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MATHS

BOOKS - CENGAGE PUBLICATION

LIMITS AND DERIVATIVES

Others

1. Evaluate the limit: $\lim_{x \to 0} \frac{\sin ax}{\sin bx}$

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2. If $\lim_{x \to 1} \frac{a \sin(x-1) + b \cos(x-1) + 4}{x^2 - 1} = -2$, then $|a+b|$ is_____.

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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 a finite non-zero number is :

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

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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 the limit: $\lim_{x \to a} \dfrac{\sqrt{3x - a} - \sqrt{x + a}}{x - a}$

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

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9. Evaluate the limit: $(\lim)_{x \to \infty} \left[\sqrt{a^2x^2 + ax + 1} - \sqrt{a^2x^2 + 1}\right]$

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

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

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12. Let $S_n = 1 + 2 + 3 + \ + n$ and $P_n = \frac{S_2}{S_2 - 1} \cdot \frac{S_3}{S_3 - 1} \cdot \frac{S_4}{S_4 - 1} \cdot \ldots \cdot \frac{S_n}{S_n - 1}$ Where $n \in N, (n \geq 2)$. Then $\lim_{n \to \infty} P_n =$ _ _ _

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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 $\lim_{n \to \infty} a_n = a$, then find the value of a.

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

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15. Evaluate the limit: $(\lim)_{n\to\infty}\cos\left(\pi\sqrt{n^2+n}\right)$ when n is an integer

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

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17. Evaluate the limit: $\lim_{x\to 0}\dfrac{\sqrt{2}-\sqrt{1+\cos x}}{\sin^2 x}$

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18. Let $f''(x)$ be continuous at $x=0$

If $\lim_{x\to 0}\dfrac{2f(x)-3af(2x)+bf(8x)}{\sin^2 x}$ exists and $f(0)\neq 0, f'(0)\neq 0$, then find the value of $3a/b$ is_____.

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19. Evaluate the limit: $(\lim)_{h \to 0} \left[\frac{1}{h(8+h)^{\frac{1}{3}}} - \frac{1}{2h} \right]$

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

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21. Using $\lim_{\theta \to 0} \left(\frac{\sin \theta}{\theta} \right) = 1$ prove that the area of circle of radius R is πR^2

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22. Evaluate: $\lim_{x \to 1} \sec\left(\frac{\pi}{2x} \right) \log x \cdot$

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23. Evaluate : $\left[\lim_{x \to 0} \frac{\sin x}{x}\right]$, where $[\cdot]$ represents the greatest integer function.

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24. Let $f(x) = \lim_{m \to \infty} \left\{ \lim_{n \to \infty} \cos^{2m}(n!\pi x) \right\}$, where $x \in R$. Then prove that $f(x) = \{1$, if x is rational and 0, if x is irrational

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

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26. Evaluate

$\lim_{n \to \infty} n^{-n^2} \left[\left(n + 2^0\right)\left(n + 2^{-1}\right)\left(n + 2^{-2}\right) \ldots \left(n + 2^{-n+1}\right)\right]^n.$

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27. Solve: $\lim_{x \to \infty} 2^{x-1} \tan\left(\frac{a}{2^x}\right)$

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

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

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

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

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32. Evaluate

$\lim_{x \to \frac{\pi}{2}} \tan^2 x\left[\sqrt{2\sin^2 x + 3\sin x + 4} - \sqrt{\sin^2 x + 6\sin x + 2}\right]$

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33. Evaluate the limit: $\lim_{x \to 1} \frac{\sin(\log x)}{\log x}$

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34. Let if then one of the possible value of is:

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

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36. 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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37. $\lim_{x \to 0} \frac{1 - \cos x}{x^2} = ?$

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

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

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39. Evaluate :

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

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40. The value of $\lim_{n \to \infty} \left[\frac{1}{n} + \frac{e^{1/n}}{n} + \frac{e^{2/n}}{n} + \ldots + \frac{e^{(n-1)/n}}{n} \right]$ is

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41. Find the values of a and b in order that $\lim_{x \to 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1$ [using L' Hospital' srule].

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42. $(\lim)_{x \to 1} \frac{nx^{n+1} - (n+1)x^n + 1}{(e^x - e)\sin \pi x}$, $where n = 100$, is equal to :

$\frac{5050}{\pi e}$ (b) $\frac{100}{\pi e}$ (c) $-\frac{5050}{\pi e}$ (d) $-\frac{4950}{\pi e}$

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

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

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46. 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

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

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

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

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

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51. Evaluate: $(\mathrm{dy}/\mathrm{dx})of \log \sin x + \tan x$

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52. The integer n for which $\lim_{x \to 0} \frac{(\cos x - 1)(\cos x - e^x)}{x^n}$ is a finite non-zero number is :

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

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54. If $\lim_{x \to 0} \frac{((a-n)nx - \tan x)\sin nx}{x^2} = 0$, where n is non zero real number, then a is equal to:

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

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56. 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 (a)0 (b) -1 (c) 1 (d) 2

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57. 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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58. If $\lim_{x \to 0} \left[1 + x \ln\left(1 + b^2\right)\right]^{\frac{1}{x}} = 2b \sin^2 \theta, b > 0 \text{and} \theta \in (-\pi, \pi]$. then the value of θ is

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

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60. Evaluate: $(\lim)_{x \to \infty} \left(\dfrac{a_1^{\frac{1}{x}} + a_2^{\frac{1}{x}} + - - + a_n^{\frac{1}{x}}}{n} \right)^{nx}$

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61. $\lim_{x \to 0} \dfrac{\sin x^{\circ}}{x} = ?$

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62. Evaluate: $(\lim)_{x \to 0} \frac{1 - \cos(1 - \cos x).}{x^4}$

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63. Evaluate: $\left[(\lim)_{x \to 0} \frac{\tan^{-1} x}{x}\right]$, where [.]represent the greatest integer function

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

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65. Evaluate: $(\lim)_{x \to \frac{\pi}{4}} \frac{\sqrt{2}\cos x - 1}{\cot x - 1}$

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66. $\lim_{x \to 0} \left[(1 - e^x) \frac{\sin x}{|x|} \right]$ is (where $[.]$ represents the greatest integer function)

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

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68. $\lim_{x \to \infty} \frac{\cot^{-1}(x^{-a} \log_a x)}{\sec^{-1}(a^x \log_x a)}, (a > 1),$ is equal to

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

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70. The value of $(\lim)_{x \to a} \sqrt{a^2 - x^2} \cot\left(\frac{\pi}{2}\sqrt{\frac{a-x}{a+x}}\right)$ is (a) $\frac{2a}{\pi}$ (b) $-\frac{2a}{\pi}$ (c) $\frac{4a}{\pi}$ (d) $-\frac{4a}{\pi}$

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71. Evaluate: $\lim_{x \to 0} \frac{\cot 2x - \cos ec2x}{x}$

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72. $\lim_{x \to 0} \frac{\log\left(1 + x + x^2\right) + \log\left(1 - x + x^2\right)}{\sec x - \cos x} =$

A. -1

B. 1

C. 0

D. 2

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

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74. The value of $\lim_{n \to \infty} \left[\frac{2n}{2n^2 - 1} \cos\left(\frac{n+1}{2n-1}\right) - \frac{n}{1-2n} \frac{n(-1)^n}{n^2+1} \right] is$ (a) 1 (b) -1 (c) 0 (d) none of these

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

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

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78. Evaluate:

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

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

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80. Evaluate $\lim_{n \to \infty} \left\{ \cos\left(\frac{x}{2}\right) \cos\left(\frac{x}{4}\right) \cos\left(\frac{x}{8}\right) \ldots \cos\left(\frac{x}{2^n}\right) \right\}$.

