



MATHS

BOOKS - NAGEEN PRAKASHAN ENGLISH

LIMITS AND DERIVATIVES

Solved Example

1. Evaluate: $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$

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2. Evaluate: $\lim_{x \rightarrow 1} \left(\frac{2}{x^2 - 1} + \frac{1}{1 - x} \right)$

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3. Evaluate: $\lim_{x \rightarrow 1} \frac{x - 1}{2x^2 - 7x + 5}$

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4. Evaluate: $\lim_{x \rightarrow a} \frac{\sqrt{x} - \sqrt{a}}{x - a}$

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5. Evaluate: $\lim_{x \rightarrow 3} \frac{x^2 - 4x + 3}{x^2 + 6x - 27}$

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6. Evaluate: $\lim_{x \rightarrow 2} \frac{x^3 - 2x^2}{x^2 - 5x + 6}$

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

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8. Evaluate:

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

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9. Evaluate: $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$

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10. Evaluate $\lim_{x \rightarrow 5} \frac{1 - \sqrt{x-4}}{x-5}$

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11. Evaluate: $\lim_{x \rightarrow 0} \frac{(3+x)^{1/2} - (3-x)^{1/2}}{x}$

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12. Evaluate:

$$\lim_{x \rightarrow 1} \frac{(2x-3)(\sqrt{x}-1)}{2x^2+x-3}$$

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13. Evaluate: $\lim_{x \rightarrow 0} \frac{\sin x}{\tan x}$

A. 0

B. 1

C. 2

D. 3

Answer: B

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14. Evaluate: $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$

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15. Evaluate: $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{x - \frac{\pi}{4}}$

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16. Evaluate: $\lim_{x \rightarrow \infty} \frac{5x^2 + 3x + 1}{3x^2 + 2x + 4}$

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17. Evaluate:
$$\lim_{x \rightarrow \infty} \frac{1 + 2 + 3 + \dots + x}{x^2}$$

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18. The function $f(x)$, for which $f(x) = \{x^2, x \neq 12, x = 1\}$

Show that:

$$\lim_{x \rightarrow 1} f(x) = 1$$

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19. Show that $\lim_{x \rightarrow 2} \frac{[x - 2]}{x - 2}$ does not exist.

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20. Evaluate:
$$\lim_{x \rightarrow 1} \frac{1 - \sqrt{x}}{(\cos^{-1} \sqrt{x})^2}$$

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21. Find the derivative of $f(x)=5x$ at $x=2$.

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22. Find the derivative of $f(x) = 2x^2 + 3x - 4$ at $x=0$.

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23. Find the slope of tangent of the curve $y = 4x^2$ at the point $(-1,4)$.

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24. Find the derivative of $\cos x$ at $x=0$.

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25. A particle is moving in a straight line such that the distance covered by it in t seconds from a point is $\left(\frac{t^3}{3} - t\right)$ cm. find its speed at $t=3$ seconds.

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26. Find the derivative of $(6x^{1/3} + 2e^x)$ with respect to 'x'.

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27. Find the derivative of $(6\log x - \sqrt{x} - 7)$ with respect to 'x'

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28. Find the derivative of $(5\sqrt{x} + 7\log_e x + \log_a x)$ with respect to 'x'

A.

B.

C.

D.

Answer:



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29. Find the derivative of $\left(\frac{6}{x^3} + 5\right)$ with respect to 'x' .



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30. Differentiate $\left(5x^{1/7} + \frac{3}{x^{3/2}}\right)$ with respect to 'x'.



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31. Differentiate $(ax)^m + \left(\frac{b}{x}\right)^n$ with respect to 'x'.

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32. Differentiate $(2 \sin x - 3 \cos x + 5)$ with respect to 'x'.

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33. Differentiate $\left(\tan x - \frac{1}{3 \sec x}\right)$ with respect to 'x'.

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34. Find the derivative of $(4 \sec x \sin x + \cos x \csc x - 5 \tan x \cot x)$ with respect to x.

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35. Differentiate

$$\left(\sqrt{x} + \frac{1}{x}\right)\left(x - \frac{1}{\sqrt{x}}\right) \text{ with respect to 'x'.$$

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36. If $y = \frac{1}{3x^3}$ then prove that $3y + x \frac{dy}{dx} = 0$.

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37. Find the derivative of the function $(x \cdot e^x)$ with respect 'x'.

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38. Find the derivative of the function $\sec x \cdot \tan x$ with respect to 'x'.

