# MATHS

## BOOKS - CENGAGE

## LIMITS AND DERIVATIVES

### Solved Examples And Exercises

**1.** Evaluate the limit: $(\lim)_{x \rightarrow 0} \frac{\sin ax}{\sin bx}$

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

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**3.** Evaluate the limit $(\lim)_{x \to 0} \frac{\sin 3x}{x}$

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**4.** The integer $n$ for which $\lim_{x \to 0} \frac{(\cos x - 1)(\cos x - e^x)}{x^n}$ is finite nonzero number is _______

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**5.** Evaluate the limit: $(\lim)_{n \to \infty} \left( \frac{1^2 - 2^2 + 3^3 - 4^2 + 5^2 + nterms}{n^2} \right)$

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**6.** Let $(\lim)_{x \to 1} \frac{x^a - ax + a - 1}{(x-1)^2} = f(a)$. Then the value of $f(4)$ is

________

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7. Evaluate $\lim_{x \to a} \frac{\sqrt{3x-a}-\sqrt{x+a}}{x-a}$.

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8. $f(x)=\frac{3x^2+ax+a+1}{x^2+x-2}$ and $\lim_{x \to -2} f(x)$ exists. Then the value of $(a-4)$ is________

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

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10. $\lim_{x \to 0} \frac{1-\sqrt{\cos 2x}\cdot\sqrt[3]{\cos 3x}\ldots.\,.\,\sqrt[n]{\cos nx}}{x^2}$ has value 10 then value of $n$ equal to

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**11.** Evaluate $\lim_{x \to 1} \frac{\sum_{k=1}^{100} x^k - 100}{x - 1}$.

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**12.** Let $S_n = 1 + 2 + 3 + \quad + n$ and $P_n = \frac{S_2}{S_2 - 1} \frac{\dot{S_3}}{S_3 - 1} \frac{\dot{S_4}}{S_4 - 1} \frac{S_n}{S_n - 1}$

Where $n \in N, (n \geq 2)$. Then $(\lim)_{x \overrightarrow{\infty}} P_n =\_ \quad \_\_ \ \_$

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**13.** If $a_1 = 1 and a_{n+1} = \frac{4 + 3a_n}{3 + 2a_n}, n \geq 1, and$ if $(\lim)_{n \overrightarrow{\infty}} a_n = a,$

then find the value of $a$.

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**14.** If $L = (\lim)_{x \overrightarrow{\infty}} \left\{ x - x^2 (\log)_e \left( 1 + \frac{1}{x} \right) \right\},$ then the value of $8L$

is_____

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**15.** Evaluate $\lim_{n \to \infty} \cos\left(\pi\sqrt{n^2 + n}\right)$ when n is an integer.

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

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**17.** Evaluate the limits

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

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**18.** Let $f''(x)$ be continuous at $x = 0$ If $(\lim)_{x \to 0}\left(2f(x) - 3a\frac{f(2x) + bf(8x)}{\sin^2 x}\right.$ exists and $f(0) \neq 0, f'(0) \neq 0,$

then the value of $\frac{3a}{b}$ is____

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**19.** Evaluate $\lim_{h \to 0}\left[\frac{1}{h^3\sqrt{8+h}} - \frac{1}{2h}\right].$

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**20.** Evaluate: $\lim_{x \to 0}\frac{e-(1+x)^{\frac{1}{x}}}{x}$

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**21.** Using $(\lim)_{\theta \to 0}\frac{\sin\theta}{\theta} = 1$ prove that the area of circle of radius $R$ is $\pi R^2$ (Figure)

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**22.** Evaluate: $(\lim)_{x \to 1} \sec\left(\frac{\pi}{2^x}\right)\log x$.

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**23.** Let $f(x) = (\lim)_{m \vec{\infty}} \left\{(\lim)_{n \vec{\infty}} \cos^{2m}(n!\pi x)\right\}$, where $x \in R$. Then prove that $f(x) = \{1, \quad \text{if} \quad xisrational0, \quad \text{if} \quad xisirrational$

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

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**25.** Evaluate:

$(\lim)_{n \vec{\infty}} n^{-n^2}\left\{\left(n + 2^0\right)\left(n + 2^{-1}\right)\left(n + 2^{-2}\right)\left(n + 2^{-n+1}\right)\right\}^n$

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**26.** Evaluate $\lim_{x \to \infty} 2^{x-1} \tan\left(\frac{a}{2^x}\right)$.

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**27.** Evaluate $\lim_{x \to \pi/2} \frac{\sin x - (\sin x)^{\sin x}}{1 - \sin x + \log_e \sin x}$.

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**28.** Evaluate $\lim_{x \to 2} \frac{x^2 - x - 2}{x^2 - 2x - \sin(x-2)}$.

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**29.** Evaluate: $\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x}\right)$

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**30.** Evaluate $\lim_{x \to \infty} x\left(\tan^{-1}\frac{x+1}{x+4} - \frac{\pi}{4}\right)$.

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**31.** Evaluate the value of

$(\lim)_{n\vec{\frac{\pi}{2}}} \tan^2 x\sqrt{(2\sin^2 x + 3\sin x + 4) - \sqrt{\sin^2 x + 6\sin x + 2}}$

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**32.** Evaluate the limit: $(\lim)_{x\vec{1}} \frac{\sin(\log x)}{\log x}$

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**33.** Evaluate: $(\lim)_{\theta\vec{0}} \frac{\cos^2(1-\cos^2(1-\cos^2(1-\cos^2(\theta))))}{\sin\left(\pi\frac{\sqrt{(\theta+4)}-2}{\theta}\right)}$

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**34.** Evaluate: $(\lim)_{x \overrightarrow{0}} \frac{1}{x} \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

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**35.** At the endpoint and midpoint of a circular are AB, tangent lines are drawn, and the points, A and B are jointed with a chord. Prove that the ratio of the areas of the triangles thus formed tends to 4 as the arc AB decreases infinitely.

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**36.** Evaluate: $(\lim)_{x \overrightarrow{0}} \frac{1-\cos mx}{1-\cos nx}$

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**37.** Evaluate $(\lim)_{x \overrightarrow{0}} \frac{x-\sin x}{x^3}$. (Do not use either LHospitals rule or series expansion for $\left.\sin x\right)$. Hence, evaluate

$(\lim)_{n \overrightarrow{0}} \frac{\sin x - x - x\cos x + x^2\cot x}{x^5}$

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**38.** $\lim_{x \to 0} \frac{\tan x - \sin x}{x^3}$

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**39.** The value of $(\lim)_{x \overrightarrow{0}} \left[\frac{1}{n} + \frac{e^{\frac{1}{n}}}{n} + \frac{e^{\frac{2}{n}}}{n} + + \frac{e^{\frac{n-1}{n}}}{n}\right] is$ 1 (b) 0 (c) $e - 1$

(d) $e + 1$

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**40.** Prove that $\lim_{x \to 0} \frac{f(x+h) + f(x-h) - 2f(x)}{h^2} = f''(x)$ (without using L' Hospital srule).

