivatives of the following at any point of their domains :

$f(x) = (x + 1)^3$

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8. Find the derivatives of the following at any point of their domains :

$f(x) = (x^2 + 2)(x^3 - 3x^2 + 4)(x^4 - 1)$

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9. Find the derivatives of the following at any point of their domains :

$$f(x) = \frac{1}{x}, x \neq 0$$

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10. Find the derivatives of the following at any point of their domains :

$$f(x) = \frac{1}{\sqrt{3}x^3}, x \neq 0$$

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11. Find the derivatives of the following at any point of their domains :

$f(x) = (ax^2 + b)^2$

Watch Video Solution

12. Find the derivatives of the following at any point of their domains :

$$\frac{x+1}{x}$$

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13. Find the derivatives of the following at any point of their domains :

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

Watch Video Solution

14. Find the derivatives of the following at any point of their domains :

$$f(x) = \frac{ax + b}{cx + d}$$

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15. Find the derivatives of the following at any point of their domains :

$$g(x) = \frac{1 + \frac{1}{x}}{1 - \frac{1}{x}}$$

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16. Differentiate the following function with respect of x : $\frac{px^2 + qx + r}{ax + b}$

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17. Find the derivatives of the following (9-10) at any point of their domains :

$f(x) = x^3(5 + 3x)$

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18. Find the derivatives of the following (9-10) at any point of their domains :

$f(x) = x^5\left(3 - 6x^{-9}\right)$

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19. Find the derivatives of the following (9-10) at any point of their domains :

$$f(x) = x^{-4}\left(3 - 4x^{-5}\right)$$

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20. Find the derivatives of the following (9-10) at any point of their domains :

$$f(x) = \frac{(x+5)\left(2x^2 - 1\right)}{x}, x \neq 0$$

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21. Find the derivatives of the following (9-10) at any point of their domains :

$H(x) = \dfrac{(x-1)(x-2)}{(x-3)(x-4)}, x \neq 3, 4$

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22. Find the derivative of :

$f(x) = \dfrac{2x+3}{x-2}$

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23. Differentiate $\dfrac{x+2}{x^2-3}$ and find the value of the derivative at x = 0.

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Exercise 13 H

1. Find the derivatives of the following :

$\frac{1}{2}\sin 2x$

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2. Find the derivative of $\sin^2 x$ with respect to 'x'

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3. Find the derivatives of the following :

$\sin x \cos x$

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4. Find the derivatives of the following :

$$\frac{a}{x^4} - \frac{b}{x^2} + \cos x$$

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5. Find the derivatives of the following :

$$\frac{\sin(x+a)}{\cos x}$$

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6. Find the derivatives of the following :

$$5\sec x + 4\cos x$$

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7. $\frac{a + b \sin x}{c + d \cos x}$

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8. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{x}{1 + \tan x}$

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9. Find the derivative of the following functions (it is to be understand that a,b,c,d,p,q,r and s are fixed non-zero constants and m and n are integers):

$\frac{\sin x + \cos x}{\sin x - \cos x}$

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10. Find the derivatives of the following :

$$\frac{x}{\sin^n x}$$

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11. Find the derivatives of the following :

$\sin x \sin 2x$

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12. Find the derivatives of the following :

$\left(x^2+2\right)\cos x$

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13. Find the derivatives of the following :

$(x^2 - 5x + 6)\sec x$

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14. Find the derivatives of the following :

$x^3 + \sin x$

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15. Find the derivative of the following functions (it is to be understand that a,b,c,d,p,q,r and s are fixed non-zero

constants and m and n are integers):

$(x + \sec x)(x - \tan x)$

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16. Use delta method to find the derivatives of the following : $\cos(3x + 5)$

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17. Use delta method to find the derivatives of the following :

$\sin x + \cos x$

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18. Use delta method to find the derivatives of the following :

$\tan 2x$

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19. Use delta method to find the derivatives of the following :

$\tan(3x+1)$

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20. Use delta method to find the derivatives of the following :

$\sec(2x - 1)$

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21. Use delta method to find the derivatives of the following : $\sqrt{\sin x}$

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22. Find $\frac{dy}{dx}$ when : $y = \frac{x + \tan x}{\tan x}$

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23. Find $\frac{dy}{dx}$ when :

$y = \frac{\cos x}{1 + \sin x}$

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24. If $y = \frac{1 - \tan x}{1 + \tan x}$, prove that $\frac{dy}{dx} = \frac{-2}{1 + \sin 2x}$.