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39. Find the differential coefficient of $\log x^x$ with respect to 'x'.

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40. Find the differential coefficient of $a \cdot x^2 \sin x$ with respect to 'x' .

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41. Find the derivative of 'x sinx' with respect to 'x'.

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42. Find the derivative of $(e^x \sin x)$ with respect to 'x'.

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43. Find the deifferential coefficient of $(x^2 + 7x + 2)(x + 3)$ with respect to 'x'.

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44. Differentiate $(e^x \cos x + x^2 \log x)$ with respect to 'x'.

A.

B.

C.

D.

Answer:

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45. Find the derivative of $\sin x \cdot \log_e x$ with respect to x .

A.

B.

C.

D.

Answer:



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46. Differentiate $\frac{2x + 5}{x^2 - 1}$ with respect to 'x'.



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47. Differentiate $\frac{\log x}{\cos x}$ with respect to 'x'.



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48. Differentiate $\frac{x^2 - x + 1}{x^2 + x + 1}$ with respect to 'x'.

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49. Differentiate $\frac{e^x + \cot x}{\tan x - x^n}$ with respect to 'x'.

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50. Find the derivative of $\frac{\tan x - \cot x}{\tan x + \cot x}$ with respect to 'x'.

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51. Find the derivative of $\frac{\sin x}{x + e^x}$ with respect to 'x'.

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52. Differentiate $\frac{\sqrt{a} + \sqrt{x}}{\sqrt{a} - \sqrt{x}}$ with respect to 'x'.

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53. If $y = \frac{\sin x}{1 + \cos x}$ then prove that $\frac{dy}{dx} = \frac{1}{1 + \cos x}$

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54. If $f(x) = \frac{x^3}{a^2 - x^2}$ then find the value of $f' \left(\frac{a}{2} \right)$.

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55. Find the differential coefficient of $\frac{\sin x - x \cos x}{x \sin x + \cos x}$ with respect to x.

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1. $\lim_{x \rightarrow 0} (x^2 - 3x + 2)$

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2. $\lim_{x \rightarrow -1} \frac{x^8 + x^4 - 2}{x - 5}$

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3. $\lim_{x \rightarrow 4} \frac{2x + 3}{x - 2}$

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4. $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$

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5. $\lim_{x \rightarrow 2} \frac{3x^2 - x - 10}{x^2 - 4}$

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6. $\lim_{x \rightarrow 3} \frac{x^3 - 27}{2x^2 - 5x - 3}$

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7. $\lim_{x \rightarrow -1} \frac{\frac{1}{x} + 1}{x + 1}$

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8. $\lim_{x \rightarrow 2} \frac{x^2 - 5x + 6}{x^2 - 6x + 8}$

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

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10. $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$

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11. $\lim_{x \rightarrow 0} \frac{\sqrt{2+x} - \sqrt{2}}{x}$

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12. $\lim_{x \rightarrow 0} \frac{2x}{\sqrt{1+x} - 1}$

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$$13. \lim_{x \rightarrow 0} \frac{\sqrt{1-x^2} - \sqrt{1+x^2}}{2x^2}$$

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$$14. \lim_{x \rightarrow 0} \frac{x}{\sqrt{1+x} - 1}$$

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$$15. \lim_{x \rightarrow 2} \frac{\sqrt{3-x} - 1}{2-x}$$

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$$16. \lim_{x \rightarrow 0} \frac{\sqrt{a+x} - \sqrt{a-x}}{x}$$

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17. $\lim_{x \rightarrow 1} \frac{\sqrt{4+x} - \sqrt{5}}{x-1}$

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18. $\lim_{x \rightarrow 0} \frac{3\sqrt{1+x} - 1}{x}$

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

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20. $\lim_{x \rightarrow 2} \frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}}$

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$$21. \lim_{x \rightarrow 4} \frac{3 - \sqrt{5 + x}}{1 - \sqrt{5 - x}}$$

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$$22. \lim_{x \rightarrow 1} \frac{x^4 - 3x^2 + 2}{x^3 - 5x^2 + 3x + 1}$$

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$$23. \lim_{x \rightarrow 0} \frac{\cos 2x - 1}{\cos x - 1}$$

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$$24. \lim_{x \rightarrow 0} x \sec x$$

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$$25. \lim_{x \rightarrow 0} \frac{x^2 - x}{\sin x}$$

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$$26. \lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$$