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41. $(\lim)_{n \xrightarrow{} \infty}\left\{\left(\frac{n}{n+1}\right)^{\alpha}+\sin\left(\frac{1}{n}\right)\right]^{n}$ (when $\alpha \in Q$) is equal to (a) $e^{-\alpha}$ (b) $-\alpha$ (c) $e^{1-\alpha}$ (d) $e^{1+\alpha}$

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42. Find the integral value of $n$ for which $\lim_{x \to 0} \frac{\cos^2 x - \cos x - e^x \cos x + e^x - \frac{x^3}{2}}{x^n}$ is a finite nonzero number

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43. If $\lim_{x \to \infty}\left(\frac{x^2+x+1}{x+1}-ax-b\right)=4, then$ (a)$a=1, b=4$ (b) $a=1, b=-4$ (c)$a=2, b=-3$ (d) $a=2, b=3$

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44. Evaluate $\lim_{x \to 0} \frac{\log \cos x}{x}$

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**45.** Let $L = \lim_{x \to 0} \frac{a - \sqrt{a^2 - x^2} - \frac{x^2}{4}}{x^4}, a > 0$. If $L$ is finite ,then $(a) a = 2$ (b) $a = 1$ (c) $L = \frac{1}{64}$ (d) $L = \frac{1}{32}$

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**46.** Evaluate $\lim_{x \to 0} \frac{2^x - 1}{(1 + x)^{1/2} - 1}$

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**47.** The largets value of non negative integer for which $\lim_{x \to 1} \left\{ \frac{(-ax + \sin(x-1) + a]1 - \sqrt{x}}{x + \sin(x-1) - 1} \right\}^{\frac{1-x}{1-\sqrt{x}}} = \frac{1}{4}$

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**48.** Evaluate: $\lim_{x \to 0} x^x$

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49. Let m and n be two positive integers greater than 1.If $\lim_{\alpha \to 0} \frac{e^{\cos \alpha^n} - e}{\alpha^m} = -\left(\frac{e}{2}\right)$ then the value of $\frac{m}{n}$ is

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50. find ; dy/dx for y= xlogsinx`

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51. The integer $n$ for which $(\lim)_{\underset{x}{\to}0}\left((\cos x - 1)\frac{\cos x - e\hat{x}}{x^n}\right.$ is finite nonzero number is _______

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52. If $m, n \in I_0$ and $\lim_{x \to 0} \frac{\tan 2x - n \sin x}{x^3}$ = some integer, then find the value of n and also the value of limit.

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**53.** If $(\lim)_{x \to 0} \frac{\{(a-n)nx - \tan x\}\sin nx}{x^2} = 0$, where $n$ is nonzero real number, the $a$ is 0 (b) $\frac{n+1}{n}$ (c) $n$ (d) $n + \frac{1}{n}$

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**54.** If $(\lim)_{\underset{x\ 0}{\to}} \frac{\cos 4x + a\cos 2x + b}{x^4}$ is finite, find $aandb$ using expansion formula.

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**55.** The value of $\lim_{x \to 0} \left( (\sin x)^{\frac{1}{x}} + \left(\frac{1}{x}\right)^{\sin x} \right)$, where $x > 0$, is 0 (b) $-1$ (c) 1 (d) 2

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**56.** If $\lim_{x \to a} \frac{a^x - x^a}{x^x - a^a} = -1$ and $a > 0$, then find the value of a.

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**57.** If $\lim_{x \to 0} \left[1 + x1n\left(1 + b^2\right)\right]^{\frac{1}{x}} = 2b \sin^2 \theta, b > 0$,where $\theta \in (-\pi, \pi]$, then the value of $\theta$ is (a)$\pm \frac{\pi}{4}$ (b) $\pm \frac{\pi}{3}$ (c) $\pm \frac{\pi}{6}$ (d) $\pm \frac{\pi}{2}$

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**58.** If $L = \lim_{x \to 0} \frac{\sin 2x + a \sin x}{x^3}$ is finite, then find the value of a and L.

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**59.** Evaluate: $(\lim)_{n \overrightarrow{\infty}} \left(\frac{a1\frac{1}{x} + a2\frac{1}{x} + \ + an\frac{1}{x}}{n}\right)^{nx}$

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**60.** Evaluate: $(\lim)_{x \to 0} \frac{\sin x^0}{x}$

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**61.** Evaluate: $(\lim)_{\overrightarrow{n\,0}} \frac{1 - \cos(1 - \cos x).}{x^4}$

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**62.** Let $f(x) = \{x + 1, x > 02 - x, x \leq 0$ and $g(x) = \{x + 3, x < 1, x^2 - 2x - 2, 1 \leq x < 2x - 5, x \geq 2$ Find the LHL and RHL of $g(f(x))$ at $x = 0$ and, hence, fin $\lim_{x \to 0} g(f(x))$.

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**63.** Evaluate: $(\lim)_{x \to \frac{3\pi}{4}} \frac{1 - \tan 3x}{1 - 2\cos^2 x}$

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**64.** $\lim_{x \to 0} \left[(1-e^x)\frac{\sin x}{|x|}\right] is(where[.]$ represents the greatest integer function). (a) $-1$ (b) $1$ (c) $0$ (d) does not exist

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**65.** Evaluate $(\lim)_{x \to 0} \frac{\sin x - 2}{\cos x - 1}$

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**66.** $\lim_{x \to \infty} \frac{\cot^{-1}(x^{-a}\log_a x)}{\sec^{-1}(a^x \log_x a)}, (a > 1)$ is equal to (a)$2$ (b)$1$ (c) $(\log)_a 2$ (d) 0

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

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**68.** The value of $(\lim)_{x \vec{a}} \sqrt{a^2 - x^2} \frac{\cot \pi}{2} \sqrt{\frac{a - x}{a + x}}$ is $\frac{2a}{\pi}$ (b) $-\frac{2a}{\pi}$ (c) $\frac{4a}{\pi}$ (d) $-\frac{4a}{\pi}$

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**69.** Evaluate: $(\lim)_{x \vec{0}} \frac{\cot 2x - \cos ec2x}{x}$

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**70.** $\lim_{x \to 0} \frac{\log(1 + x + x^2) + \log(1 - x + x^2)}{\sec x - \cos x} =$ (a)$-1$ (b) 1 (c) 0 (d) 2

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**71.** Evaluate: $\left( \lim_{n \to \infty} n \cos\left(\frac{\pi}{4n}\right) \sin\left(\frac{\pi}{4n}\right) \right)$

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**72.** The value of $\left(\lim_{n \to \infty}\left[\frac{2n}{2n^2-1}\frac{\cos(n+1)}{2n-1}-\frac{n}{1-2n}\frac{n(\dot{-}1)^n}{n^2+1}\right]is\right.$

1 (b) $-1$ (c) 0 (d) none of these

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**73.** Evaluate: $(\lim)_{h\overrightarrow{0}}\frac{2\left[\sqrt{3}\sin\left(\frac{\pi}{6}+h\right)-\cos\left(\frac{\pi}{6}+h\right)\right]}{\sqrt{3}h\left(\sqrt{3}\cosh-\sinh\right)}$

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**74.** Evaluate:

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

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**75.** Evaluate $\lim_{x\to 0}\frac{\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)}{\sin^{-1}x}$.

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76. Evaluate:

$$\lim_{n \to \infty} n^2 \left\{ \sqrt{\left(1 - \cos\left(\frac{1}{n}\right)\right) \sqrt{\left(1 - \cos\left(\frac{1}{n}\right)\right) \sqrt{\left(1 - \cos\left(\frac{1}{n}\right)\right) \ldots\ldots.}}} \right.$$

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77. Evaluate: $(\lim)_{\vec{x\,0}\,\vec{x\,0}} \frac{y^2 + \sin x}{x^2 + \sin y^2}$ where $(x, y)\vec{0,}$ along the curve $x = y^2$

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78. Evaluate:

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

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**79.** Find the value of $\alpha$ so that $\lim_{x \to 0} \frac{1}{x^2}(e^{\alpha x} - e^x - x) = \frac{3}{2}$

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**80.** If $x_1$ and $x_2$ are the real and distinct roots of $ax^2 + bx + c = 0$, then prove that $\lim_{n \to x_1} \{1 + \sin(ax^2 + bx + c)\}^{\frac{1}{x - x_1}} = e^{a(x_1 - x_2)}$

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**81.** If $\lim_{x \to 0} (1 + ax + bx^2)^{2/x} = e^3$, then find the values of a and b.