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

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82. If x_1 and x_2 are the real and distinct roots of $ax^2 + bx + c = 0$ then prove that $\lim_{x \to x1} \left(1 + \sin\left(ax^2 + bx + c\right)\right)^{\frac{1}{x - x_1}}$ equals to

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83. If $\lim_{x \to 0} \left(1 + ax + bx^2\right)^{2/x} = e^3$, then the value of a and b, is :

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84. Evaluate: $(\lim)_{n\to\infty} x\left[\tan^{-1}\left(\frac{x+1}{x+2}\right)-\tan^{-1}\left(\frac{x}{x+2}\right)\right]$

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

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

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

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88. Evaluate: $(\lim)_{x \to 1} \frac{x \sin\{x\}}{\{x-1\}}$ if exists, where $\{x\}$ is the fractional part of x.

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

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

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91. Let $f(x) = \begin{cases} \cos[x], & x \leq 0 \\ |x| + a, & x > 0 \end{cases}$. Then 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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92. If $f(x) = |x-1| - [x], where\ [x]$ is the greatest integer less then or equal to x , then

(A) $f(1+0) = -1, f(1-0) = 0$

(B) $f(1+0) = 0 = f(1-0)$

(C) $(\lim)_{x \to 1} f(x)$ exists

(D) $(\lim)_{x \to 1} f(x)$does not exist

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

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94. 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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95. Evaluate $(\lim)_{x \to 0} \dfrac{\sin x - 2}{\cos x - 1}$

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96. $\lim\limits_{x \to 0} \dfrac{\sin\left(\pi \cos^2 x\right)}{x^2}$ is equal to :

A. $-\pi$

B. π

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

D. 1

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

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

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100. $\lim_{n \to \infty} \left\{ \frac{1}{1-n^2} + \frac{2}{1-n^2} + \ldots\ldots \frac{n}{1-n^2} \right\} isequal \to$

(a) 0

(b) $-\frac{1}{2}$

(c) $\frac{1}{2}$

(d) none of these

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101. Evaluate $\lim_{x \to \frac{5\pi}{4}} [\sin x + \cos x]$, where [.] denotes the greatest integer function.

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

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103. 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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104. If $f(x) = \sqrt{\frac{x - \sin x}{x + \cos^2 x}}$, then $\lim_{x \to \infty} f(x)$ is

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105. Evaluate the right hand limit and left hand limit of the function

$$f(x) = \begin{cases} \frac{|x-4|}{x-4} & x \neq 4 \\ 0 & x = 4 \end{cases}$$

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106. 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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107. If $\alpha_1, , \alpha_2, \ldots . , \alpha_n$ 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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108. Evaluate : $\lim_{x \to 0} \frac{x \tan 2x - 2x \tan x}{(1 - \cos 2x)^2}$

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109. Evaluate $\lim_{x \to 0} \frac{\sin^{-1} x - \tan^{-1} x}{x^3}$.

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

a. exists and its equals $\sqrt{2}$

b. exists and its equals $\sqrt{-2}$

c.does not exist because $x - 1 \to 0$

d. L.H.L not equal R.H.L

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

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112. 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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113. Evaluate: $\lim_{x \to \frac{7}{2}} \left(2x^2 - 9x + 8\right)^{\cot(2x-7)}$

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114. If $f(x) = \begin{matrix} \sin[x], & \text{for } [x] \neq 0 \\ 0, & \text{for } [x] = 0 \end{matrix}$ where $[x]$ denotes the greatest integer less than or equal to x. Then find $\lim_{x \to 0} f(x)$.

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115. Let $f(a) = g(a) = k$ and their nth derivatives exist and are not equal for some n. If. $(\lim)_{x \to a} \dfrac{f(a)g(x) - f(a) - g(a)f(x) + g(a)}{g(x) - f(x)} = 4.$ Find the value of k.

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116. 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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117. Let $f(x)$ be a twice-differentiable function and f"(0)=2. The evaluate:

$$\lim_{x \to 0} \frac{2f(x) - 3f(2x) + f(4x)}{x^2}$$

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118. The value of $\lim_{x \to 1} \left(\frac{p}{1 - x^p} - \frac{q}{1 - x^q} \right), p, q, \in N,$ equal (a) $\frac{p+q}{2}$ (b) $\frac{pq}{2}$ (c) $\frac{p-q}{2}$ (d) $\sqrt{\frac{p}{q}}$

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119. Evaluate : $\lim_{x \to 0} (\log)_{\tan^2 x} (\tan^2 2x)$.

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120. $\lim_{x \to 0} \frac{\sin(x^2)}{1n(\cos(2x^2 - x))}$ is equal to

(a) 2

(b) -2

(c) 1

(d) -1

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121. If the graph of the function $y = f(x)$ has a unique tangent at the point $(a, 0)$ through which the graph passes, then evaluate

$$\lim_{x \to a} \frac{\log_e\{1 + 6f(x)\}}{3f(x)}$$

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122. $\lim_{x \to -1} \frac{1}{\sqrt{|x| - \{-x\}}}$ (where $\{x\}$ denotes the fractional part of x) is equal to

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

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

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125. Evaluate $\left(\lim_{x \to \infty}\right)\left(x(\log)_e \left\{\frac{\sin\left(a + \frac{1}{x}\right)}{\sin a}\right\}\right), 0 < a < \frac{\pi}{2}$

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126. $\lim_{x \to 0} \left\{(1+x)^{\frac{2}{x}}\right\}$ (where {.} denotes the fractional part of x

(a) $e^2 - 7$

(b) $e^2 - 8$

(c) $e^2 - 6$

(d) none of these

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

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

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130. Find $\lim_{x \to 0} \frac{5x + 2\cos x}{3x + 14}$ using sandwitch theorem

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131. Evaluate : $\left[\lim_{x \to 0} \frac{\tan x}{x} \right]$, where $[\cdot]$ represents the greatest integer function.

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

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133. Evaluate : $\left[\lim_{x \to 0} \frac{\tan x}{x}\right]$, where $[\cdot]$ represents the greatest integer function.