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$$27. \lim_{x \rightarrow 0} \frac{\tan 4x}{\tan 2x}$$

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$$28. \lim_{x \rightarrow 0} \frac{\sin 3x}{2x}$$

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29. $\lim_{x \rightarrow 0} \frac{\sin(x)}{4x}$

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30. $\lim_{x \rightarrow 0} (\cos ecx - \cot x)$

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31. $\lim_{x \rightarrow 0} \frac{x \cos x - \sin x}{x^2 \sin x}$

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32. Evaluate: $\lim_{x \rightarrow \infty} \left(\frac{\sqrt{1+x} - \sqrt{1-x}}{\sin^{-1} x} \right)$

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33. $\lim_{x \rightarrow 0} \frac{\sin ax + bx}{ax + \sin bx}, a \neq 0, b \neq 0, a + b \neq 0$

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

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35. (i) $\lim_{x \rightarrow a} \frac{x^m - a^m}{x^n - a^n}$

(ii) $\lim_{x \rightarrow a} \frac{(1 + x)^{1/n} - 1}{x}$

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36. $\lim_{x \rightarrow \infty} \frac{x^3 + 3x^2 + 6x + 5}{x^3 + x + 2}$

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$$37. \lim_{x \rightarrow 0} \frac{(2x - 3)(3x - 4)}{(4x - 5)(5x - 6)}$$

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$$38. \lim_{x \rightarrow \infty} \frac{1^2 + 2^2 + 3^2 + \dots + x^2}{x^3}$$

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$$39. \lim_{x \rightarrow \infty} \frac{2x}{1 + 4x}$$

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$$40. \frac{1^2 + 2^2 + 3^2 + \dots + x^2}{x^3}$$

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$$41. \lim_{x \rightarrow \infty} \frac{\sqrt{3x^2 - 1} - \sqrt{2x^2 - 3}}{4x + 3}$$

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$$42. \text{Evaluate : } \lim_{x \rightarrow \infty} \sqrt{x^2 + x + 1} - \sqrt{x^2 + 1}$$

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$$43. \lim_{x \rightarrow \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$$

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$$44. (i) \lim_{x \rightarrow \pi} \frac{\cos ex - \cot x}{x}$$

$$(ii) \lim_{x \rightarrow 0} \frac{\sin x - 2 \sin 3x + \sin 5x}{x}$$

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$$45. (i) \lim_{x \rightarrow 0} \frac{x \tan 4x}{1 - \cos 4x}$$

$$(ii) \lim_{y \rightarrow 0} \frac{(x + y)\sec(x + y) - x \sec x}{y}$$

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$$46. \lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \cos 2x}{(\pi - 2x)^2}$$

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47. If $f(x)$ is defined as follows:

$$f(x) = \begin{cases} 1 & x > 0 \\ -1 & x < 0 \\ 0 & x = 0 \end{cases}$$

Then show that $\lim_{x \rightarrow 0} f(x)$ does not exist.

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48. If $f(x)$ is defined as

$$f(x) = \begin{cases} x & 0 \leq x < \frac{1}{2} \\ 0 & x = \frac{1}{2} \\ 1 - x & \frac{1}{2} < x \leq 1 \end{cases}$$

then evaluate : $\lim_{x \rightarrow \frac{1}{2}} f(x)$

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49. If $f(x)$ is defined as

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

then evaluate : $\lim_{x \rightarrow 0} f(x)$ and $\lim_{x \rightarrow 1} f(x)$

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50. If $f(x) = \frac{|x|}{x}$, then show that $\lim_{x \rightarrow 0} f(x)$ does not exist.

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51. If $f(x) = \frac{|x - a|}{x - a}$, then show that $\lim_{x \rightarrow a} f(x)$ does not exist.

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52. If $f(x)$ is defined as

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

then show that $\lim_{x \rightarrow 1} f(x) = 1$

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53. If $f(x) = \begin{cases} a + bx & x < 1 \\ 4 & x = 1 \\ b - ax & x > 1 \end{cases}$

and $\lim_{x \rightarrow 1} f(x) = f(1)$, then find the values of 'a' and 'b'

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1. If $f(x) = x^2$ is a real function, find the value of $f(1)$.

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2. If $f(x) = x^2 - 4$ then find $f'(2)$.

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3. Find the derivative of $f(x)=x$ at $x=2$.

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4. Find the derivative of $\sin x$ at $x=0$

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5. Find the derivative of $f(x)=k$ at $x=0$ and $x=2$.