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**82.** Evaluate $\lim_{x \to \infty} x\left[\tan^{-1}\left(\frac{x+1}{x+2}\right) - \tan^{-1}\left(\frac{x}{x+2}\right)\right]$.

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**83.** If $(\lim)_{x \xrightarrow{} \infty}\left\{\frac{x^2+1}{x+1}-(ax+b)\right\}=0,$ then find the value of $a and b$.

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**84.** If $(\lim)_{x \xrightarrow{} 0}\frac{ae^x-b}{x}=2,$ then find the value of $a and b$.

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**85.** Evaluate: $(\lim)_{n \xrightarrow{} 1}\frac{\sin\{x\}}{\{x\}}$ if exists, where $\{x\}$ is the fractional part of $x$.

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**86.** Evaluate : $(\lim)_{x \xrightarrow{} 2^+}\frac{[x-2]}{\log(x-2)}$, where [.] represents the greatest integer function.

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87. Evaluate: $(\lim)_{x \to 0}\left(1^{1/\sin^2 x} + 2^{\frac{1}{\sin^2 x}} + \dots + n^{1/\sin^2 x}\right)^{\sin^2 x}$

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88. Let $f(x) = \{\cos[x], x \geq 0|x| + a, x < 0$ The find the value of $a$, so that $(\lim)_{x \to 0} f(x)$ exists, where $[x]$ denotes the greatest integer function less than or equal to $x$ .

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89. If $y = 2^{-2^{\left(\frac{1}{1-x}\right)}}$ , then find $\lim_{x \to 1^+} y$

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90. Let $f(x) = \left\{1 + \frac{2x}{a}, 0 \leq x < 1 \text{ and } ax, 1 \leq x < 2\right.$ If $\lim_{x \to 1} f(x)$ exists ,then $a$ is (a)$1$ (b) $-1$ (c) $2$ (d) $-2$

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91. Evaluate $(\lim)_{x \to 0} \frac{\sin x - 2}{\cos x - 1}$

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92. $(\lim)_{x \to 0} \left(\frac{\sin(\pi \cos^2 x)}{x^2}\right)$ is equal to (a) $-\pi$ (b) $\pi$ (c) $\frac{\pi}{2}$ (d) 1

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93. For $x \in R$, $\lim_{x \to \infty} \left(\frac{x-3}{x+2}\right)^x$ is equal to (a) $e$ (b) $e^{-1}$ (c) $e^{-5}$ (d) $e^5$

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94. Evaluate $\lim_{n \to \infty} \left[\sum_{r=1}^{n} \left(\frac{1}{2}\right)^r\right]$, where [.] denotes the greatest integer function.

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**95.** $\lim_{x \to \infty} \left( \frac{1}{1-n^2} + \frac{2}{1-n^2} + \ldots + \frac{n}{1-n^2} \right)$ is

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**96.** Evaluate $(\lim)_{x \vec{\frac{5\pi}{4}}} [\sin x + \cos x]$, where [.] denotes the greatest integer function.

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**97.** If $G(x) = -\sqrt{25-x^2}, then \lim_{x \to 1} \frac{G(x) - G(1)}{x-1} is$ (a) $\frac{1}{24}$ (b) $\frac{1}{5}$ (c) $-\sqrt{24}$ (d) none of these

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**98.** Evaluate the left-and right-hand limits of the function defined by $f(x) = \begin{cases} 1+x^2 & 0 \leq x < 1 \\ 2-x & x > 1 \end{cases}$ at $x = 1$ Also, show that $\lim_{x \to 1} f(x)$ does not exist

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99. $\lim_{x \to \infty} \sqrt{\frac{x - \sin x}{x + \cos^2 x}} =$

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100. Evaluate the left-and right-hand limits of the function $f(x) = \left\{ \frac{|x - 4|}{x - 4}, x \neq 40, x = 4atx = 4 \right.$

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101. If $(\lim)_{x \to a}[f(x)g(x)]$ exists, then both $(\lim)_{x \to a} f(x) and (\lim)_{x \to a} g(x)$ exist.

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**102.** If $\alpha_1, , \alpha_2, , \alpha_n$ are the roots of equation $x^n + nax - b = 0,$ show that $(\alpha_1 - \alpha_2)(\alpha_1 - \alpha_3)\ldots\ldots(\alpha_1 - \alpha_n) = n\left(\alpha_1^{n-1} + a\right)$

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**103.** Evaluate: $(\lim)_{x \overrightarrow{0}} \frac{\sin^{-1} x - \tan^{-1} x}{x^3}$

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**104.** $\lim_{x \to 1} \frac{\sqrt{1 - \cos 2(x-1)}}{x-1}$ is

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**105.** $\lim_{x \to 0} \sin^2\left(\frac{\pi}{2 - px}\right)^{\sec^2\left(\left(\frac{\pi}{2 - qx}\right)\right)}$

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**106.** The value of $\lim_{x \to 0} \frac{\sqrt{\frac{1}{2}(1-\cos 2x)}}{x}$ $is$ (a)1 (b) $-1$ (c) 0 (d) none of these

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**107.** let $f(x) = \frac{\sin 4\pi[x]}{1+[x]^2}$, where px] is the greatest integer less than or equal to x then

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**108.** If $f(x) = \begin{cases} x^n \sin\left(\frac{1}{x^2}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$, $(n \in I)$, then (a) $\lim_{x \to 0} f(x)$ exists for $n > 1$ (b) $\lim_{x \to 0} f(x)$ exists for $n < 0$ (c) $\lim_{x \to 0} f(x)$ does not exist for any value of $n$ (d) $\lim_{x \to 0} f(x)$ cannot be determined

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**109.** $(\lim)_{x \overrightarrow{0}} \frac{\sin(x^2)}{1n(\cos(2x^2 - x))} is equal \rightarrow$ 2 (b) $-2$ (c) 1 (d) $-1$

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**110.** $\lim_{x \to -1} \frac{1}{\sqrt{|x| - \{-x\}}} (where \{x\}$ denotes the fractional part of $(x)$) is equal to (a)does not exist (b) 1 (c)$\infty$ (d) $\frac{1}{2}$

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**111.** Evaluate: $\lim_{x \to 0} x^m (\log x)^n, m, n \in N\cdot$

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**112.** Let $f(x) = (\lim)_{x \overrightarrow{\infty}} \frac{1}{\left(\frac{3}{\pi}\tan^{-1} 2x\right)^{2n} + 5}\cdot$ Then the set of values of $x$ for which $f(x) = 0$ is $|2x| > \sqrt{3}$ (b) `|2x|

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113. If $f(n+1)=\frac{1}{2}\left\{f(n)+\frac{9}{f(n)}\right\}, n\in N,$ and $f(n)>0$ for all $n\in N,$ then find $\lim_{n\to\infty} f(n)$

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114. Find $(\lim)_{n\overrightarrow{\infty}}\frac{5x+2\cos x}{3x+14}$ using sandwich theorem

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115. Evaluate: $(\lim)_{x\overrightarrow{0}}\frac{\tan x}{x}$ where $[.]$ represents the greatest integer function

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116. If $\lim_{n\to\infty}\frac{1}{\left(\sin^{-1}x\right)^{n}+1}=1$ , $then$ find the value of x.

