MATHS

BOOKS - JBD PUBLICATION

LIMITS AND DERIVATIVES

Exercise

1. $\lim_{x \to 2} \frac{x^2 - 4}{4x^2 + 4x}$ is equal to:

A. 4

B. 2

C. 0

D. not defined

Answer:

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2. $\frac{d}{dx}\left(\tan^2 x\right)$ is equal to:

A. $\sec^2 x$

B. $2\tan x$

C. $2\tan x \sec^2 x$

D. $\cot^2 x$

Answer:

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3. $\lim_{x \to 0} \frac{\sin ax}{bx}$ is equal to:

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

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

C. 0

D. not defined.

Answer:

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4. The derivative of $x^2 + \frac{1}{x^2}$ with respect to x is:

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

B. $2x + \frac{2}{x^3}$

C. $2x - \frac{2}{x^3}$

D. $\frac{4x^3+1}{2x}$

Answer:

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

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

B. 2

C. 0

D. not defined.

Answer:

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6. The derivative of $\sin^n x$ is:

A. $n \sin^{n-1} x$

B. $n \cos^{n-1} x$

C. $n \sin^{n-1} x \cos x$

D. $-n \cos^{n-1} x \sin x$

Answer:

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7. The derivative of sinx cosx is:

A. $\sin^2 x - \cos^2 x$

B. $\sin x + \cos^2 x$

C. $\cos^2 x - \sin^2 x$

D. sin2x

Answer:

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8. $\frac{d}{dx}(x \sin x)$ is equal to:

A. sinx

B. sinx+xcosx

C. sinx+cosx

D. 0

Answer:

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9. $\frac{d}{dx}\sin 2x$ is equal to:

A. cos 2x

B. $-\cos 2x$

C. 2 cos 2x

D. 2 sin 2x

Answer:

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10. $\lim_{x \to 1} \frac{x^{15} - 1}{x^{12} - 1}$ is equal to:

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

B. $\frac{5}{4}$

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

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

Answer:

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11. $\lim_{x \to 5} \frac{|x-4|}{x-4}$ is equal to:

A. 1

B. 2

C. 3

D. 5

Answer:

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12. $\frac{d}{dx}\left(x^{3n}\right)$ is equal to:

A. $3x^{3n+1}$

B. $3nx^{3n-1}$

C. $\frac{x^{3n+1}}{3n+1}$

D. None of these

Answer:

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13. $\frac{d}{dx}\left(\frac{x-1}{x}\right)$ is equal to:

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

B. $-\frac{1}{x^2}$

C. x^2

D. None of these

Answer:

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

A. 0

B. -1

C. 1

D. None of these

Answer:

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15. If $f(x) = \frac{x-4}{2\sqrt{x}}$, then f'(1) is equal to:

A. 0

B. $\frac{4}{5}$

C. $\frac{1}{\sqrt{3}}$

D. None of these

Answer:

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16. If $y = \frac{\sin x + \cos x}{\sin x - \cos x}$, then value of $\frac{dy}{dx}$ at x=0 is:

A. 0

B. -2

C. 2

D. None of these

Answer:

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

A. 0

B. -1

C. $\sqrt{2}$

D. None of these

Answer:

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18. $\lim_{x \to 0} \frac{\sin x}{x}$ is equal to:

A. 0

B. 1

C. -1

D. Does not exist.

Answer:

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19. $\lim_{x \to 10} \frac{\sqrt{3+x} - \sqrt{5-x}}{x^2 - 1}$ is equal to:

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

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

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

D. None of these

Answer:

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20. $\lim_{x \to \frac{\pi}{2}} (\sec x - \tan x)$ is equal to:

A. 0

B. 1

C. 2

D. None of these

Answer:

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21. Let F(2)=4 and f'(2)=4 then

$$\lim_{x \to 2} \frac{xf(2) - 2f'(2)}{x - 2}$$ is equal to:

A. -2

B. 4

C. 3

D. None of these

Answer:

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22. If y=sinx+tanx, then value of $\frac{dy}{dx}$ at $x = \frac{\pi}{3}$ is:

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

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

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

D. None of these

Answer:

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23. The derivation of $\sqrt{\frac{1-\cos 2x}{1+\cos 2x}}$ is:

A. $\sec^2 x$

B. $\cos^2 x$

C. cot x

D. None of these

Answer:

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24. If $y = \frac{1 + \tan x}{1 - \tan x}$, then value of $\frac{dy}{dx}$ is:

A. $\sec^2\left(\frac{\pi}{4} + x\right)$

B. $\cos^2\left(\frac{\pi}{4} + x\right)$

C. 1

D. None of these

Answer:

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25. If $y = \dfrac{\sin x}{1 + \cos x}$, then value of $\dfrac{dy}{dx}$ is:

A. $\dfrac{1}{1 + \sin x}$

B. $-\sin x$

C. $\dfrac{1}{1 + \cos x}$

D. None of these

Answer:

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26. Let $y = \frac{x}{x+5}$, then value of $\frac{dy}{dx}$ is:

A. $\frac{1+y}{y}$

B. $y(1-y)$

C. $1+y^2$

D. None of these

Answer:

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27. $\lim_{x \to 0} \frac{1 - \cos 2x}{x}$ is equal to:

A. 1

B. 2

C. 0

D. None of these

Answer:

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28. $\lim_{x \to a} \frac{x^n - a^n}{x - a}$ is equal to:

A. na^n

B. na^{n-1}

C. 1

D. None of these

Answer:

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29. The value of $\lim_{x \to 0} \frac{\sin 2x}{\sin 3x}$ is:

A. 0

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

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

D. not defined.

Answer:

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30. Find the derivative of 3 cotx + 5 secx.

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Example

1. Find the derivative of $\frac{\sin x}{1+\cos x}$ with respect to x.

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2. Find the derivative of cosx from first principle.

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3. Find the derivative of $\frac{\sin x + \cos x}{\sin x - \cos x}$

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

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5. Find k, so that $\lim_{x \to 2}$ f(x) may exist, where

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

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

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7. Evaluate $\lim_{x \to 0} \frac{\sin ax + bx}{ax + \sin bx}$

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8. Evaluate $\lim_{x \to 0} \frac{e^{ax} - 1}{e^{bx} - 1}$.

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9. Find the derivative of the folloiwng functions:

(x-1)(x-2).

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10. Find the derivative of $\frac{1}{\sqrt{3x+1}}$ at x=2.

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11. Find the derivative of the folloiwng: $\left(5x^3+3x-1\right)(x-1)$.

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

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13. Differentiate the following functions w.r.t. x

(x+2)

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14. Find the derivative of (x^2-3x)

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

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

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17. Evaluate $\lim_{z \to 1} \frac{z^{1/3} - 1}{z^{1/6} - 1}$

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18. $\lim_{x \to 0} \frac{1 - \cos mx}{1 - \cos nx}$.

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19. Evaluate

$$\lim_{x \to 0} \frac{2^{x+3} - 8}{x}.$$

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

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21. Evaluate $\lim_{x \to 0} \frac{e^{2x} - 1}{\sin x}$.

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

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23. Evaluate: $\lim_{x \to 0} \frac{x(e^x - 1)}{1 - \cos x}$

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24. Find the derivative of $f(x) = \sqrt{x}$.

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25. Find the derivatives of the following functions:

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

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26. For some constants a and b, find the derivatives of the following functions:

$(ax^2 - b)^2$.

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27. Find the derivative of

$(2x + 3)(5x^2 - 7x + 1)$.

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28. Find the derivatives of the following functions:

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

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29. Find the derivatives of the following functions:

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

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30. Find the derivative of $\cos\left(x - \frac{\pi}{8}\right)$

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31. Differentiate $\sqrt{\sin x}$ from first principles.

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32. Evaluate:

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

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33. Differentiate $\frac{ax+b}{cx+d}$ w.r.t x.

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34. Differntiate $\cos\left(x^2+1\right)$ w.r.t. x

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35. Prove that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log a.$

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