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6. Find the slope of tangent of the curve $y = x^2$ at point $\left(\frac{1}{3}, \frac{1}{9}\right)$

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7. Find $f(2)$ and $f(3)$ if $f(x) = x^2 + 2x - 3$.

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8. Find the derivative of $f(x) = \sin x$ at $x = \frac{\pi}{2}$

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9. Find the derivative of $f(x)=\tan x$ at $x=0$.

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10. A particle moves in a straight line such that its distance in 't' seconds from a fixed point is $(6t - t^2)$ cm. find its velocity at the end of $t=2$ sec.

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11. A particle moves in a straight line such that its position in 't' time is $s(t) = \frac{t^2 + 3}{t - 1}$ cm. find its velocity at $t=4$ sec.

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1. Find the differential coefficient of the following function with respect to 'x' from first principle.

$$x^2 + 1$$

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2. Find the differential coefficient of the following function with respect to 'x' from first principle.

$$x^3 + x - 1$$

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3. Find the differential coefficient of the following function with respect to 'x' from first principle.

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

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4. Find the differential coefficient of the following function with respect to 'x' from first principle.

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

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5. Differentiate the following function with respect to x from first principle: $ax^2 + \frac{b}{x}$

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6. Differentiate wrt x : $(x + 1)(2x - 3)$

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7. Find the derivative of the following function with respect to 'x' :

$$\sin x + \cos x$$

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8. Find the derivative of the following function with respect to 'x' :

$$x \cos x$$

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9. Find the derivative of the following function with respect to 'x' :

$$\tan 2x$$

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10. Differentiate following function with respect to x : $-\sin(2x + 3)$

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11. Find the derivative of the following function with respect to 'x' :

$$\tan^2 x$$

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Ex 13 D

1. Find the derivative of the following function with respect to 'X' (i)

$$x^4 \text{ (ii) } x^{-3} \text{ (iii) } 3x^2$$

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2. Differentiate the following wrto x :(i) $6x^{-2}$ (ii) $\frac{1}{5}x^5$ (iii) $\frac{1}{3x}$

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

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4. Differentiate the following wrto x : $ax^2 + bx + c$

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5. Differentiate the following wrto x : $(ax)^m + (b)^n$

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6. Find the derivative of following function with respect to x.

$$x^m + a^n$$

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7. Find the derivative of the following function w.r.t 'x' : $x^6 + 3x^2 - 5$

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8. Find the derivative of the following function w.r.t 'x' :

$$3 \sin x + b \cos x$$

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9. Differentiate the following wrto x : $\cos x + \frac{1}{\sin x}$

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10. Differentiate the following wrto x $\tan x + 3 \cot x - 5 \sec x$

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11. Differentiate the following wrto x :: $\frac{3}{\tan x} - 2 \cos x$

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12. Find the derivative of following function with respect to x , the function is $\frac{2}{\sec x} - \frac{3}{\tan x}$

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13. Find the derivative of the following function with respect to 'X' :

$$xe^x \frac{-1}{x}$$

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14. Differentiate w.r.t x : $\frac{x}{2} - \frac{2}{x} + \sqrt{x} + \frac{3}{\sqrt{x}} + x^2 - 3^x + \frac{2}{3}x^6$

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15. Find the derivative of the following function with respect to 'X' :

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

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16. Find the derivative of the following function with respect to 'X' :

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

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17. Find the derivative of the following function with respect to 'X' :

$$\left(x^2 - \frac{1}{x^2}\right)^3$$

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18. Find the derivative of the following function with respect to 'X' :

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

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19. find derivative of $\frac{(1+x).3\sqrt{x}}{\sqrt{x}}$

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20. Find the derivative of the following function with respect to 'X' :

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

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21. If $y = 6x^5 - 4x^4 + 2x^2 + 3x + 2$, then find $\frac{dy}{dx}$ at $x=-1$.

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22. If $y = 2 \sin x + \cot x$, then find $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$.

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23. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, prove that $2x \frac{dy}{dx} = \sqrt{x} - \frac{1}{\sqrt{x}}$

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24. If $y = \sqrt{\frac{x}{a}} + \sqrt{\frac{a}{x}}$, prove that $2xy \frac{dy}{dx} = \left(\frac{x}{a} - \frac{a}{x} \right)$

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25. If $y = \sqrt{\frac{1 - \cos 2x}{1 + \cos 2x}}$, then find $\frac{dy}{dx}$.