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**117.** Evaluate : $(\lim)_{x \to 2} \frac{x^2 - 5x + 6}{x^2 - 4}$

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**118.** Evaluate: $\lim_{n \to 0} \frac{e^{\sin x} - (1 + \sin x)}{\{\tan^{-1}(\sin x)\}^2}$

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**119.** Evaluate $\lim_{x \to a} \frac{\log x - \log a}{x - a}$.

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**120.** Evaluate: $(\lim)_{x \to \frac{3\pi}{4}} \frac{1 - \tan 3x}{1 - 2\cos^2 x}$

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**121.** Evaluate $\lim_{x \to 0} \frac{10^x - 2^x - 5^x + 1}{x \tan x}$.

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**122.**

$(\lim)_{x \overrightarrow{2}} \left( \left( \frac{x^3 - 4x}{x^3 - 8} \right)^{-1} - \left( \frac{x + \sqrt{2x}}{x - 2} - \frac{\sqrt{2}}{\sqrt{x} - \sqrt{2}} \right)^{-1} \right) isequa < o$

a) $\frac{1}{2}$ (b) 2 (c) 1 (d) none of these

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**123.** Evaluate $\lim_{x \to 0} \frac{\log(5 + x) - \log(5 - x)}{x}$.

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**124.** Let $p_n = a^{P_{n-1}} - 1, \forall n = 2, 3, , andletP_1 = a^x - 1,$ where $a \in R^+$. Then evaluate $(\lim)_{x \overrightarrow{0}} \frac{P_n}{x}$

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125. Column I ([.] denotes the greatest integer function), Column II

$(\lim)_{x \to 0}\left(\left[100\frac{\sin x}{x}\right]+\left[100\frac{\tan x}{x}\right]\right)$, p. 198

$(\lim)_{x \to 0}\left(\left[100\frac{x}{\sin x}\right]+\left[100\frac{\tan x}{x}\right]\right)$, q. 199

$(\lim)_{x \to 0}\left(\left[100\frac{\sin^{-1} x}{x}\right]+\left[100\frac{\tan^{-1} x}{x}\right]\right)$, r. 200

$(\lim)_{x \to 0}\left(\left[100\frac{x}{\sin^{-1} x}\right]+\left[100\frac{\tan^{-1} x}{x}\right]\right)$, s. 199

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126. Let $f(x)=\{x+1, x>02-x, x \leq 0$ and $g(x)=\{x+3, x<1x^2-2x-2, 1 \leq x<2x-5, x \geq 2$ Find the LHL and RHL of $g(f(x))$ at $x=0$ and, hence, fin $(\lim)_{x \to 0} g(f(x)0.$

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127. Evaluate: $\lim_{x \to \infty} \frac{x+7\sin x}{-2x+13}$ using sandwich theorem.

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128. If $f(x) = \left\{\frac{x - |x|}{x}, x \neq 0, x = 0, showthat (\lim)_{x \to 0} f(x)\right.$ does not exist.

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129. The reciprocal of the value of: $(\lim)_{n \to \infty}\left(1 - \frac{1}{2^2}\right)\left(1 - \frac{1}{3^2}\right)\left(1 - \frac{1}{4^2}\right)\left(1 - \frac{1}{n^2}\right) is$

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130. Show that $(\lim)_{x \to 0}$ (e^ (1/x)+1 / e^ (1/x)-1) does not exist

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131. : If $f(x) = \{x^2 + 2, x \geq 21 - x, x < 2and$ $g(x) = \left\{2x, x > 1, 3 - x, x \leq 0, thenthevalueof \lim_{x \to 1} f(g(x)) is_{-}\right.$

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**132.** Evaluate : $(\lim)_{x \to 2^+} \dfrac{[x-2]}{\log(x-2)}$, where [.] represents the greatest integer function.

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**133.** The value of $(\ \lim\ )_{x \overrightarrow{\infty}} \left(\tan^{-1} x)\right)\right)$ is equal to $(a) - 1$ (b) $\dfrac{\pi}{2}$ (c) $-\dfrac{1}{\sqrt{2}}$ (d) $\dfrac{1}{\sqrt{2}}$

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**134.** Evaluate: $(\lim)_{x \to 0} \dfrac{\sin[\cos x]}{1 + [\cos x]}([.]$ denotes the greatest integer function).

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135. $\lim_{x \to 0} \left(\frac{1^x + 2^x + \dots\dots\dots . + n^x}{n}\right)^{\frac{1}{x}}$ is equal to

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136. If $\lim_{x \to 0} \frac{x^n - \sin x^n}{x - \sin^n x}$ is non-zero finite, then $n$ must be equal to 4 (b) 1 (c) 2 (d) 3

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137. If $(\lim)_{x \overset{\rightarrow}{0}} \left[1 + x + \frac{f(x)}{x}\right]^{\frac{1}{x}} = e^3$, then find the value of $1n\left((\lim)_{x \overset{\rightarrow}{0}} \left[1 + \frac{f(x)}{x}\right]^{\frac{1}{x}}\right) is_{-}-$

A. (a) Need not exist

B. (b) exist and is 3/4

C. (c) exists and is - 3/4

D. (d) exists and is 4/3

**Answer: null**

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**138.** evaluate (i) $\lim_{x \to \infty} \sec^{-1}\left(\frac{x}{\sin x}\right)$ and $(ii) \lim_{x \to \infty} \sec^{-1}\left(\frac{\sin x}{x}\right)$.

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**139.** $\lim_{x \to 0} \frac{3x + |x|}{7x - 5|x|}$

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**140.** $f(x) = \{x, x \leq 0$ 1,x=0,then find $(\lim)_{x \to 0} f(x) \quad \text{if} \quad \exists x^2, x > 0$

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**141.** $\lim_{x \to \infty} \frac{e^{\frac{1}{x^2}} - 1}{2\tan^{-1}(x^2) - \pi}$ is equal to (a) 1 (b) $-1$ (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

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**142.** Evaluate $\lim_{x \to \infty} \left(1 + \frac{1}{a + bx}\right)^{c+dx}$, where a, b, c, and d are positive.

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**143.** If $x_1 = 3$ and $x_{n+1} = \sqrt{2 + x_n}, n \geq 1, then(\lim)_{x \to \infty} x_n$ is (a) $-1$ (b) $2$ (c) $\sqrt{5}$ (d) 3

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**144.** Evaluate: $(\lim)_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$

Watch Video Solution

**145.** $(\lim)_{x \overrightarrow{0}} \frac{\cos(\tan x) - \cos x}{x^4} isequa < o \frac{1}{6}$ (b) $-\frac{1}{3}$ (c) $\frac{1}{2}$ (d) 1

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**146.** Evaluate: $(\lim)_{x \to 0}\left(\frac{a^x + b^x + c^x}{3}\right)^{\frac{2}{x}}$; $(a, b, c > 0)$

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**147.** $(\lim)_{x \to \infty}\{x + 5) \tan^{-1}(x + 5) - (x + 1)\tan^{-1}(x + 1)\}$ is equal to (a) $\pi$ (b) $2\pi$ (c) $\frac{\pi}{2}$ (d) none of these

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**148.**

$$f(n) = \lim_{x \to 0}\left\{\left(1 + \sin\left(\frac{x}{2}\right)\right)\left(1 + \sin\left(\frac{x}{2^2}\right)\right)\ldots\ldots\left(1 + \sin\left(\frac{x}{2^n}\right)\right)\right\}^{\frac{1}{x}}$$

then find $\lim_{n \to \infty} f(n)$

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**149.** If $\lim_{x \to -2^-} \frac{ae^{\frac{1}{|x+2|}} - 1}{2 - e^{\frac{1}{|x+2|}}} = \lim_{x \to -2^+} \sin\left(\frac{x^4 - 16}{x^5 + 32}\right)$, then a is

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**150.** The population of a country increases by 2% every year. If it increases $k$ times in a century, then prove that $[k] = 7, where[.]$ represents the greatest integer function.