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Objective Type Questions A Multiple Choice Questions

1. $\lim_{x \to 0} \frac{\sin x}{1 + \cos x}$ is equal to :

A. 0

B. $\frac{1}{2}$

C. 1

D. -1

Answer: B

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2. $\lim_{x \to \frac{\pi}{2}} \frac{1 - \sin x}{\cos x}$ is equal to :

A. 0

B. -1

C. 1

D. does not exist

Answer: A

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3. $\lim_{x \to 0} \frac{|0|}{x}$ is equal to :

A. 1

B. -1

C. 0

D. does not exist

Answer: C

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4. If $f(x) = x \sin x \text{ then } f'(\pi/2) = \frac{1}{2}$ b. 1 c. 0 d. -1

A. 0

B. 1

C. -1

D. $\frac{1}{2}$

Answer: B

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5. If $f(x) = 1 + x + \frac{x^2}{2} + + \frac{x^{100}}{100}$, then $f'(1)$ is equal to $\frac{1}{100}$ b. 100 c. 50 d. 0

A. $\frac{1}{100}$

B. 100

C. does not exist

D. 0

Answer: B

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6. $\lim_{x \to 0} \frac{\tan x}{x}$ is :

A. 0

B. 1

C. -1

D. Not defined

Answer: B

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7. Evaluate $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$

A. 0

B. 1

C. $\frac{1}{2}$

D. None of these

Answer: C

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8. $\frac{d}{dx}(\sec x)$ is :

A. $\tan x$

B. $\tan x . \sec x$

C. $-\cot^2 x$

D. $\cos ecx$

Answer: B

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9. What is $\lim_{x \to 0} \frac{1 - \cos x}{x}$ equal to ?

A. 0

B. 1

C. $\frac{1}{2}$

D. None of these

Answer: A

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10. $\frac{d}{dx}(\cot x)$ is :

A. $\tan x$

B. $-\cos ec^2 x$

C. $-\cos ecx \cot x$

D. None of these

Answer: B

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11. $\left(\lim\right)_{x \to 0} \frac{\sqrt{1+x}-1}{x}$ is equal to

A. $\frac{1}{2}$

B. 2

C. 0

D. 1

Answer: A

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12. $\lim_{x \to 0} \frac{a^x - 1}{x}$ is equal to :

A. log a

B. log x

C. $\log \frac{1}{a}$

D. None of these

Answer: A

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13. The value of $\lim_{x \to 0} \frac{e^{4x} - 1}{x}$ is :

A. 1

B. 2

C. 4

D. 3

Answer: C

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14. For any positive integer $\lim_{x \to a} \frac{x^n - a^n}{x - a} =$

A. x^{n-1}

B. nx^{n-1}

C. na^{n-1}

D. n

Answer: C

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15. The derivatives of $2x - \frac{5}{4}$ is equal to :

A. 2

B. $\frac{3}{4}$

C. $\frac{-3}{4}$

D. 1

Answer: A

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16. If $y = (ax + b)^n$, they $\frac{dy}{dx}$ is equal to :

A. $\frac{n(ax+b)^{n-1}}{a}$

B. $n(ax+b)^{n-1}$

C. $na(ax+b)^{n-1}$

D. None of these

Answer: C

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17. $\lim_{x \to 0} \frac{\sin 4x}{\sin 2x}$

A. 0

B. 1

C. 2

D. 3

Answer: C

Watch Video Solution

18. The value of $\lim_{x \to 0} \left(\frac{e^x - 1}{x} \right)$ is

A. 0

B. 1

C. -1

D. None of these

Answer: B

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19. $\lim_{x \to 0} \frac{\tan x}{x}$ is :

A. 1

B. 0

C. ∞

D. None of these

Answer: C

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20. The value of $\lim_{x \to 0} \frac{e^{2x} - 1}{x}$ is :

A. -2

B. $\frac{1}{2}$

C. ∞

D. 2

Answer: D

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21. $\lim_{x \to 0} \frac{\sin ax}{\sin bx}, a, b \neq 0$