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1. Differentiate wrt x : $x^3 \cdot \sec x$

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2. Differentiate wrt x : $\cos x \cdot \cot x$

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3. Differentiate wrt x : $\cos ecx \cdot \cot x$

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4. Differentiate wrt x : $x^3 \cdot e^x$

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5. Differentiate wrt x : $x^2 \cdot \cos x$.

 [Watch Video Solution](#)

6. Differentiate wrt x : $(x^2 + 2x + 2) \cdot \tan x$

 [Watch Video Solution](#)

7. Differentiate wrt x : $e^x(1 + \log x)$

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8. Differentiate wrt x : $(x^2 \sin x - e^x \log x)$

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9. Differentiate wrt x : $k \cdot \sin x \cdot \log x$

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10. Differentiate wrt x : $(x^n \cdot e^x + a^x \cdot \tan x)$

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11. Differentiate wrt x : $(3e^x \sin x + a^x \cdot \log x)$

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12. Differentiate wrt x : $(a^x \log_e x - \cos x \cdot x^2)$

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13. Differentiate wrt x : $(x + \sin x)(x - \cot x)$

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14. Differentiate wrt x : $(x^2 + 5x + 1)\cos x$

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15. Differentiate wrt x : $(x - 1)(x + 2)e^x$

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16. Differentiate wrt x : $4 \sec x \sin x - 5 \tan x \cdot \cot x$

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17. Differentiate wrt x : $\left(\sqrt{x} + \frac{1}{x}\right)\left(x - \frac{1}{\sqrt{x}}\right)$

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18. Differentiate wrt x : $(\tan x + \sec x)(\cos ecx + \cot x)$

A. $(\sec x + \cot x)(\sec x + \tan x)(\sec x - \cos ecx)$

B. $(\cos ecx + \cot x)(\sec x + \tan x)(\sec x + \cos ecx)$

C. $(\cos ecx - \cot x)(\sec x + \tan x)(\sec x - \cos ecx)$

D. $(\cos ecx + \cot x)(\sec x + \tan x)(\sec x - \cos ecx)$

Answer: D

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19. Differentiate wrt x : $x^2 \cdot e^x \cdot \sin x$

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20. Differentiate wrt x : $(x^2 + 5x + 3)(2x^2 - 5)$

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21. If $y = (x - a)(x - b)$ then find the value of x when $\frac{dy}{dx} = 0$.

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22. If $y = x \sin x$ then prove that $\frac{1}{y} \frac{dy}{dx} - \frac{1}{x} = \cot x$.

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1. Differentiate wrto x: $\frac{x^m}{\log_e x}$

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2. Differentiate wrto x: $\frac{\cos x}{\log_e x}$

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3. $\frac{x^2 - 1}{x^2 + 7x + 1}$

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4. Differentiate wrto x: $\frac{5x^2 + 6x + 7}{2x^2 + 3x + 4}$

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5. Find the derivative of the following function with respect to 'x' :

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

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6. Differentiate wrto x: $\frac{1 - \tan x}{1 + \tan x}$

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7. Find the derivative of the following function with respect to 'x' :

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

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8. Find the derivative of the following function with respect to 'x' :

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

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9. Differentiate wrto x: $\frac{e^x}{1 + e^x}$

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10. Find the derivative of the following function w.r.t 'x': $\frac{a + b \sin x}{c + d \cos x}$

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11. find derivative of $\frac{\cos ecx + \cot x}{\cos ecx - \cot x}$

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12. Find the derivative of the following function w.r.t 'x': $\frac{x^2 \sin x}{1 - x}$

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13. Differentiate wrt x : $\frac{\sec x - \tan x}{\sec x + \tan x}$

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

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15. Differentiate the following function with respect of x : $\frac{\sec x - 1}{\sec x + 1}$

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16. Differentiate wrt x : $\frac{e^x(x - 1)}{x + 1}$

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17. Differentiate wrt x : $\frac{x \tan x}{\sec x + \tan x}$

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18. If $y = \frac{x}{x + 5}$ then prove that $x \frac{dy}{dx} = y(1 - y)$

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19. If $y = \frac{e^x}{x}$ then prove that $x \frac{dy}{dx} = y(x - 1)$

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20. If $f(x) = \frac{x - 4}{2\sqrt{x}}$, then $f'(4)$ is equal to

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1. $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x} = ?$

A.