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**151.** Evaluate $\lim_{x \to \infty} \left[\frac{x^4 \sin\left(\frac{1}{x}\right) + x^2}{\left(1 + |x|^3\right)}\right]$.

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**152.** Evaluate $\lim_{x \to \infty} \left(\frac{x+2}{x+1}\right)^{x+3}$.

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**153.** ABC is an isosceles triangle inscribed in a circle of radius $r\cdot$ If $AB = AC$ and $h$ is the altitude from $A$ to $BC$, then triangle $ABC$ has perimeter $P = 2\left(\sqrt{2hr - h^2} + \sqrt{2hr}\right)$ and area A= __________ and also $(\lim)_{h \to 0} \frac{A}{P^3} =_{\_}\ \ -_{\_}\ -$

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**154.** Evaluate $\lim_{x \to \frac{\pi^-}{2}} (\cos x)^{\cos x}$.

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**155.** $(\lim)_{x \overrightarrow{0}} \left(x^4 \frac{\cot^4 x - \cot^2 x + 1}{\left(\tan^4 x - \tan^2 x + 1\right) isequa < o}\right.$ 1 (b) 0 (c) 2 (d) none of these

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**156.** Evaluate: $(\lim)_{x \overrightarrow{0}}(1+x)^{osecxc}$

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**157.** $(\lim)_{x \to \infty}\left(\frac{1}{e}-\frac{x}{1+x}\right)^{x}$ is equal to (a) $\frac{e}{1-e}$ (b) 0 (c) $\frac{e}{e^{1-e}}$ (d) does not exist

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**158.** $\lim_{x \to 1}\frac{1-x^{2}}{\sin 2\pi x}$ is equal to (a) $\frac{1}{2\pi}$ (b) $-\frac{1}{\pi}$ (c) $\frac{-2}{\pi}$ (d) none of these

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**159.** Evaluate $\lim_{x \to 0}\left(\frac{\sin x}{x}\right)^{\left(\frac{\sin x}{x-\sin x}\right)}$.

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**160.** $\lim_{x \to \infty} \left(\frac{x^2 + 2x - 1}{2x^2 - 3x - 2}\right)^{\frac{2x+1}{2x-1}}$ is equal to (a) 0 (b) $\infty$ (c) $\frac{1}{2}$ (d) none of these

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**161.** lim_(x->0) ((1+x)^(1/x)-e +(ex)/2)/(x^2)

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**162.** $(\lim)_{x \to 0} \frac{x^a \sin^b x}{\sin(x^c)}$, where a , b , c in R ~{0},exists and has non-zero value. Then, (a)$a + c$ (b) 1 (c) $-1$ (d) none of these

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**163.** $(\lim)_{x \to 0} \frac{5 \sin x - 7 \sin 2x + 3 \sin 3x}{x^2 \sin x}$

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164. $(\lim)_{x \to \infty}\left\{\frac{x^3+1}{x^2+1}-(ax+b)\right\}=2, then$ (a)$a=1, b=1$ (b) $a=1, b=2$ (c)$a=1, b=-2$ (d) none of these

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165. Evaluate the following limits using sandwich theorem: $(\lim)_{x \to \infty}\frac{(\log)_e x}{x}$

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166. The value of $\lim_{x \to 1}(2-x)^{\tan\left(\frac{\pi x}{2}\right)}$ is (a) $e^{-\frac{2}{\pi}}$ (b) $e^{\frac{1}{\pi}}$ (c) $e^{\frac{2}{\pi}}$ (d) $e^{-\frac{1}{\pi}}$

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167. Evaluate the following limits using sandwich theorem: $\lim_{x \to \infty}\frac{[x]}{x}, where[.]$ represents greatest integer function.

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168. `("lim")_(xvec0)(sinx^n)/((sinx)^m),(m

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169. If $\frac{x^2+x-2}{x+3} \le \frac{f(x)}{x^2} \le \frac{x^2+2x-1}{x+3}$ hold for a certain interval containing the point $x = -1$ and $\lim_{x \to 1} f(x)$ then find the value of $\lim_{x \to 1} f(x)$

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170. $(\lim)_{x \overrightarrow{\infty}} \frac{2\sqrt{x}+3\sqrt{x}+4\sqrt{x}+\dots+n\sqrt{n}}{\sqrt{(2x-3)}+\left(\sqrt{2x-3}\right)+\dots+\left(\sqrt{2x-3}\right)}$i se q u al to 1 (b) $\infty$ (c) $\sqrt{2}$ (d) none of these

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171. $(\lim)_{y \overrightarrow{0}} \frac{(x+y)\sec(x+y) - x\sec x}{y} is equal \rightarrow$ (a) $\sec x(x\tan x + 1)$ (b) $x\tan x + \sec x$ (c) $x\sec x + \tan x$ (d) none of these

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172. $\lim_{x \to \infty} \left(\frac{1}{1-n^2} + \frac{2}{1-n^2} + \ldots + \frac{n}{1-n^2}\right)$ is

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173. If $L = \lim_{x \to 2} \frac{(10-x)^{\frac{1}{3}} - 2}{x-2}$, then the value of $\left|\frac{1}{4L}\right|$ is

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174. Suppose that $f$ is a function such that $2x^2 \leq f(x) \leq x(x^2+1)$ for all $x$ that are near to 1 but not equal to 1. Show that this fact contains enough information for us to find $(\lim)_{x \overrightarrow{1}} f(x)$. Also, find this limit.

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**175.** If $L = \lim_{x \to 0} \frac{e^{-\left(\frac{x^2}{2}\right)} - \cos x}{x^3 \sin x}$, then the value of $\frac{1}{3L}$ is

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**176.** If $[.]$ denotes the greatest integer function, then $\left(\lim\right)_{x \to 0} \frac{x}{a}\left[\frac{b}{x}\right]$ $\frac{b}{a}$

b. $0$ c. $\frac{a}{b}$ d. does not exist

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**177.** If $lm_{x \to \infty} f(x)$ exists and is finite and nonzero and if $\lim_{x \to \infty} \left\{\left\{f(x) + \frac{3f(x) - 1}{f_2(x)}\right\}\right. = 3$,then the value of $\lim_{x \to \infty} f(x)$ is

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178. If $3-\left(\frac{x^2}{12}\right) \leq f(x) \leq 3+\left(\frac{x^3}{9}\right)$ for all $x \neq 0$, then find the value of $(\lim)_{x \to 0} f(x)$

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179. If

$f(x)=\{x-1, x \geq 12x^2-2, x<1, g(x)=\{x+1, x>0-x^2+1, x \leq$

h(x)=|x|, $then(\lim)_{x \to 0} f(g(h(x)))$ is___

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180. Evaluate $\lim_{x \to 0}\left\{\frac{\sin x-x+\frac{x^3}{6}}{x^5}\right\}$.

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181. $\lim_{x \to \infty} f(x), where \frac{2x-3}{x}<f(x)<\frac{2x^2+5x}{x^2}, is$

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**182.** Evaluate $\lim_{x \to 0} \frac{\sin x + \log(1-x)}{x^2}$.