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. 1

D. $-\frac{b}{a}$

Answer: A

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22. $\lim_{x \to -1} \left[1 + x + x^2 + \ldots + x^{10}\right]$

A. 1

B. 10

C. 0

D. None of these

Answer: A

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23. $\lim_{x \to 0} \frac{\sin ax}{bx}$

A. ab

B. $\frac{b}{a}$

C. $\frac{a}{b}$

D. None of these

Answer: C

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24. $\left(\lim \right)_{x \to 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}, a + b + c \neq 0$

A. $a + b + c$

B. 1

C. abc

D. 2

Answer: B

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25. If $f(x) = 2x^2, \quad \text{find} \quad \dfrac{f(3 \cdot 8) - f(4)}{3 \cdot 8 - 4}$:

A. $1 \cdot 56$

B. 156

C. $15 \cdot 6$

D. $0 \cdot 156$

Answer: D

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Objective Type Questions B Fill In The Blanks

1. $\lim_{x \to 0} \frac{\sin x}{x} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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2. $\lim_{x \to 0} \frac{\tan x}{x} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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3. $\lim_{x \to a} \frac{x^n - a^n}{x - a} = n \cdot a^{n-1}$

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4. If $f(x) = x^3 - 27$, then

$f'(x) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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5. If $f(x) = 4x^3 + 7$, then

$f'(x) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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6. If $f(x) = 4x^3 - 1$, then

$f'(x) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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7. $\frac{d}{dx}(\sqrt{x}) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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8. $\lim_{x \to 3} \frac{x^3 - 4x - 15}{x^3 + x^2 - 6x - 18} = \ldots\ldots\ldots\ldots\ldots\ldots$

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9. $\lim_{x \to 0} \frac{1 - \cos 4x}{1 - \cos 6x}$

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10. $\lim_{x \to 0} \frac{3^x - 2^x}{x} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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11. If f is defined by $f(x) = x^2$, find $f'(2)$.

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12. $\frac{d}{dx}(x \sin x) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

Watch Video Solution

Watch Video Solution

13. $\frac{d}{dx}(x \cos ecx) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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14. $\frac{d}{dx}\left(x^5 \cot x\right) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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15. $\frac{d}{dx}(\sin^n x) = \ldots\ldots\ldots\ldots\ldots\ldots\ldots$

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Objective Type Questions C True False Questions

1. For any positive integer $\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$

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2. Prove that $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1 (\theta$ measured in radians)

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3. $\lim_{r \to 1} \pi r^2$

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4. Prove that $\frac{d}{dx}(\sec x) = \sec x \tan x.$

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5. Prove that $\frac{d}{dx}(\cos ec\theta) = -\cos ec\theta \cot \theta.$

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6. State Whether it is true or false.

$\frac{d}{dx}(\cot x) = \sec^2 x.$

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7. If $f'(x) = x + \frac{1}{x}$, then the value of f(x) is

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Objective Type Questions D Very Short Answer Type Questions

1. Evaluate : $\lim_{x \to 2} \frac{4x + 3}{x + 2}$.

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2. Evaluate : $\lim_{x \to 4} \frac{4x + 3}{x - 2}$.

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3. $\lim_{x \to -1} \frac{x^{10} + x^5 + 1}{x - 1}$

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4. $\left(\lim\right)_{x \to 3} \dfrac{x^4 - 81}{2x^2 - 5x - 3}$

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5. Evaluate $\lim\limits_{x \to 1} \left(\dfrac{1 - x^{-1/3}}{1 - x^{-2/3}} \right)$.

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6. $\lim\limits_{x \to 0} \dfrac{\sin 3x + 7x}{4x + \sin 2x}$

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7. $\lim_{x \to 0} \frac{\sin 5x}{\tan 3x}$

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8. Evaluate : $\lim_{x \to 0} \frac{1 - \cos 2x}{3x^2}$

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9. $\lim_{x \to 0} \frac{3 \sin x - \sin 3x}{x^3}$

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10. Evaluate: $\lim_{x \to 0} \frac{\sin 3x}{\sin 7x}$

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11. Compute $\left(\lim\right)_{x \to 0} \dfrac{e^{3x} - 1}{x}$

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12. Evaluate : $\lim\limits_{x \to 0} \dfrac{2^{2+x} - 9}{x}$.