B.

C.

D.

Answer: 1/2



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2. If $f(x) = \begin{cases} x + 4 & x \geq 1 \\ 5x & x < 1 \end{cases}$ then $f'(x) = ?$

A. 3

B. 4

C. 5

D. 6

Answer:



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3. $\lim_{x \rightarrow 0} \frac{6^x - 3^x - 2^x + 1}{x^2} = ?$

A. $\log 3 + \log 2$

B. $\log 3 \cdot \log 2$

C. $\log \frac{3}{2}$

D. $\log 6$

Answer:



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4. Evaluate: $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{x - \frac{\pi}{4}} = ?$

A. 0

B. 1

C. $\sqrt{2}$

D. None of these

Answer:



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5. $\lim_{x \rightarrow 0} \frac{\sin x}{x} = ?$

A. 0

B. 2

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

D. None of these

Answer: D

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6. $\lim_{x \rightarrow 0} \frac{2x}{\tan 3x} = ?$

A. 3

B. 2

C. $\frac{2}{3}$

D. $\frac{3}{2}$

Answer: C

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7. $\lim_{x \rightarrow 0} \frac{\sin^2 4x}{x^2} = ?$

A. 4

B. 8

C. 12

D. 16

Answer:



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8. $\lim_{x \rightarrow 0} \frac{\sin 4x - \sin 2x + x}{x} = ?$

A. 3

B. 4

C. 6

D. 7

Answer: A

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9. $\lim_{x \rightarrow 0} \frac{\sin 2x + x}{x + \tan 3x} = ?$

A. 1

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

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

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

Answer:

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10. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos^2 x}{1 - \sin^3 x} = ?$

A. $\frac{2}{3}$

B. $\frac{3}{2}$

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

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

Answer:



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Ex 13 H

1. $\lim_{x \rightarrow \infty} \frac{\sin x}{x} = ?$

A. -1

B. 1

C. 0

D. 2

Answer:

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2. $\lim_{x \rightarrow 0} \frac{\sqrt{x^2 + 1} - 1}{\sqrt{x^2 + 9} - 3} ?$

A. 3

B. -3

C. 2

D. -2

Answer: A

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3. $\lim_{x \rightarrow 0} \frac{\sin 4x}{1 - \sqrt{1 - x}} = ?$

A. 6

B. 8

C. 10

D. 12

Answer: 8



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4. $\lim_{x \rightarrow 0} \frac{\tan x - x}{x^2 \tan x} = ?$

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

B. $\frac{1}{3}$

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

D. $\frac{1}{6}$

Answer: B

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5. Evaluate $\lim_{x \rightarrow a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}, (a \neq 0)$.

A. $\sqrt{\frac{3}{2}}$

B. $\sqrt{\frac{2}{3}}$

C. $\frac{\sqrt{2}}{9}$

D. $\frac{2}{3\sqrt{3}}$

Answer:

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6. $\lim_{x \rightarrow \infty} \frac{\cos x}{x} = ?$

A. 0

B. 1

C. -1

D. None of these

Answer: A

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7. If $G(x) = -\sqrt{25 - x^2}$, then $\lim_{x \rightarrow 1} \frac{G(x) - G(1)}{x - 1} = ?$

A. $-\frac{1}{\sqrt{24}}$

B. $-\sqrt{24}$

C. $\sqrt{24}$

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

Answer: D

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8. $\lim_{x \rightarrow 1} (1 - x) \tan\left(\frac{\pi x}{2}\right)$ is equal to

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

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

C. π

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

Answer:

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9. Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos(1 - \cos x)}{x^4}$.

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

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

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

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

Answer:



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10. Evaluate $\lim_{x \rightarrow \infty} \left[\sqrt{a^2 x^2 + ax + 1} - \sqrt{a^2 x^2 + 1} \right]$.

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

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

C. 1

D. 2

Answer:

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Ex 13 1

1. $\lim_{x \rightarrow 3} x + 3$

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2. $\lim_{(x \rightarrow \pi)} \left(x - \frac{22}{7} \right)$

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3. $\lim_{r \rightarrow 0} \pi r^2$



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4. $\lim_{x \rightarrow 4} \frac{4x + 3}{x - 2}$

A.

B.

C.

D.