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**183.** If $(\lim)_{x \overrightarrow{0}} \left[1 + x + \frac{f(x)}{x}\right]^{\frac{1}{x}} = e^3$, then find the value of $1n\left((\lim)_{x \overrightarrow{0}} \left[1 + \frac{f(x)}{x}\right]^{\frac{1}{x}}\right) is\_\_$

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

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**185.** The value of $(\lim)_{x \overrightarrow{\infty}} \left[3\sqrt{(n+1)^2} - 3\sqrt{(n-1)^2}\right)\Big]$ is_____

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**186.** Evaluate : $(\lim)_{x \rightarrow 2} \frac{x^2 - 5x + 6}{x^2 - 4}$

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**187.** If: $(\lim)_{x \rightarrow 1}\left(1 + ax + bx^2\right)^{\frac{c}{(x-1)}} = e^3$, then the value of $bc$ is___

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**188.** Evaluate : $(\lim)_{x \rightarrow 1}\left(\frac{2}{1 - x^2} + \frac{1}{x - 1}\right)$

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**189.** $(\lim)_{x \rightarrow 0}\left(\frac{1 + 5x^2}{1 + 3x^2}\right)^1 / x^2 =\_ \_$

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**190.** Evaluate : $(\lim)_{x \to 1} \frac{x^2 + x(\log)_e x - (\log)_e x - 1}{(x^2 - 1)}$

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**191.** If $L = (\lim)_{n \to \infty} \left(2x3^2x2^3x3^4\ldots..x2^{n-1}x3^n\right)^{\frac{1}{(n^2+1)}}$, then the value of $L^4$ is

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**192.** Evaluate $\lim_{x \to \frac{\pi}{4}} \frac{1 - \sin 2x}{1 + \cos 4x}$.

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**193.** The value of $(\lim)_{x \to \infty} \left((\log)_e \frac{(\log)_e x}{e\sqrt{x}}\right)$ is__________`

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194. Evaluate $\lim_{x \to \pi/4} \frac{1 - \cot^3 x}{2 - \cot x - \cot^3 x}$.

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195. $(\lim)_{x \overset{\rightarrow}{} 0} \frac{(x+y)\sec(x+y) - x\sec x}{y} isequa < o$ (a) $\sec x(x\tan x + 1)$ (b) $x\tan x + \sec x$ (c)$x\sec x + \tan x$ (d) none of these

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

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197. The value of $\lim_{m \to \infty} \left(\cos\left(\frac{x}{m}\right)\right)^{\mathrm{m}}$ is 1 (b) e (c) $e^{-1}$ (d) none of these

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198. Find the value of $\lim_{x \to 0} \frac{\sin x + \log_e\left(\sqrt{1 + \sin^2 x} - \sin x\right)}{\sin^3 x}$.

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199. Evaluate $\lim_{h \to 0} \frac{\log_e(1 + 2h) - 2\log_e(1 + h)}{h^2}$.

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200. Evaluate: $(\lim)_{x \overrightarrow{2}} \frac{\sqrt{(x + 7)} - 3\sqrt{(2x - 3)}}{3\sqrt{x + 6} - 23\sqrt{3x - 5}}$

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201. `("lim")_(xvec0)(sinx^n)/((sinx)^m),(m

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**202.** Evaluate: $(\lim)_{x\overrightarrow{\infty}}\frac{\sqrt{3x^2-1}-\sqrt{2x^2-1}}{4x+3}$

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**203.** $(\lim)_{x\overrightarrow{0}}\left(x^4\frac{\cot^4 x-\cot^2 x+1}{(\tan^4 x-\tan^2 x+1)isequa<o}\right.$ 1 (b) 0 (c) 2 (d) none of these

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**204.** Evaluate: $(\lim)_{x\overrightarrow{\infty}}\sin^n\left(\frac{2\pi n}{3n+1}\right), n\in N.$

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**205.** $(\lim)_{x\overrightarrow{\infty}}\left(\frac{1}{e}-\frac{x}{1+x}\right)^{\xi}sequa<o\ \frac{e}{1-e}$ (b) 0 (c) $\frac{e}{e^{1-e}}$ (d) does not exist

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**206.** Evaluate $\lim_{x \to 1} \frac{\sqrt{x} + \sqrt{\sqrt{x}} + \sqrt{\sqrt{\sqrt{x}}} + \sqrt{\sqrt{\sqrt{\sqrt{x}}}} - 4}{x - 1}$.

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**207.** $(\lim)_{\underset{x\,1}{\to}} \frac{1 - x^2}{s \in 2\pi x} isequa < o \frac{1}{2\pi}$ (b) $-\frac{1}{\pi}$ (c) $\frac{-2}{\pi}$ (d) none of these

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**208.** Evaluate $\lim_{x \to 2} \frac{x^{10} - 1024}{x^5 - 32}$.

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**209.** `("lim")_(xvec0)1/xcos^(-1)((1-x^2)/(1+x^2)) is equal to (a)1 (b) 0 (c) 2 (d)

none of these

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**210.** If $\lim_{x \to 2} \frac{x^n - 2^n}{x - 2} = 80$ and $n \in N$, then find the value of n.

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**211.** $(\lim)_{x \overrightarrow{\infty}} \left(\frac{x^2 + 2x - 1}{2x^2 - 3x - 2}\right)^{\frac{2x+1}{2x-1}} isequa < o\,0$ (b) $\infty$ (c) $\frac{1}{2}$ (d) none of these

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

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**213.** $(\lim)_{x \overrightarrow{\infty}} \frac{2\sqrt{x} + 3\sqrt{x} + 4\sqrt{x} + \ldots + n\sqrt{n}}{\sqrt{(2x-3)} + (\sqrt{2x-3}) + \ldots. + (\sqrt{2x-3})}$ i se q u al to 1 (b) $\infty$ (c) $\sqrt{2}$ (d) none of these

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**214.** Evaluate: $\lim_{x \to \infty} \frac{\sqrt{x^2+1} - \sqrt[3]{x^3+1}}{\sqrt[4]{x^4+1} - \sqrt[5]{x^4+1}}$

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**215.** The value of $\lim_{x \to 1} \frac{1-\sqrt{x}}{\left(\cos^{-1} x\right)^2}$ is 4 (b) $\frac{1}{2}$ (c) 2 (d) $\frac{1}{4}$

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**216.** Evaluate $\lim_{x \to \infty} \sqrt{x}\left(\sqrt{x+c} - \sqrt{x}\right)$

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**217.** $\lim_{x \to \infty} \frac{(x+1)^{10} + (x+2)^{10} + \ldots + (x+100)^{10}}{x^{10} + 10^{10}}$ is equal to

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**218.** Evaluate $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2}$

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**219.** $\lim_{x \to \infty} \left[\sqrt{x + \sqrt{x + \sqrt{x}}} - \sqrt{x}\right]$ is equal to (a)0 (b) $\frac{1}{2}$ (c) log 2 (d) $e^4$

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**220.** Evaluate: $\lim_{x \to 2} \frac{\sin(e^{x-2} - 1)}{\log(x - 1)}$

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**221.** $\lim_{n \to \infty} \frac{n(2n+1)^2}{(n+2)(n^2+3n-1)}$ is equal to (a)0 (b) 2 (c) 4 (d) $\infty$

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**222.** Evalaute $\lim_{x \to 0} \frac{x2^x - x}{1 - \cos x}$

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**223.** Find the value of limit

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

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**224.** Evaluate $\lim_{x \to \infty} \left[x\left(a^{1/x} - 1\right)\right], a > 1$

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**225.** If $f(x) = \frac{2}{x - 3}, g(x) = \frac{x - 3}{x + 4}$ , and $h(x) = -\frac{2(2x + 1)}{x^2 + x - 12}$ then $\lim_{x \to 3} [f(x) + g(x) + h(x)]$ is (a) $-2$ (b) $-1$ (c) $-\frac{2}{7}$ (d) $0$

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226. Evaluate: $(\lim)_{x \to 0} \frac{(1 - 3^x - 4^x + 12^x)}{\sqrt{(2\cos x + 7)} - 3}$