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134. Evaluate $\lim_{x \to 0} \frac{e^x - e^{x \cos x}}{x + \sin x}$.

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135. Evaluate: $\lim_{x \to 2} \frac{x - 2}{(\log)_a (x - 1)}$

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136. Evaluate: $\lim_{x \to 0} \frac{e^{\sin x} - (1 + \sin x)}{\left\{\tan^{-1}(\sin x)\right\}^2}$

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137. Evaluate: $\lim_{x \to a} \frac{\log x - \log a}{x - a}$

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138. Evaluate: $\left(\lim \right)_{x \to \frac{3\pi}{4}} \frac{1 + (\tan x)^{\frac{1}{3}}}{1 - 2\cos^2 x}$

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

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140. $\lim_{x \to -1} \left(\frac{x^4 + x^2 + x + 1}{x^2 - x + 1} \right)^{\frac{1 - \cos(x+1)}{(x+1)^2}}$ is equal to (a) 1 (b) $\left(\frac{2}{3} \right)^{\frac{1}{2}}$ (c) $\left(\frac{3}{2} \right)^{\frac{1}{2}}$ (d) $e^{\frac{1}{2}}$

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

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142.

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

$\frac{1}{2}$

2

1

none of these

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

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144. Each question contains statements given in two columns which have to be matched. Statements (a,b,c,d) in column I have to be matched with statements (p,q,r,s) in column II. If the correct match are a-p, s, b-r c-p, q. and d-s, then the correctly bubbled $4x4$ matrix should be as follows: figure Column I, a) If $\int \frac{2^x}{\sqrt{1-4^x}} dx = k \sin^{-1}(f(x)) + C$, then $k$is greater than, b) If $\int \frac{\left(\sqrt{x}\right)^5}{\left(\sqrt{x}\right)^7 + x^6} dx = a \frac{\ln\left(x^k\right)}{x^k + 1} + c$, then $ak$is less than, c) If $\int \frac{x^4 + 1}{x\left(x^2 + 1\right)^2} dx = k \ln|x| + \frac{m}{1 + x^2} + n$, where $n$is the constant of integration, then $mk$is greater than, d) If $\int \frac{dx}{5 + 4\cos x} = k \tan^{-1}\left(m tan \frac{x}{2}\right) + C$, then $k/m$is greater than, COLUMN II p) 0 q) 1 r) 3 s)4

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145. Let $P_n = a^{P_{n-1}} - 1, \forall n = 2, 3, \ldots,$ and let $P_1 = a^x - 1,$ where $a \in R^+$. Then evaluate $\lim_{x \to 0} \frac{P_n}{x}$.

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146. 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. 201

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

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148. Evaluate: $\lim_{x \to \infty} \frac{x + 7 \sin x}{-2x + 13}$

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149. Find the values of b for which the points $(2b + 3, b^2)$ lies above of the line 3x-4y-a(a-2) = 0 $\forall a \in R$.

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150. If $f(x) = \begin{cases} \frac{x - |x|}{x}, x \neq 0 \\ 2, \quad x = 0 \end{cases}$, show that $\lim_{x \to 0} f(x)$ does not exist.

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151. 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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152. Show that $(\lim)_{x \to 0} \dfrac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1}$ does not exist

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153. If $f(x) = \begin{cases} x^2 + 2 & x \geq 2 \\ 1 - x & x < 2 \end{cases}$; $g(x) = \begin{cases} 2x & x > 1 \\ 3 - x & x \leq 1 \end{cases}$ then the value of $\lim_{x \to 1} f(g(x))$ is

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154. Evaluate $\lim_{x \to 2^+} \dfrac{[x - 2]}{\log(x - 2)}$, where $[.]$ represents the greatest integer function.

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155. Find the value of the limit $(\lim)_{x \to 0} \left(\dfrac{\left(\sqrt{a + x}\right) - \left(\sqrt{a - x}\right)}{x} \right)$

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156. Evaluate $\lim_{x \to 0} \frac{\sin[\cos x]}{1 + [\cos x]}$ ($[.]$ denotes the greatest integer function).

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

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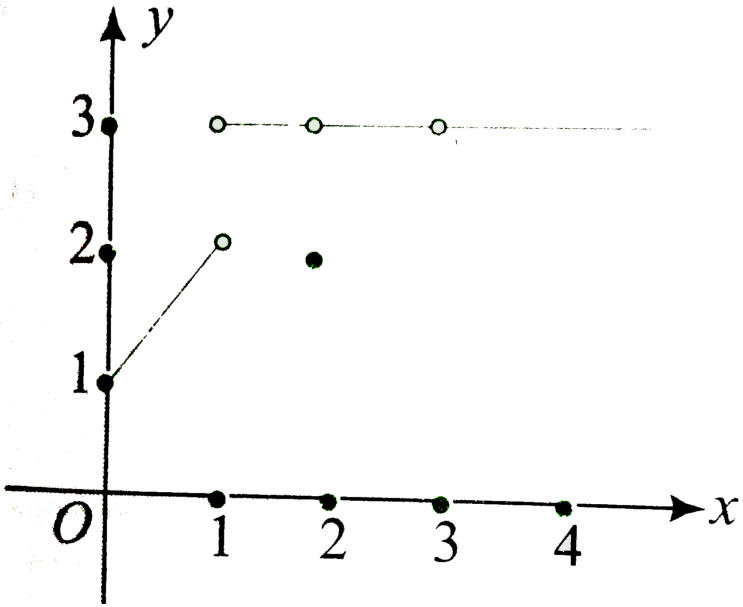
158. Consider the following graph of the function y=f(x). Which of the following is//are correct?



$(a)\ \lim_{x \to 1} f(x)$ does not exist.

$(b)\ \lim_{x \to 2} f(x)$ does not exist.

$(c)\ \lim_{x \to 3} f(x) = 3.$

$(d)\ \lim_{x \to 1.99} f(x)$exists.

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159. 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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160. If $\lim_{x \to a} [f(x) + g(x)] = 2$ and $\lim_{x \to a} [f(x) - g(x)] = 1$, then find the value of $\lim_{x \to a} f(x)g(x)$.

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161. Among (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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162. Evaluate $\lim_{x \to 0} \frac{3x + |x|}{7x - 5|x|}$

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163. The value of $\lim_{x \to 0} \frac{1 + \sin x - \cos x + \log(1 - x)}{x^3} is$

(a) $\frac{1}{2}$

(b) $-\frac{1}{2}$

(c) 0

(d) none of these

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164.