Answer:



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



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$$6. \lim_{x \rightarrow 0} \frac{(x+1)^5 - 1}{x}$$

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$$7. \lim_{x \rightarrow 2} \frac{3x^2 - x - 10}{x^2 - 4}$$

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$$8. \lim_{x \rightarrow 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$$

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

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10. $\lim_{z \rightarrow 1} \frac{z^{\frac{1}{3}} - 1}{z^{\frac{1}{6}} - 1}$

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11. $\lim_{x \rightarrow 1} \frac{ax^2 + bx + c}{cx^2 + bx + a} a + b + c \neq 0$

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12. $\lim_{x \rightarrow -2} \frac{\frac{1}{x} + \frac{1}{2}}{x + 2}$

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

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

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15. $\lim_{x \rightarrow \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$

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16. $\lim_{x \rightarrow 0} \frac{\cos x}{\pi - x}$

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17. $\lim_{x \rightarrow 0} \frac{\cos 2x - 1}{\cos x - 1}$

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18. $\lim_{x \rightarrow 0} \frac{ax + x \cos x}{b \sin x}$

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19. $\lim_{x \rightarrow 0} x \sec x$

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

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21. $\lim_{x \rightarrow 0} (\cos ex - \cot x)$

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

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23. Find

$f(x)$ and $(\lim)_{x \rightarrow 1} f(x)$, where $f(x) = [2x + 3, x \leq 0; 3(x + 1), x > 0]$

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24. Find

$(\lim)_{x \rightarrow 1} f(x)$, where $f(x) = [x^2 - 1, x \leq 1; -x^2 - 1, x > 1]$

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25. Evaluate $\lim_{x \rightarrow 0} f(x)$, where

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

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26. Find $\lim_{x \rightarrow 0} f(x)$ where

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

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27. Find $(\lim_{x \rightarrow 5} f(x))$, where $f(x) = |x| - 5$

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

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29. Let a_1, a_2, \dots, a_n be fixed real numbers and define a function $f(x) = (x - a_1)(x - a_2)\dots(x - a_n)$, what is $\lim_{x \rightarrow a} f(x)$? For some $a \neq a_1, a_2, \dots, a_n$, compute $\lim_{x \rightarrow a} f(x)$

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

for what value (s) of a does $\lim_{x \rightarrow a} f(x)$ exists?

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31. If the function $f(x)$ satisfies $(\lim)_{x \rightarrow 1} \frac{f(x) - 2}{x^2 - 1} = \pi$, evaluate $(\lim)_{x \rightarrow 1} f(x)$

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32. If $f(x) = \begin{cases} mx^2 + n, & x < 0 \\ nx + m, & x \leq 1 \\ 1nx^3 + m, & x > 1. \end{cases}$

For what integers m and n does both $(\lim)_{x \rightarrow 1} f(x)$.

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Ex 13 2

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

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2. Find the derivative of x at $x=1$,



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



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4. Find the derivative of the following functions from first principle.(i)

$$x^3 - 27 \text{ (ii) } (x - 1)(x - 2) \text{ (iii) } \frac{1}{x^2} \text{ (iv) } \frac{x + 1}{x - 1}$$



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5. For the function

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

. Prove that $f'(1) = 100f'(0)$.



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

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

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

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9. 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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10. Find the derivative of $\cos x$ from first principle.

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11. 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) $3 \cot x + 5 \cos ecx$

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Miscellaneous Exercise

1. Find the derivative of the following functions from first principles:
(i) x (ii) $(-x)^{-1}$ (iii) $s \in (x + 1)$ (iv) $\cos\left(x - \frac{\pi}{8}\right)$ Find derivative of

the following functions (it is to be understood that a, b, c, d, p, q, r and s are

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2. 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):

$$(x + a)$$

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3. 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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4. 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):

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



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5. 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):

$$\frac{ax + b}{cx + d}$$



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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):

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

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7. 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):

$$\frac{1}{ax^2 + bx + c}$$

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8. 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):

$$\frac{ax + b}{px^2 + qx + r}$$

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9. 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):

$$\frac{px^2 + qx + r}{ax + b}$$

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10. 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):

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

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11. 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):

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

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12. 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):

$$(ax + b)^n$$

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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):

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

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14. 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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15. 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):

$$\operatorname{cosec} x \cot x$$

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16. 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):

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

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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):

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

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18. 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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19. 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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20. 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):

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

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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):

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

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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):

$$x^4(5 \sin x - 3 \cos x)$$

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23. 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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24. 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):

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

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25. 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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26. 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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27. 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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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):

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

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29. 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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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):

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

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