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227. $\lim_{x \to \infty} \left( \frac{x^3}{3x^2 - 4} - \frac{x^2}{3x + 2} \right)$ is equal to

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228. Evaluate $\lim_{x \to 0} \frac{a^{\tan x} - a^{\sin x}}{\tan x - \sin x}, a > 0$

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229. $\lim_{x \to \infty} \frac{(2x + 1)^{40} (4x - 1)^5}{(2x + 3)^{45}}$ is equal to (a)16 (b) 24 (c) 32 (d) 8

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230. $\lim_{x \to a} \frac{\log(x - a)}{\log(e^x - e^a)}$

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**231.** The value of $(\lim)_{x \to 2} \frac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2} is$ (a)$\frac{1}{8\sqrt{3}}$ (b) $\frac{1}{4\sqrt{3}}$ (c) 0 (d) none of these

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

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**233.** $\lim_{n \to \infty} n^2 \left(x^{1/n} - x^{1/(n+1)}\right), x > 0,$ is equal to

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**234.** Evaluate $\lim_{x \to \infty} x^{\frac{1}{x}}$.

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235. The value of $(\lim)_{x \vec{\pi}} \frac{1+\cos^3 x}{\sin^2 x} is \frac{1}{3}$ (b) $\frac{2}{3}$ (c) $-\frac{1}{4}$ (d) $\frac{3}{2}$

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236. $\lim_{x \to 0} \frac{(729)^x - (243)^x - (81)^x + 9^x + 3^x - 1}{x^3}$

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237. If $f(x) = \frac{3x^2 + ax + a + 1}{x^2 + x - 2}$, then which of the following can be correct (a) $(\lim)_{x \to 1} f(x) existsa = -2$ (b) $(\lim)_{x \to -2} f(x) existsa = 13$ (c) $(\lim)_{x \to 1} f(x) = \frac{4}{3}$ (d) $(\lim)_{x \to -2} f(x) = -\frac{1}{3}$

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**238.** Evaluate:

$(\lim)_{n \to \infty}(-1)^{n-1}\sin\left(\pi\sqrt{n^2+0.5n+1}\right), where n \in N$

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**239.** $(\lim)_{x \to \infty}\frac{1}{1+n\sin^2 nx} is equal (a)-1$ (b) 0 (c) 1 (d) $\infty$

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**240.** Let the sequence $\{b_n\}$ real numbers satisfies the recurrence relation $b_{n+1}=\frac{1}{3}\left(2b_n+\frac{125}{(b_n)^2}\right), b_n \neq 0.$ Then find the $(\lim)_{n \to \infty} b_n.$

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**241.** Which of the following true ({.} denotes the fractional part of the function)? (a)$(\lim)_{x \to \infty}\frac{(\log)_e x}{\{x\}}=\infty$ (b) $(\lim)_{x \to 2^+}\frac{x}{x^2-x-2}=\infty$ (c)$(\lim)_{x \to 1^-}\frac{x}{x^2-x-2}=-\infty$ (d) $(\lim)_{x \to \infty}\frac{(\log)_{0.5}x}{\{x\}}=\infty$

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**242.** If $(\lim)_{x \to 1^-}(2 - x + a[x-1] + b[1+x])$ exists, then $aandb$ can take the values of (where [.] denotes the greatest integer function). (a) $a = \frac{1}{3}, b = 1$ (b) $a = 1, b = -1$ (c) $a = 9, b = -9$ (d)$a = 2, b = \frac{2}{3}$

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**243.** Evaluate: $(\lim)_{n \to \infty} \frac{n^p \sin^2(n!)}{n+1}$

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**244.** $(\lim)_{x \to \infty}\left(an - \frac{1+n^2}{1+n}\right) = b,$ where $a$ is a finite number, then(a) $a = 1$ (b) $a = 0$ (c) $b = 1$ (d) $b = -1$

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**245.** Evaluate $\lim_{x \to \infty} x^3\left\{\sqrt{x^2+\sqrt{1+x^4}}-x\sqrt{2}\right\}.$

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**246.** If $m, n \in N$, $(\lim)_{\underset{x}{\to} 0} \frac{\sin x^m}{(\sin x)^m} is\ 1, \quad \text{if} \quad n=m$ (b) $0, \quad \text{if} \quad n>m$

`oo,ifn

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**247.** Evaluate: $\lim_{x \to \infty} \sqrt[3]{(x+1)(x+2)(x+3)}-x$

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**248.** $L=(\lim)_{x \to a} \frac{|2\sin x-1|}{2\sin x-1}\dot{Then}$ limit does not exist when (a) $a=\frac{\pi}{6}$ (b) $L=-1 when a=\pi$ (c) $L=1 when a=\frac{\pi}{2}$ (d) $L=1 when a=0$

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**249.** If $[x]$ denotes the greatest integer less than or equal to $x$, then evaluate $(\lim)_{n \to \infty} \frac{1}{n^2}([1.\,x] + [2.\,x] + [3.\,x] + \ldots. + [n.\,x])$

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**250.** If $f(x) = \log\left(\frac{1+x}{1-x}\right)$, *then* $f(x_1)f(x) = f(x_1 + x_2)$ $f(x+2) - 2f(x+1) + f(x) = 0$ $f(x) + f(x+1) = f(x^2 + x)$ $f(x_1) + f(x_2) = f\left(\frac{x_1 + x_2}{1 + x_1 x_2}\right)$

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**251.** Evaluate $\lim_{x \to 1} \frac{(2x-3)(\sqrt{x}-1)}{2x^2 + x - 3}$.

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**252.** $(\lim)_{n \to \infty} \sum_{x=1}^{20} \cos^{2n}(x - 10)$ is equal to (a) 0 (b) 1 (c) 19 (d) 20

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**253.** $f(x) = \frac{\ln(x^2 + e^x)}{\ln(x^4 + e^{2x})}$. Then $\lim_{x \to \infty} f(x)$ is equal to

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**254.** $(\lim)_{n \overrightarrow{\infty}} \left\{ \left( \frac{n}{n+1} \right)^{\alpha} + \sin\left( \frac{1}{n} \right) \right]^{n}$ (when $\alpha \in Q$) is equal to (a) $e^{-\alpha}$ (b) $-\alpha$ (c) $e^{1-\alpha}$ (d) $e^{1+\alpha}$

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**255.** The value of $\lim_{x \to 2} \frac{2^x + 2^{3-x} - 6}{\sqrt{2^{-x}} - 2^{1-x}}$ is

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**256.** If $\lim (n \to \infty) \frac{n \cdot 3^n}{n(x-2)^n + n \cdot 3^{n+1} - 3^n} = \frac{1}{3}$ then the range of x is (where $n \varepsilon N$)

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**257.** If $(\lim)_{x \to a}[f(x)g(x)]$ exists, then both $(\lim)_{x \to a} f(x) and (\lim)_{x \to a} g(x)$ exist.