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13. If $g(t) = 1 - 4t^2$, find $g'(1)$.

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14. Find the derivative of the function f defined by $f(x) = mx + c$ at $x = 0$.

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15. Find $f'(2)$ and $f'(5)$, where $f(x) = x^2 - 7x + 6$.

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16. For the function, $f(x) = x^2 - 6x + 8$, prove that : $f'(4) - 3f'(2) = f'(7)$.

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17. If $f(x) = x^n$ & $f'(1) = 10,$ find the value of n.

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18. Let $G(x) = 2 - x^3 + \frac{x^5}{5}$. Find $G'(-2)$.

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19. Differentiate the following function with respect of x : $\frac{ax + b}{px^2 + qx + r}$

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20. Find the derivative of $\frac{1-\cos x}{1+\cos x}$.

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21. Find the derivative of $3\sin x + 2\sin\alpha$, where $'\alpha'$ is a constant.

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22. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{4x+5\sin x}{3x+7\cos x}$

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23. If $f(x) = (x + \cos x)(x - \tan x)$, find $f'(x)$.

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24. If $f(x) = \sqrt{\sin x}$, find $f'(x)$.

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25. Find $\frac{dy}{dx}$ when $y = \frac{x^5 - \cos x}{\sin x}$.

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Ncert File Exercise 13 1

1. Evaluate the following limits in Exercise 1 to 22.

$$\lim_{x \to 3} 3x + 6$$

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2. $\operatorname{Lim}_{x \to \pi} \left(x - \frac{22}{7} \right)$

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3. $\lim_{r \to 1} \pi r^2$

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4. Evaluate the following limits $\lim_{x \to 4} \frac{4x + 3}{x - 2}$

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5. Evaluate the following limits in Exercise

$$\lim_{x \to -1} \frac{x^{10} + x^5 + 1}{x - 1}$$

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6. Evaluate the following limits in $\lim_{x \to 0} \frac{(x+1)^5 - 1}{x}$

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7. $\lim_{x \to 2} \frac{3x^2 - x - 10}{x^2 - 4}$ Evaluate lim -10* - 2

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8. $\left(\lim\right)_{x \to 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$

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9. $\lim_{x \to 0} \frac{ax + b}{cx + 1}$

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10. $\lim_{z \to 1} \frac{2^{1/3} - 1}{z^{1/6} - 1}$

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11. $\left(\lim\right)_{x \to 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}, a + b + c \neq 0$

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12. Evaluate the following limits in $\lim_{x \to -2} \frac{\frac{1}{x} + \frac{1}{2}}{x + 2}$.

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13. $\lim_{x \to 0} \frac{\sin ax}{bx}$

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14. Evaluate the following limits $\lim_{x \to 0} \frac{\sin ax}{\sin bx}$, $a, b \neq 0$.

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15. $\left(\lim\right)_{x \to \pi} \dfrac{\sin(\pi - x)}{\pi(\pi - x)}$

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16. $\lim_{x \to 0} \dfrac{\cos x}{\pi - x}$

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17. $\lim_{x \to 0} \dfrac{\cos 2x - 1}{\cos x - 1}$

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18. Evaluate the following limits in Exercise 1 to 22.

$$\lim_{a \to 0} \frac{ax + x \cos x}{b \sin x}.$$

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19. Evaluate the following limits in Exercise 1 to 22.

$$\lim_{x \to 0} x \sec x.$$

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20. $\lim_{x \to 0} \frac{\sin ax + bx}{ax + sinbx}, a, b, a + b \neq 0$

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21. $\lim_{x \to 0} (\operatorname{cosec} x - \cot x)$

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22. $\lim_{x \to \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$

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23. Find $\lim_{x \to 0} f(x)$ and $\lim_{x \to 1} f(x)$, where

$$f(x) = \begin{cases} 2x + 3, & x \leq 0 \\ 3(x + 1), & x > 0 \end{cases}$$

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24. Find $\lim_{x \to 1} f(x)$, where

$$f(x) = \begin{cases} x^2 - 1 & x \leq 1 \\ -x^2 - 1 & x > 1 \end{cases}$$

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25. Evaluate

$$(\lim)_{x \to 0} f(x), \ where \ f(x) = \left\{ \frac{|x|}{x}, \ x \neq 00, \ x = 0 \right.$$

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26. Find $\lim_{x \to 0} f(x)$, where $f(x) = \begin{cases} \frac{x}{|x|} & , \quad x \neq 0 \\ 0, & x = 0 \end{cases}$

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27. Find $\left(\lim\right)_{x \to 5} f(x)$, where $f(x) = |x| - 5$

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28. Suppose $f(x) = \begin{cases} a + bx & x < 1 \\ 4 & x = 1 \\ b - ax & x > 1 \end{cases}$ and if $\lim_{x \to 1} f(x) = f(1)$, what are the values of a and b?