$f(x)=\left\{x, x \leq 01, x=0, then f \in d(\lim)_{x \underset{0}{\rightarrow}} f(x) x^2, x>0 \quad \text{if} \quad e \xi sts\right.$

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165. $\lim_{x \to \infty} \frac{e^{1/x^2}-1}{2\tan^{-1}(x^2)-\pi}$ is equal to

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166. Evaluate: $\lim_{x \to \infty}\left(1+\frac{1}{a+bx}\right)^{c+dx}$, where a, b, c and dare positive

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

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169. $\lim_{x \to 0} \frac{\cos(\tan x) - \cos x}{x^4} isequa < o \frac{1}{6}$ (b) $-\frac{1}{3}$ (c) $\frac{1}{2}$ (d) 1

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170. 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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171. $\lim_{x \to \infty} \{(x+5)\tan^{-1}(x+5) - (x+1)\tan^{-1}(x+1)\}$ is equal to

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172. If $f(n) = \lim_{x \to 0} \left\{ \left(1 + \sin\frac{x}{2}\right)\left(1 + \sin\frac{x}{2^2}\right)\ldots\left(1 + \sin\frac{x}{2^n}\right) \right\}^{\frac{1}{x}}$ then find $\lim_{n \to \infty} f(n)$.

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

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174. 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 the greatest integer function.

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175. 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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176. Evaluate the limit: $\lim_{x \to \infty} \left(\frac{x+2}{x+1} \right)^{x+3}$

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177. ABC is an isosceles triangle inscribed in a circle of radius r. 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 = _____ and also $(\lim)_{h \to 0} \frac{A}{P^3} =$ _ _ _

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178. Evaluate: $\lim_{x \to \frac{\pi}{2}} (\cos x)^{\cos x}$

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179. $\lim_{x \to 0} \left(x^4 \frac{\cot^4 x - \cot^2 x + 1}{\tan^4 x - \tan^2 x + 1} \right)$ is equal to (a) 1 (b) 0 (c) 2 (d) none of these

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180. Evaluate: $\lim_{x \to 0} (1 + x)^{\cos ecx}$

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

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182. Evaluate: $\lim_{x \to 0} (\cos x)^{\cot x}$

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

(a) $\frac{1}{2\pi}$

(b) $-\frac{1}{\pi}$

(c) $\frac{-2}{\pi}$

(d) none of these

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184. Evaluate $(\lim)_{x \to 0} \left(\frac{\sin x}{x} \right)^{\left(\frac{\sin x}{x - \sin x} \right)}$

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

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186. Evaluate $\lim_{x \to 0} \frac{(1+x)^{1/x} - e + \frac{1}{2}ex}{x^2}$.

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187. If $\lim_{x \to 0} \frac{x^a \sin^b x}{\sin(x^c)}$, where a , b , c in R ~{0},exists and has non-zero value. Then,`

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188. Evaluate $\lim_{x \to 0} \frac{5 \sin x - 7 \sin 2x + 3 \sin 3x}{x^2 \sin x}$.

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

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190. Evaluate $\lim_{x \to \infty} \frac{\log_e x}{x}$

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

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193. $\lim_{x \to 0} \frac{\sin x^n}{(\sin x)^m}, (m < n),$ is equal to (a) 1 (b) 0 (c) n/m (d) none of these

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194. If $\frac{x^2+x-2}{x+3} \leq \frac{f(x)}{x^2} \leq \frac{x^2+2x-1}{x+3}$ holds for a certain interval containing the value of $\lim_{x \to -1} f(x)$.

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195. $\lim_{x \to \infty} \frac{2\sqrt{x}+3\sqrt[3]{x}+4\sqrt[4]{x}+\ldots\ldots+n\sqrt[n]{x}}{\sqrt{(2x-3)}+\sqrt[3]{2x-3}+\ldots\ldots+\sqrt[n]{2x-3}}$ is equal to (a) 1 (b) ∞ (c) $\sqrt{2}$ (d) none of these

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196. Let $f:(1,2)\vec{R}$ satisfies the inequality $\frac{\cos(2x-4)-33}{2} < f(x) < \frac{x^2|4x-8|}{x-2} \forall x \in (1,2)$. Then find $\lim_{x \to 2^-} f(x)$.

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197. $\lim_{y \to 0} \dfrac{(x+y)\sec(x+y) - x\sec x}{y}$ is equal to (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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198. Evaluate $\lim_{n \to \infty} \dfrac{1}{1+n^2} + \dfrac{2}{2+n^2} + \ldots + \dfrac{n}{n+n^2}$.

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

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

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201. If $L = \lim_{x \to 0} \frac{e^{-x^2/2} - \cos x}{x^3 \sin x}$, then find the value of $1/(3L)$ is _____.

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202. If $[.]$ denotes the greatest integer function, then find the value of $\lim_{x \to 0} \frac{[x] + [2x] + \ + [nx]}{n^2}$

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203. If $\lim_{x \to \infty} f(x)$ exists and is finite and nonzero and if $\lim_{x \to \infty} \left\{ f(x) + \frac{3f(x) - 1}{f^2(x)} \right\} = 3$,then find the value of $\lim_{x \to \infty} f(x)$

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204. If $3-\left(\frac{x^2}{12}\right) \leq f(x) \leq 3+\left(\frac{x^3}{9}\right)$ in the neighborhood of x=0, then find the value of $\lim_{x \to 0} f(x)$.

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205. If $f(x)=\begin{cases} x-1, & x \geq 1 \\ 2x^2-2, & x<1 \end{cases}, g(x)=\begin{cases} x+1, & x>0 \\ -x^2+1, & x \leq 0 \end{cases}$, and $h(x)=|x|$, then $\lim_{x \to 0} f(g(h(x)))$ is _____.

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

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207. $\lim_{x \to \infty} f(x)$, where $\frac{2x-3}{x}<f(x)<\frac{2x^2+5x}{x^2} \forall x>0$, is _____.

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

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209. If $\lim_{x \to 0} \left[1 + x + \frac{f(x)}{x}\right]^{1/x} = e^3$, then the value of $\ln\left(\lim_{x \to 0} \left[1 + \frac{f(x)}{x}\right]^{1/x}\right)$ is _____.

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210. Evaluate the limits using the expansion formula of functions $\lim_{x \to 0} \frac{e^x - 1 - x}{x^2}$

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211. The value of $(\lim)_{n \to \infty} \left[(n+1)^2 3 - (n-1)^2 3\right]$ is____

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212. Evaluate : $\lim_{x \to 2} \frac{x^2 - 5x + 6}{x^2 - 4}$

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213. If: $(\lim)_{x \to 1}\left(1 + ax + bx^2\right)^{\frac{c}{(x-1)}} = e^3$, then Find the conditions of a,b,c

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

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215. $\lim_{x \to 0}\left(\frac{1 + 5x^2}{1 + 3x^2}\right)^{1/x^2} =$ _ _

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216. Evaluate : $\lim_{x \to 1} \frac{x^2 + x(\log)_e x - (\log)_e x - 1}{(x^2 - 1)}$

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217. If $L = \lim_{n \to \infty} \left(2 \times 3^2 \times 2^3 \times 3^4 \ldots \times 2^{n-1} \times 3^n\right)^{\frac{1}{(n^2+1)}}$, and n is even then the value of L^4 is _____.