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**258.** If $f(x) = \lim_{n \to \infty} n\left(x^{\frac{1}{n}} - 1\right), thenf$ or $x > 0, y > 0, f(xy)$ is equal to : (a)$f(x)f(y)$ (b) $f(x) + f(y)$ (c)$f(x) - f(y)$ (d) none of these

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**259.** $\lim_{n \to \infty} \left(\frac{n^2 - n + 1}{n^2 - n - 1}\right)^{n(n-1)}$ is

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260. $(\lim)_{x \to 1}\left[\cos ec\frac{\pi x}{2}\right]^{\frac{1}{(1-x)}}(where[.]representsthe$

$g$ if $isequal \to$ (a) 0 (b) 1 (c) $\infty$ (d) does not exist

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261. Given $(\lim)_{x \to 0}\frac{f(x)}{x^2} = 2, where[.]$ denotes the greatest integer function, then (a) $(\lim)_{x \to 0}[f(x)] = 0$ (b) $(\lim)_{x \to 0}[f(x)] = 1$ (c) $(\lim)_{x \to 0}\left[\frac{f(x)}{x}\right]$ does not exist (d)$(\lim)_{x \to 0}\left[\frac{f(x)}{x}\right]$ exists

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262. Let $f(x) = \frac{x^2 - 9x + 20}{x - [x]}$ (where $[x]$ is the greatest integer not greater than $x$. Then (a) $(\lim)_{x \to 5}f(x) = 1$ (b)$(\lim)_{x \to 5}f(x) = 0$ (c) $(\lim)_{x \to 5}f(x)does \neg e\xi st$ (d)none of these

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**263.** Use formula $\lim_{x \to 0} \frac{a^x - 1}{x} = \log(a)$ to find $\lim_{x \to 0} \frac{2^x - 1}{(1 + x)^{\frac{1}{2}} - 1}$

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**264.** Find $(\lim)_{x \to 0} \left\{\tan\left(\frac{\pi}{4} + x\right)\right\}^{1/x}$

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**265.** Evaluate $\lim_{h \to 0} \frac{(a + h)^2 \sin(a + h) - a^2 \sin a}{h}$.

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**266.** $\lim_{x \to \infty} \left(x \frac{\log(x)^3}{1 + x + x^2}\right.$ equals 0 (b) $-1$ (c) 1 (d) none of these

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**267.** $(\lim)_{x \to 0} \frac{(2^m + x)^{\frac{1}{m}} - (2^n + x)^{\frac{1}{n}}}{x} isequalto$ (a) 2 $\left(\frac{1}{m2^m} - \frac{1}{n2^n}\right)'(b)$(1/(m2^m)+1/(n2^n))$(c)$1/(m2^(-m))-1/(n2^(-n))$(d)$ 1/(m2^(-m))+1/(n2^(-n))`

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**268.** Evaluate $\lim_{x \to 1} (1 - x)\tan\frac{\pi x}{2}$.

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**269.** If $f(x) = \begin{cases} \sin x & x \neq n\pi \text{ and } n \in Z \\ 2 & x = n\pi \end{cases}$ and $g(x) = \begin{cases} x^2 + 1 & x \neq 0 \\ 4 & x = 0 \\ 5 & x = 2 \end{cases}$ then $\lim_{x \to 0} g\{f(x)\}$ is

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**270.** $(\lim)_{x \overrightarrow{0}}\left[\min\left(y^2 - 4y + 11\right)\frac{\sin x}{x}\right](where[.]de \neg esthe$ greatest integer function is 5 (b) 6 (c) 7 (d) does not exist

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**271.** $\lim_{x \to \pi/2} \frac{\sin(x \cos x)}{\cos(x \sin x)}$ is equal to

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**272.** If $\lim_{x \to 0}\left(x^{-3}\sin 3x + ax^{-2} + b\right)$ exists and is equal to 0, then (a) $a = -3$ and $b = \frac{9}{2}$ (b) $a = 3$ and $b = \frac{9}{2}$ (c) $a = -3$ and $b = -\frac{9}{2}$ (d) $a = 3$ and $b = -\frac{9}{2}$

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**273.** If $\lim_{x \to 0} \frac{x^n - \sin x^n}{x - \sin^n x}$ is non-zero finite, then $n$ must be equal to 4 (b) 1 (c) 2 (d) 3

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**274.** $(\lim)_{x \overset{\to}{1}} \frac{(1-x)(1-x^2)(1-x^{2n})}{\{(1-x)(1-x^2)(1-x^n)\}^2}, n \in N, equals$ ^ $2nP_n$ (b) ^ $2nC_n$ (c) $(2n)!$ (d) none of these

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**275.** The value of $\lim_{x \to 0}\left(\left[\frac{100x}{\sin x}\right]+\left[\frac{99 \sin x}{x}\right]\right)$ (where [.] represents the greatest integral function) is (a)$199$ (b) $198$ (c)$0$ (d) none of these

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**276.** The value of $\lim_{x \to \frac{1}{\sqrt{2}}} \frac{x-\cos(\sin^{-1} x)}{1-\tan(\sin^{-1} x)}$ is

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**277.** The value of $\lim_{x \to \infty} \frac{\left(2^{x^n}\right)^{\frac{1}{e^x}} - \left(3^{x^n}\right)^{\frac{1}{e^x}}}{x^n}$ (where $n \in N$) is (a) $\log n\left(\frac{2}{3}\right)$ (b) 0 (c) $n \log n\left(\frac{2}{3}\right)$ (d) none of defined

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**278.** Let $\lim_{x \to 0} \frac{[x]^2}{x^2} = l$ and $\lim_{x \to 0} \frac{[x^2]}{x^2} = m,$ where $[.]$ denotes greatest integer. Then (a)$l$ exists but $m$ does not (b)$m$ exists but $l$ does not (c)both l and m exist (d) neither l nor m` exists

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**279.** $(\lim)_{x \overrightarrow{1}} \frac{x \sin(x - [x])}{x - 1}, where[.]$ denotes the greatest integer function is equal to (a) 0 (b) $-1$ (c) not exist (d) none of these

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**280.** $(\lim)_{x \overrightarrow{0}}\left[\frac{\sin(sgn(x))}{(sgn(x))}\right]$, where $[.]$ denotes the greatest integer function, is equal to (a)0 (b) 1 (c) $-1$ (d) does not exist

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**281.** $\lim_{x \to 0} \frac{2+2x+\sin 2x}{(2x+\sin 2x)e^{\sin x}}$ is

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**282.** If $f(x)=\frac{\cos x}{(1-\sin x)^{\frac{1}{3}}}$ then (a) $(\lim)_{x \to \frac{\pi}{2}} f(x)=-\infty$ (b) $(\lim)_{x \to \frac{\pi}{2}} f(x)=\infty$ (c) `("lim")_(xrarrpi/2)f(x)=o (d) none of these

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**283.** $\lim_{x \to -\infty} \frac{x^2 \cdot \tan\left(\frac{1}{x}\right)}{\sqrt{8x^2+7x+1}}$ is

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**284.** Find the area of an isosceles triangle whose perimeter is 36 cm and base is 16 cm.

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**285.** If $f(x)=0$ is a quadratic equation such that $f(-\pi)=f(\pi)=0$ and $f\left(\frac{\pi}{2}\right)=-\frac{3\pi^2}{4}$, then $\lim_{x\to-\pi}\frac{f(x)}{\sin(\sin x)}$ is equal to (a)0 (b) $\pi$ (c) $2\pi$ (d) none of these

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**286.** $(\lim)_{x\overrightarrow{\infty}}\left[\left(\frac{e}{1-e}\right)\left(\frac{1}{e}-\frac{x}{1+x}\right)\right]^{\xi}s\ e^{(1-e)}$ (b) $e^{\left(\frac{1-e}{e}\right)}$ (c) $e^{\left(\frac{e}{1-e}\right)}$ (d) $e^{\left(\frac{1+e}{e}\right)}$

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**287.** $(\lim)_{x \to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\cos ecx} isequalto$ (a)e (b) $\frac{1}{e}$ (c) 1 (d) none of these

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**288.** $(\lim)_{x \overrightarrow{\infty}} \frac{\sin^4 x - \sin^2 x + 1}{\cos^4 x - \cos^2 x + 1}$ is equal to (a) 0 (b) 1 (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

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