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29. Let $a_1, a_2, \ldots, a_n$ be fixed real numbers and let

$f(x) = (x - a_1)(x - a_2)(x - a_3)\ldots(x - a_n).$

Find $\lim_{x \to a_1} f(x).$

If $a \neq a_1, a_2, \ldots, a_n$, *Compute* $\lim_{x \to a} f(x).$

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30. Let $f(x)\begin{cases}|x|+1, & x<0\\ 0, & x=0\\ |x|-1, & x>0\end{cases}$

For what values (s) of a does $\lim_{x\to a} f(x)$ exists?

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31. If the function f(x) satisfies $\lim_{x\to 1}\dfrac{f(x)-2}{x^2-1}=\pi$, then $\lim_{x\to 1} f(x)$ is equal to

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32. If $f(x) = \begin{cases} mx^2 + n, & x < 0 \\ nx + m, & 0 \leq x \leq 1 \\ nx^3 + m, & x > 1 \end{cases}$. For what integers m and n does $\lim_{x \to 0} f(x)$ and $\lim_{x \to 1} f(x)$ exist ?

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Ncert File Exercise 13 2

1. Find the derivative of $x^2 - 2$ at x=10.

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2. Find the derivative of 99x at $x = 100$.

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3. Find the derivative of x at $x = 1$.

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4. Find the derivatives of the following function from first principle: $x^3 - 27$

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5. Find the derivatives of the following function from first principle: $(\mathrm{x} - 1)(x - 2)$

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6. Find the derivatives of the following function from first principle: $\frac{1}{x^2}$

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7. Find the derivative of the following functions from first principle. $\frac{x+1}{x-1}$

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8. For the function

$$f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + \ldots\ldots + \frac{x^2}{2}\Bigg) + x + 1.$$

prove that f(1)=100f(0).

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9. Find the derivative of $x^n + ax^{n-1}1 + a^2x^{n-2} + \vdots + a^{n-1}x + a^n$ for some fixed real number a.

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10. For some constants a and b, find the derivative of (i) $(x \quad a) \quad (x \quad b)$ (ii) $\left(ax^2 + b\right)^2$ (iii) $\frac{x-a}{x-b}$

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11. For some constants a and b, find the derivative of :

$$(ax^2 + b)^2$$

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12. For some constants a and b, find the derivative of :

$$\frac{x - a}{x - b}$$

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13. Find the derivative of $\frac{x^n - a^n}{x - a}$ for some constant a.

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14. Find the derivative of (i) $2x - \frac{3}{4}$ (ii) $(5x^3 + 3x - 1)(x - 1)$ (iii) $x^{-3}(5 + 3x)$

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15. Find the derivative of

$(5x^3 + 3x - 1)(x - 1).$

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16. Find the derivative of

$x^{-3}(5 + 3x)$

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17. Find the derivative of

$x^5(3 - 6x^{-9})$

Watch Video Solution

18. Find the derivative of $x^{-4}(3 - 4x^{-5})$

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19. Find the derivative of

$$\frac{2}{x+1} - \frac{x^2}{3x-1}.$$

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20. Find the derivative of cos x from first principle.