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

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219. The value of $\lim_{x \to \infty} \frac{\log_e(\log_e x)}{e\sqrt{x}}$ is _____.

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

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221. $\lim_{y \to 0} \frac{(x+y)\sec(x+y) - x \sec x}{y}$ is equal to (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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222. Evaluate $\lim_{x \to 0} \frac{\sqrt{2+x} - \sqrt{2}}{x}$

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223. 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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224. 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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225. The value of $\lim_{h \to 0} \frac{\ln(1+2h) - 2\ln(1+h)}{h^2}$, is

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226. Evaluate : $\lim_{x \to \infty} \frac{ax^2 + bx + c}{dx^2 + ex + f}$.

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227. 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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228. Evaluate $\lim_{x \to 2} \frac{\sqrt{(x+7)} - 3\sqrt{(2x-3)}}{\sqrt[3]{(x+6)} - 2\sqrt[3]{(3x-5)}}$.

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229. $\lim_{x \to 0} \frac{\sin x^n}{(\sin x)^m}, (m < n),$ is equal to (a) 1 (b) 0 (c) n/m (d) none of these

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230. Evaluate: $\lim_{x \to \infty} \frac{\sqrt{3x^2 - 1} - \sqrt{2x^2 - 1}}{4x + 3}$

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231. $\lim_{x \to 0} \left(x^4 \frac{\cot^4 x - \cot^2 x + 1}{\tan^4 x - \tan^2 x + 1} \right)$ is equal to (a) 1 (b) 0 (c) 2 (d) none of these

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232. Evaluate $\lim_{n \to \infty} \sin^n \left(\frac{2\pi n}{3n + 1} \right), n \in N.$

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

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234. 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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235. $\lim_{x \to 1} \frac{1 - x^2}{\sin 2\pi x}$ is equal to

(a) $\frac{1}{2\pi}$

(b) $-\frac{1}{\pi}$

(c) $\frac{-2}{\pi}$

(d) none of these

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

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237. $(\lim)_{x \to 0} \frac{1}{x} \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ is equals to (a)1 (b) 0 (c) 2 (d) none of these

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

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

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241. $\lim_{x \to \infty} \frac{2\sqrt{x} + 3x3 + 4x4 + \ + nxn}{\sqrt{(2x-3)} + (2x-3)3 + \ + (2x-3)n}$ is equal to

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

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242. Evaluate: $\lim_{x \to \infty} \left(\frac{\sqrt{x^2+1} -^3 \sqrt{x^2+1}}{4\sqrt{x^4+1} -^5 \sqrt{x^4+1}} \right)$

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

(a)4

(b) $\frac{1}{2}$

(c) 2

(d) $\frac{1}{4}$

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

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

(a) 0

(b) 1

(c) 10

(d) 100

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

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247. $\lim_{x \to \infty} \left[\sqrt{x + \sqrt{x + \sqrt{x}}} - \sqrt{x}\right]$ is equal to

(a) 0

(b) $\frac{1}{2}$

(c) log 2

(d) e^4

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

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249. $\lim_{n \to \infty} \frac{n(2n+1)^2}{(n+2)(n^2+3n-1)}$ is equal to

(a) 0

(b) 2

(c) 4

(d) ∞

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250. Evaluate: $\lim_{x \to 0} \frac{x2^x - x}{1-\cos x}$

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

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252. Evaluate: $\lim_{x \to \infty} \left[x \left(a^{\frac{1}{x}} - 1 \right) \right], a > 1$

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

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

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

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257. $\lim_{x \to \infty} \frac{(2x+1)^{40}(4x-1)^5}{(2x+3)^{45}}$ is equal to

(a)16

(b) 24

(c) 32

(d) 8

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

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259. The value of $\lim_{x \to 2} \frac{\sqrt{1+\sqrt{2+x}} - \sqrt{3}}{x-2}$ is

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

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261. $\lim_{n \to \infty} n^2 \left(x^{\frac{1}{n}} - x^{\frac{1}{(n+1)}} \right), x > 0$, is equal to (a)0 (b) e^x (c) $(\log)_e x$ (d) none of these

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262. Evaluate: $(\lim)_{x \to \infty} x^{\frac{1}{x}}$

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263. The value of $\lim_{x \to \pi} \frac{1 + \cos^3 x}{\sin^2 x} is$

(a) $\frac{1}{3}$

(b) $\frac{2}{3}$

(c) $-\frac{1}{4}$

(d) $\frac{3}{2}$

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

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265. If $f(x) = \frac{3x^2 + ax + a + 1}{x^2 + x - 2}$, then which of the following can be correct

(a) $(\lim)_{x \to 1} f(x) f$ or $a = -2$ (b) $(\lim)(x \to -2) f(x) f$ or $a = 13$

(c) $(\lim)(x \to 1) f(x) = \frac{4}{3}$ (d) $(\lim)(x \to -2) f(x) = -\frac{1}{3}$

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

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268. Let the sequence $< b_n >$ of real numbers satisfy the recurrence relation $b_{n+1} = \frac{1}{3}\left(2b_n + \frac{125}{b_n^2}\right), b_n \neq 0$. Then find $\lim_{n \to \infty} b_n$.

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269. Which of the following true ({.} denotes the fractional part of the function)? $(\lim)_{x \to \infty} \frac{(\log)_e x}{\{x\}} = \infty$ (b) $(\lim)_{x \to 2^+} \frac{x}{x^2 - x - 2} = \infty$

$(\lim)_{x \to 1^-} \frac{x}{x^2 - x - 2} = -\infty$ (d) $(\lim)_{x \to \infty} \frac{(\log)_{0.5} x}{\{x\}} = \infty$

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270. Evaluate: $\lim_{n \to \infty} (4^n + 5^n)^{\frac{1}{n}}$

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271. If $(\lim)_{x \to 1}(2 - x + a[x - 1] + b[1 + x])$ exists, then a and b 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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272. Evaluate $\lim_{n \to \infty} \frac{n^p \sin^2(n!)}{n + 1}$, where $0 < p < 1$.

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273. If $\lim_{n \to \infty} \left(an - \frac{1+n^2}{1+n} \right) = b$ a finite number then

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

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275. prove that, If $m, n \in N$, $(\lim)_{x \to 0} \frac{\sin x^n}{(\sin x)^m} is$ (a) 1, if n=m (b) 0, if n>m

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276. For any two complex numbers z1,z2 and any real numbers $aandb$, $|az_1 - bz_2|^2 + |bz_1 + az_2|^2 =$

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277. $\lim_{n \to \infty} \frac{-3n + (-1)^n}{4n - (-1)^n}$ is equal to a. $-\frac{3}{4}$ b. 0 if n is even c. $-\frac{3}{4}$ if n is odd d. none of these

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278. Evaluate $\lim_{x \to \infty} \left(\sqrt{25x^2 - 3x} + 5x\right)$.