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21. Find the derivative of the following functions:

(i) $\sin x \cos x$ (ii) $\sec x$

(iii) $5 \sec x + 4 \cos x$ (iv) $\cos ecx$

(v) $3 \cot x + 5 \cos ecx$ (vi) $5 \sin x - 6 \cos x + 7$

(vii) $2 \tan x - 7 \sec x$

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22. Find the derivative of the following functions :

$\sec x$

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23. Find the derivative of the following functions :

$5 \sec x + 4 \cos x$

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24. Find the derivative of the following functions :

$\cos ecx$

Watch Video Solution

25. Find the derivative of the following functions :

$3 \cot x + 5 \cos ecx$

Watch Video Solution

26. Find the derivative of the following functions :

$5\sin x - 6\cos x + 7$

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27. Find the derivative of the following functions :

$2\tan x - 7\sec x$

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Miscellaneous Exercise On Chapter 13

1. Find the derivative of the following functions from first principles :

$-x$

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2. Differentiate each of the following from first principle:

$(-x)^{-1}$

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3. Find the derivative of the following functions from first principles :

$\sin(x+1)$

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4. Differentiate each of the following from first principle: $\cos\left(x - \frac{\pi}{8}\right)$

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5. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $(x + a)$

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6. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$(px+q)\left(\frac{r}{x}+s\right)$

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7. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $(ax+b)(cx+d)^2$

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8. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{ax+b}{cx+d}$

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9. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{1+\frac{1}{x}}{1-\frac{1}{x}}$

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10. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero

constants and m and n are integers): $\frac{1}{ax^2+bx+c}$

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11. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{ax+b}{px^2+qx+r}$

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12. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{px^2+qx+r}{ax+b}$

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13. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$$\frac{2a}{x^4} - \frac{3b}{x^2} + \cos x$$

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14. Find the derivative of the following functions :

$$4\sqrt{x} - 2$$

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15. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero

constants and m and n are integers): $(ax+b)^n$

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16. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $(ax+b)^n(cx+d)^m$

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17. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$\sin(x+a)$

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18. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\cos ecx \cot x$

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19. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{\cos x}{1+\sin x}$

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20. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{\sin x + \cos x}{\sin x - \cos x}$

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21. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$$\frac{\sec x - 1}{\sec x + 1}$$

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22. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$\sin^n x$

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23. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{a + b \sin x}{c + d \cos x}$

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24. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{\sin(x+a)}{\cos x}$

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25. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $x^4(5\sin x - 3\cos x)$

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26. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-

zero constants and m and n are integers) :

$(x^2 + 1)\cos x$

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27. Find the derivative of the following functions:

$(ax^2 + \sin x)(p + q\cos x)$

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28. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$(x + \cos x)(x - \tan x)$

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29. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{4x + 5\sin x}{3x + 7\cos x}$

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30. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$$\frac{x^2 \cos\left(\frac{\pi}{4}\right)}{\sin x}$$

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31. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$$\frac{x}{1+\tan x}$$

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32. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers) :

$$(x+\sec x)(x-\tan x)$$

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33. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{x}{\sin^n x}$

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Questions From Ncert Exemplar

1. $\lim_{x \to 2} \left[\frac{1}{x-2} - \frac{2(2x-3)}{x^3 - 3x^2 + 2x} \right]$

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2. $\lim_{x \top i/6} \frac{2\sin^2 x \sin x - 1}{2\sin^2 x - 3\sin x + 1} =$

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3. Evaluate: $(\lim)_{x \to a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}, (a \neq 0)$.

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4. Let $f(x) = \begin{cases} x+2 & x \leq -1 \\ xc^2 & x > -1 \end{cases}$, find 'c', if $\lim_{x \to -1} f(x)$ exists.

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5. Find the derivative of $f(x) = x^3$, by first principle.

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6. Find the derivative of $f(x) = x^n$, where n is positive integer, by first principle.

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7. find the derivative using first principle $\sqrt{\sin x}$

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8. Find the derivative of the following functions (it is to be understand that a,b,c,d,p,q,r and s are fixed non-zero constants and m and n are integers):

$$\frac{\cos x}{1 + \sin x}$$

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Exercise

1. Evaluate $\lim_{x \to a} \frac{(x+2)^{5/3} - (a+2)^{5/3}}{x - a}$.

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2. Evaluate $\lim_{x \to 20} \frac{x^2 - 4}{\left(\sqrt{3x} - 2\right) - \left(\sqrt{x} + 2\right)}$

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3. $\lim_{x \to \frac{1}{2}} \left(\frac{8x - 3}{2x - 1} - \frac{4x^2 + 1}{4x^2 - 1} \right)$.