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279. Given a real-valued function f such that $f(x) = \begin{cases} \dfrac{\tan^2\{x\}}{\left(x^2 - [x]^2\right)\sqrt{\{x\}\cot\{x\}}}, f \text{ or } x < 0, fx > 0 \end{cases}$ Where $[x]$ is the integral part and $\{x\}$ is the fractional part of x, then $(\lim)_{x \to 0^+} f(x) = 1$, $(\lim)_{x \to 0^-} f(x) = \cot 1$, $\cot^{-1}\left((\lim)_{x \to 0^-} f(x)\right)^2 = 1, \tan^{-1}\left((\lim)_{x \to 0^+} f(x)\right) = \frac{\pi}{4}$

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

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281. $L = \lim_{x \to a} \frac{|2 \sin x - 1|}{2 \sin x - 1} \dot{T}hen$

(a) limit does not exist when $a = \frac{\pi}{6}$

(b)$L = -1 whena = \pi$

(c) $L = 1 whena = \frac{\pi}{2}$

(d) $L = 1 whena = 0$

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

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283. $f(x) = (\lim)_{n \to \infty} \frac{x}{x^{2n}+1} \dot{T}hen,$ A. $f(1^+) + f(1^{-1}) = 0$ B. $f(1^+) + f(1^-) + f(1) = \frac{3}{2}$ C. $f(-1^+) + f(-1^-) = -1$ D. $f(1^+) + f(-1^-) = 0$

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284. Evaluate the limit: $\lim_{x \to 1} \frac{(2x-3)(\sqrt{x}-1)}{2x^2}$

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285. $(\lim)(n \to \infty) \sum_{x=1}^{20} \cos^{2n}(x-10)$ is equal to

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286. $\lim_{x \to 1} \frac{1 + \sin \pi\left(\frac{3x}{1+x^2}\right)}{1 + \cos \pi x}$ is equal to

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287. $f(x) = \dfrac{1n\left(x^2 + e^x\right)}{1n\left(x^4 + e^{2x}\right)} \dot{T}hen \lim_{x \to \infty} f(x)$ is equal to

(a) 1

(b) $\dfrac{1}{2}$

(c) 2

(d) none of these

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288. $\lim_{n \to \infty} \left\{ \left(\dfrac{n}{n+1} \right)^{\alpha} + \sin \dfrac{1}{n} \right\}^{n}$ (where $\alpha \in Q$) is equal to

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289. 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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290. If $\lim_{n \to \infty} \frac{n.3^n}{n(x-2)^n + n.3^{n+1} - 3^n} = \frac{1}{3}$, then the range of x is (where $n \in N$)

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291. 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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292. If $f(x) = \lim_{n \to \infty} n\left(x^{1/n} - 1\right)$, then for $x > 0, y > 0, f(xy)$ is equal to

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

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294. $\lim_{x \to 1} \left[\cos ec \frac{\pi x}{2} \right]^{1/(1-x)}$ (where $[.]$ represents the greatest integer function) is equal to

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295. Given $\lim_{x \to 0} \frac{f(x)}{x^2} = 2$, where $[.]$ denotes the greatest integer function, then which options are correct?

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296. 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 not exist. (D)none of these

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297. 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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298. Evaluate : $\lim_{x \to 0} \left\{ \tan\left(\frac{\pi}{4} + x\right) \right\}^{\frac{1}{x}}$

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299. $f(x)$ is the integral of $\frac{2\sin x - \sin 2x}{x^3}, x \neq 0.$ Find $\lim_{x \to 0} f'(x) \left[where f'(x) = \frac{df}{dx} \right]$

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

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301. $\lim_{x \to \infty} \frac{x(\log x)^3}{1 + x + x^2}$ equals

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302. $\lim_{x \to 0} \frac{(2^m + x)^{1/m} - (2^n + x)^{1/n}}{x}$ is equal to

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303. $\lim_{x \to 1} (1 - x)\tan\left(\frac{\pi x}{2}\right)$

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304. If $f(x) = \{\sin x, x \neq n\pi, n \in I2, otherwise$

$g(x) = \{x^2 + 1, x \neq 0, 4, x = 05, x = 2$ then $(\lim)_{x \overrightarrow{0}} g\{f(x)\} is =$

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

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306. $\lim_{x \to \frac{\pi}{2}} \frac{\sin(x \cos x)}{\cos(x \sin x)}$ is equal to (a) 0 (b) $\frac{\pi}{2}$ (c) π (d) 2π

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307. 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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308. 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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309. $\lim_{x \to 1} \frac{(1-x)(1-x^2)...(1-x^{2n})}{\{(1-x)(1-x^2)...(1-x^n)\}^2}$, n in N, equals`

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310. 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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311. The value of $\lim_{x \to \frac{1}{\sqrt{2}}} \left(\frac{x - \cos\left(\sin^{-1} x\right)}{1 - \tan\left(\sin^{-1} x\right)} \right)$ is

(a) $-\frac{1}{\sqrt{2}}$

(b) $\frac{1}{\sqrt{2}}$

(c) $\sqrt{2}$

(d) $-\sqrt{2}$

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312. The value of $\lim_{x \to \infty} \frac{\left(2^{x^n}\right)e^{\frac{1}{x}} - \left(3^{x^n}\right)e^{\frac{1}{x}}}{x^n}$ (where $n \in N$) is

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313. Let $\lim_{x \to 0} \frac{[x]^2}{x^2} = m$, where $[.]$ denotes greatest integer. Then, m equals to

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314. $\lim_{x \to 1} \frac{x \sin(x - [x])}{x - 1}$, where $[.]$ denotes the greatest integer function, is equal to

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315. $\lim_{x \to 0} \left[\frac{\sin(sgn(x))}{(sgn(x))}\right]$, where $[.]$ denotes the greatest integer function, is equal to

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316. $\lim_{x \to \infty} \frac{2 + 2x + \sin 2x}{(2x + \sin 2x)e^{\sin x}}$ is equal to

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317. 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) $(\lim)_{x \to \frac{\pi}{2}} f(x) = 0$ (d) none of these

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

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319. T_1 is an isosceles triangle in circle C. Let T_2 be another Ãsosceles triangle inscribed in C whose base is one of the equal sides of T_1 and

which overlaps the interior of T_1. Similarly, create isosceles triangle T_3 from T_2; T_4 and T_5, and so on. Prove that the triangle T_n, approaches an equilateral triangle as $n \to \infty$,

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320. 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

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321. $\lim_{x \to \infty} \left[\left(\frac{e}{1-e}\right)\left(\frac{1}{e} - \frac{x}{1+x}\right)\right]^x$ is :

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322. $(\lim)_{x \to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\cos ecx}$ is equal to

(a)e

(b) $\frac{1}{e}$

(c) 1

(d) none of these

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323. $\lim_{x \to \infty} \frac{\sin^4 x - \sin^2 x + 1}{\cos^4 x - \cos^2 x + 1}$ is equal to

(a) 0

(b) 1

(c) $\frac{1}{3}$

(d) $\frac{1}{2}$

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324. Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{4x}{1+5x^2}\right) + \tan^{-1}\left(\frac{2+3x}{3-2x}\right)$

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325. Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$, where $x \neq 0$

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326. (c)answer any three questions: 1. if y=$\sin^{-1}\left(\frac{2x}{1+x^2}\right)$, find dy/dx.