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4. Evaluate $\lim_{x \to \pi} \frac{\sqrt{1 - \cos 6x}}{\sqrt{2}\left(\frac{\pi}{3} - x\right)}$

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5. Evaluate, $\lim_{x \to 0} \frac{\sqrt{2} - \sqrt{1 + \cos x}}{\sin^2 x}$

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6. if $f(x) = \begin{cases} x + 2, & x \leq 1 \\ cx^2, & x > -1 \end{cases}$, then find c when $\lim_{x \to -1} f(x)$ exists.

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7. Differentiate the following with respect to 'x' using first principle : $\frac{ax+b}{cx+d}$

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8. Differentiate the following (7-10) with respect to 'x' using first principle :

$x^{\frac{2}{3}}$

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9. Differentiate the following with respect to 'x' using first principle : $x \cos x$

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10. Differentiate the following with respect to 'x' using first principle : $\cos\left(x^2+1\right)$.

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Revision Exercise

1. $\lim_{x \to 1} \frac{x^4 - 3x^2 + 2}{x^3 - 5x^2 + 3x + 1}$

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2. Evaluate the following limits $\lim_{x \to 1} \left(\frac{1}{x-1} - \frac{3(x-2)}{x^3 - 3x^2 + 2} \right)$.

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3. Evaluate the following limit: $(\lim)_{x \to 1} \left(\frac{1}{x^2 + x - 2} - \frac{x}{x^3 - 1} \right)$

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4. $\lim_{x \to 3} \frac{x^3 - 7x^2 + 15x - 9}{x^4 - 5x^3 + 27x - 27}$ is equal to:

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5. Evaluate: $\lim_{x \to 0} \frac{(1+x)^6 - 1}{(1+x)^2 - 1}$

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6. Evaluate : $(\lim)_{x \to \infty} \frac{ax^2 + bx + c}{dx^2 + ex + f}$.

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7. The value of $\lim_{x \to \infty} \frac{\sqrt{3x^2 - 1} + \sqrt{2x^2 - 1}}{4x + 3}$, is

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8. Evaluate the following limits :

$\lim_{x \to \infty} \left(\sqrt{x^2 + x + 1} - \sqrt{x^2 + 1}\right)$.

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9. Given $f(x) = \frac{ax + b}{x + 1}$, $\lim_{x \to \infty} f(x) = 1$ and $\lim_{x \to 0} f(x) = 2$, then f(-2) is

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10. If $\lim_{x \to 0} kx \cos ecx = \lim_{x \to 0} x \cos eckx$, show that $k = \pm 1$.

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11. $\lim_{x \to 0} \frac{2\sin x^0 - \sin 2x^0}{x^3}$

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12. If α, β are the zeroes of $ax^2 + bx + c$, then evaluate :

$$\lim_{x \to \beta} \frac{1 - \cos\left(ax^2 + bx + c\right)}{(x - \beta)^2}.$$

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13. Find the derivative of the following functions (it is to be understand that a,b,c,d,p,q,r and s are fixed non-zero constants and m and n are integers):

$4\sqrt{x} - 2$

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14. Find the derivative of $\frac{x^n - a^n}{x - a}$ for some constant a.

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15. Differentiate each of the following from first principle:

$\tan \sqrt{x}$

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16. Find the derivative :

$x^2 \cos x$

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17. Find the derivative of $s \in x3$ from first principles.

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18. If $f(x) = x^2 - 3x + 4$, find the value of x for which the derivative is zero.

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19. If $f(x) = x^2 - 4x + 3$, find the value of x for which the derivative is 2.

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20. If $f(x) = x^3 \tan x + 3x^4 \sin x$, find its derivative at x = 0 and $x = \frac{\pi}{4}$.

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Competition File

1. Let $f: R \to [0, \infty)$ be such that $\lim_{x \to 5} f(x)$ exists and $\lim_{x \to 5} \frac{[f(x)]^2 - 9}{\sqrt{|x-5|}} = 0$. then, $\lim_{x \to 6} f(x)$ equals to

A. 10

B. 1

C. 2

D. 3

Answer: d

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2. $\lim_{x \to 0} \frac{(1 - \cos x)(3 + \cos x)}{x \tan 4x}$ is equal to

A. $\frac{1}{2}$

B. 1

C. 2

D. $\frac{-1}{4}$

Answer: C

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3. $\lim_{x \to 0} \frac{(1 - \cos 2x)(3 + \cos x)}{x \tan 4x}$ is equal to