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327. If $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$, $-\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}}$, then find $\frac{dy}{dx}$

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328. Find $\frac{dy}{dx}$ for the functions: $y = \frac{x + \sin x}{x + \cos x}$

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329. Find the derivative of the function given by $f(x) = (1 + x)\left(1 + x^2\right)\left(1 + x^4\right)\left(1 + x^8\right)$ and, hence, find $f'(1)$.

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330. Find $\frac{dy}{dx}$ if $y = \sec^{-1}\left(\frac{\sqrt{x} + 1}{\sqrt{x} - 1}\right) + \sin^{-1}\left(\frac{\sqrt{x} - 1}{\sqrt{x} + 1}\right)$

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331. Let $f(x) = x \sin \pi x,\ x > 0$. Then for all natural numbers $n,\ f'(x)$ vanishes at (a) A unique point in the interval $\left(n,\ n + \frac{1}{2}\right)$ (b) a unique point in the interval $\left(n + \frac{1}{2},\ n + 1\right)$ (c) a unique point in the interval $(n,\ n + 1)$ (d) two points in the interval $(n,\ n + 1)$

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332. Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{4x}{1+5x^2}\right) + \tan^{-1}\left(\frac{2+3x}{3-2x}\right)$

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333. If $y = \sec^{-1}\left(\frac{1}{2x^2-1}\right); 0 < x < (\sqrt{2}),$ then find= $\frac{dy}{dx}$

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334. $\frac{d^2x}{dy^2}$ equals: (1) $\left(\frac{d^2y}{dx^2}\right)^{-1}$ (2) $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$ (3) $\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-2}$ (4) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

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335. Find $\frac{dy}{dx}$ if $y = \log\left\{e^x\left(\frac{x-2}{x+2}\right)^{\frac{3}{4}}\right\}$

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336. let $f(x) = 2 + \cos x$ for all real x. Statement 1: For each real t, there exists a point c in $[t, t + \pi]$ such that $f'(c) = 0$. Statement 2: $f(t) = f(t + 2\pi)$ for each real t

A. Only statement 1 is correct

B. Only statement 2 is correct

C. Both statements are correct

D. None of these

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337. Differentiate the function with respect to x using the first principle : $\tan x$

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338. Differentiate the function with respect to x using the first principle :

$\cos^2 x$

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339. Differentiate the following functions with respect to x from first principles: $\sqrt{\sin x}$

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340. If f(x) is differentiable and strictly increasing function, then the value of $\lim_{x \to 0} \frac{f(x^2) - f(x)}{f(x) - f(0)}$ is

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341. If $f(x) = [2x]\sin 3\pi x$ then prove that $f'\left(k^{+}\right) = 6k\pi(-1)^{k}$, (where [.] denotes the greatest integer function and $k \in N$).

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342. $\lim_{h \to 0} \dfrac{f\left(2h + 2 + h^{2}\right) - f(2)}{f(h - h^{2} + 1) - f(1)}$ given that $f'(2) = 6$ and $f'(1) = 4$ then (a) limit does not exist (b) is equal to $-\dfrac{3}{2}$ (c) is equal to $\dfrac{3}{2}$ (d) is equal to 3

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343. Evaluate $\lim_{h \to 0} \dfrac{(a + h)^{2}\sin^{-1}(a + h) - a^{2}\sin^{-1}a}{h}$

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344. If $x^{2} + y^{2} = 1, then$

(a) $yy'' - 2(y')^2 + 1 = 0$

(b) $yy'' + (y')^2 + 1 = 0$

(c) $yy'' + (y')^{-2} - 1 = 0$

(d) $yy'' + 2(y')^2 + 1 = 0$

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345. Using the first principle, prove that $\frac{d}{dx}(1 - x^2) = -2x$

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346. If y is function of x and log(x+y)=2xy, then find the value of y'(0).

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347. Find the derivative of $\sqrt{4-x}$ w.r.t. x using the first principle.

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348. The slope of the tangent to the curve $\left(y-x^5\right)^2 = x\left(1+x^2\right)^2$ at the point (1,3) is

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349. If $f(x) = x\tan^{-1}x$, find $f'\left(\sqrt{3}\right)$.

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350. Let $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$ then the value of $\frac{d}{d(\tan\theta)}f(\theta)$ is

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351. Find the derivative of $e^{\sqrt{x}}$ w.r.t. x using the first principle.

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352. $f(x) = \tan^{-1}\left\{\frac{\log\left(\frac{e}{x^2}\right)}{\log(ex^2)}\right\} + \tan^{-1}\left(\frac{3+2\log x}{1-6\log x}\right)$ then find $\frac{d^n y}{dx^n}$

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353. If $f\left(\frac{x+2y}{3}\right) = \frac{f(x)+2f(y)}{3}\ \forall x, y \in R and f'(0) = 1, f(0) = 2,$ then find $f(x)$.

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354. If $f(x) = \left|x^2 - 5x + 6\right|, then f'(x) equals$ `2x-5for225-2xforx<3`

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355. If graph of $y = f(x)$ is symmetrical about the point $(5, 0)$ and $f'(7) = 3$, then the value of $f'(3)$ is_____

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356. Let $f(x^m y^n) = mf(x) + nf(y)$ for all $x, y \in R^+$ and for all $m, n \in R$. If $f'(x)$ exists and has the value $\frac{e}{x}$, then find $\lim_{x \to 0} \frac{f(1+x)}{x}$

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357. Let $g: R \overrightarrow{R}$ be a differentiable function satisfying $g(x) = g(y)g(x-y) \forall x, y \in R$ and $g'(0) = aandg'(3) = b$. Then find the value of $g'(-3)$.

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358. If $f, g, and\ h$ are differentiable functions of x and

$$d(x) = \begin{vmatrix} f & g & h \\ (xf)' & (xg)' & (xh)' \\ (x^2f)'' & (x^2g)'' & (x^2h)'' \end{vmatrix}$$ prove that

$$d'(x) = \begin{vmatrix} f & g & h \\ f' & g' & h' \\ (x^3f'')' & (x^3g'')' & (x^3h'')' \end{vmatrix}$$

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359. Let f be a function such that $f(x+y) = f(x) + f(y)$ for all x and y and $f(x) = (2x^2 + 3x)g(x)$ for all$x$, where $g(x)$ is continuous and $g(0) = 3$. Then find $f'(x)$.