A. 4

B. 3

C. 2

D. $\frac{1}{2}$

Answer: C

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4. $\lim_{x \to 0} \frac{\sin\left(\pi \cos^2 x\right)}{x^2}$ is equal to

A. 1

B. $-\pi$

C. π

D. $\frac{\pi}{2}$

Answer: C

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5. Evaluate $\lim_{x \to 0} \left(1 + \tan^2 \sqrt{x}\right)^{\frac{1}{2x}}$

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. 2

Answer: B

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6. The $\lim_{x \to \frac{\pi}{2}} \frac{\cot x - \cos x}{(\pi - 2x)^3}$ equals

A. $\frac{1}{16}$

B. $\frac{1}{8}$

C. $\frac{1}{4}$

D. $\frac{1}{24}$

Answer: A

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7. For each $t \in R$ let $[t]$ be the greatest integer less than or equal to t then $\lim_{x \to 0^+} x\left(\left[\frac{1}{t}\right] + \left[\frac{2}{t}\right] + \ldots + \left[\frac{15}{t}\right]\right)$

(1) is equal to 0 (2) is equal to 15 (3) is equal to 120 (4) does not exist (in R)

A. is equal to 0

B. is equal to 15

C. is equal to 120

D. does not exist is R

Answer: C

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8. $\lim_{x \to \frac{\pi}{4}} \frac{\cot^3 x - \tan x}{\cos\left(x + \frac{\pi}{4}\right)}$ is

A. $8\sqrt{2}$

B. 4

C. $4\sqrt{2}$

D. 8

Answer: D

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Chapter Test 13

1. If $f(x) = 1 + x + \frac{x^2}{2} + + \frac{x^{100}}{100}$, then $f'(1)$ is equal to $\frac{1}{100}$ b. 100 c. 50 d. 0

A. $\frac{1}{100}$

B. 100

C. does not exist

D. 0

Answer: B

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2. $\lim_{x \to 0} \frac{\sin ax}{\sin bx}, a, b \neq 0$

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. 1

D. $-\frac{b}{a}$

Answer: A

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3. Evaluate : $\lim_{x \to 3} [x(x+1)]$.

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4. Evaluate $\lim_{x \to 0} \frac{\sin x^0}{x}$.

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5. Find f' when $f(x) = x^3$.

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6. Prove that $\lim_{x \to 0} \frac{(1+x)^n - 1}{x} = n$.

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7. Evaluate:

$$(\lim)_{n \to 0} \frac{8}{x^8} \left\{ 1 - \frac{\cos\left(x^2\right)}{2} - \frac{\cos\left(x^2\right)}{4} + \frac{\cos\left(x^2\right)}{2} \frac{\cos\left(x^2\right)}{4} \right\}$$

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8. Differentiate each of the following from first principle:

$$\frac{1}{\sqrt{x}}$$

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9. If $y = 1 = \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + + \frac{x^n}{n!}$, show that $\frac{dy}{dx} - y + \frac{x^n}{n!} = 0.$

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10. Find $\frac{dy}{dx}$ when $y = \frac{x + \cos x}{\tan x}.$

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11. Evaluate the following limits:

$$\lim_{x \to \frac{\pi}{6}} \frac{2\sin^2 x + \sin x - 1}{2\sin^2 x - 3\sin x + 1}$$

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12. Let $f(x) = \begin{cases} x + k & x \leq -1 \\ cx^2 & x > -1, \end{cases}$ find 'c', if $\lim_{x \to -1} f(x)$ exists.

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Check Your Understanding

1. What is $\lim_{x \to 2} (x + 2)$?

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2. $\lim_{x \to -1} \left[1 + x + x^2 + \ldots + x^{10}\right]$

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3. What is the value of $\lim_{x \to 0} \frac{x}{\tan x}$?

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4. What is $\lim_{x \to 0} x \sec x$?

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5. $\lim_{x \to 0} \frac{\sin 4x}{\sin 2x}$

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6. What is $\lim_{x \to 0} \frac{e^x - 1}{x}$?

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7. What is $\lim_{x \to 0} (1 + x)^{1/x}$?

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8. Find the derivative of $f(x) = 10x$.

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9. Find the derivative of $(ax+b)^n$ using first principle.

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10. The derivative of $f(x)=\sin 2x$ is

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