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360. If $f\left(\frac{x+y}{3}\right) = \frac{2 + f(x) + f(y)}{3}$ for all $x, y\ f'(2) = 2$ then find $f(x)$

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361. Prove that $\lim_{x \to 0} \frac{f(x+h)+f(x-h)-2f(x)}{h^2} = f''(x)$

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362. Let $f(x+y) = f(x)+f(y)+2xy-1$ for all real x and y and $f(x)$ be a differentiable function. If $f'(0) = \cos\alpha$, the prove that $f(x) > 0 \forall x \in R$.

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363. If $x = e^{y+e^{y+e^{y}\ldots\infty}}$, where $x > 0$,then find $\frac{dy}{dx}$

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364. Let $f: R\vec{R}$ be a function satisfying condition $f(x+y^3) = f(x)+[f(y)]^3 f$ or $allx, y \in R$. If $f'(0) \geq 0$, find $f(10)$.

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365. If $xy = e^{(x-y)}$, then find $\frac{dy}{dx}$

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366. $\frac{dy}{dx}$ for $y = \tan^{-1}\left\{\sqrt{\frac{1+\cos x}{1-\cos x}}\right\}$,where $0 < x < \pi$, is

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367. If $y^x = x^y$, then find $\frac{dy}{dx}$.

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368. Differentiate $(x\cos x)^x$ with respect to x.

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369. If $f(xy) = \frac{f(x)}{y} + \frac{f(y)}{x}$ holds for all real x and y greater than 0 and $f(x)$ is a differentiable function for all $x > 0$ such that $f(e) = \frac{1}{e}$, then find $f(x)$

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370. Find $\frac{dy}{dx}$ for $y = x^{x}$.

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371. If P_n is the sum of a $G\dot{P}$. upto n terms $(n \geq 3)$, then prove that $(1-r)\frac{dP_n}{dr} = (1-n)P_n + nP_{n-1}$, where r is the common ratio of $G\dot{P}$.

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372. If $y = f(a^x) and f'(\sin x) = (\log)_e x, then find\left(\frac{dy}{dx}\right)$, if it exists, where pi/2 less than x less than pi

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373. if $x < 1$ then $\frac{1}{1+x} + \frac{2x}{1+x^2} + \frac{4x^3}{1+x^4} + \ldots\ldots\ldots\ldots \infty$

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374. Find the derivative of $\frac{\sqrt{x}(x+4)^{\frac{3}{2}}}{(4x-3)^{\frac{4}{3}}}$

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375. Find $(\lim)_{x \to 2} \frac{xf(2) - 2f(x)}{x-2}$ if f(2)=4 and f'(2)=1`

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376. If $y = x^{x^{x^{\cdots\infty}}}$, find $\frac{dy}{dx}$

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377. If $y = e^{\sqrt{x}} + e^{-\sqrt{x}}$, then $\frac{dy}{dx}$ is equal to (a) $\frac{e^{\sqrt{x}}}{2\sqrt{x}}$ (b) $\frac{e^{\sqrt{x}} - e^{-\sqrt{x}}}{2\sqrt{x}}$ (c) $\frac{1}{2\sqrt{x}}\sqrt{y^2 - 4}$ (d) $\frac{1}{2\sqrt{x}}\sqrt{y^2 + 4}$

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378. Differentiate $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$ with respect to x

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379. If $f(x) = |\sin x - |\cos x|\,|$, then the value of $f'(x)$ at $x = \frac{7\pi}{6}$ is (a) *positive* (b) $\frac{1-\sqrt{3}}{2}$ (c) 0 (d) none of these

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380. If $y = (\tan x)^{(\tan x)^{(\tan x)^{\ldots \infty}}}$,then find $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$

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381. If graph of $y = f(x)$ is symmetrical about the y-axis and that of $y = g(x)$ is symmetrical about the origin and if $h(x) = f(x)\dot{g}(x), then \frac{d^3h(x)}{dx^3}$ at x=0 is (a)cannot be determined (b) $f(0)\dot{g}(0)$ (c)0 (d) none of these

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382. Differentiate the function with respect to x using the first principle : $(\log)_e x$

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383. If $x = t^2, y = t^3, then \frac{d^2y}{dx^2}$ is (a)$\frac{3}{2}$ (b) $\frac{3}{4t}$ (c) $\frac{3}{2t}$ (d) $\frac{3t}{2}$

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384. Using the first principle, prove that:

$$\frac{d}{dx}(f(x)g(x)) = f(x)\frac{d}{dx}(g(x)) + g(x)\frac{d}{dx}(f(x))$$

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385. If $y = x + e^x$, then $\frac{d^2x}{dy^2}$ is

(a) e^x

(b) $-\frac{e^x}{(1+e^x)^3}$

(c) $-\frac{e^x}{(1+e^x)^2}$

(d) $\frac{-1}{(1+e^x)^3}$

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386. If $y = \left(1 + x^{\frac{1}{4}}\right)\left(1 + x^{\frac{1}{2}}\right)\left(1 - x^{\frac{1}{4}}\right)$, then find $\frac{dy}{dx}$.

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387. Let $f(x) = (\lim)_{h \to 0} \frac{(\sin(x+h))^{1n(x+h)} - (\sin x)^{1nx}}{h}$. Then $f\left(\frac{\pi}{2}\right)$ equal to (a)0 (b) equal to 1 (c)In $\frac{\pi}{2}$ (d) non-existent

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388. If $f(x) = x|x|$, then prove that $f'(x) = 2|x|$

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389. A function $f: R \to R$ satisfies

$\sin x \cos y(f(2x + 2y) - f(2x - 2y) = \cos x \sin y(f(2x + 2y) + f(2x - 2y)$

If $f'(0) = \frac{1}{2}, then$ (a)$f''(x) = f(x) = 0$ (b)$4f''(x) + f(x) = 0$ (c) $f''(x) + f(x) = 0$ (d)$4f''(x) - f(x) = 0$

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390. If $y = \sqrt{\frac{1 - \cos 2x}{1 + \cos 2x}}, x \in \left(0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right)$, then find $\frac{dy}{dx}$.

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391. If $x = \log p$ and $y = \frac{1}{p}$,then

(a)$\frac{d^2y}{dx^2} - 2p = 0$

(b) $\frac{d^2y}{dx^2} + y = 0$

(c)$\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

(d) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

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

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393. Let $y = \ln(1 + \cos x)^2$. Then the value of $\frac{d^2y}{dx^2} + \frac{2}{e^{\frac{y}{2}}}$ equal

(a) 0

(b) $\frac{2}{1 + \cos x}$

(c) $\frac{4}{1 + \cos x}$

(d) $\frac{-4}{(1 + \cos x)^2}$

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394. Find $\frac{dy}{dx}$ for $y = x \sin x \log x$.

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395. If the function $f(x) = -4e^{\frac{1-x}{2}} + 1 + x + \frac{x^2}{2} + \frac{x^3}{3} and g(x) = f^{-1}(x)$, then the reciprocal of $g'\left(\frac{-7}{6}\right)$ is_____

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396. Differentiate $y = \frac{e^x}{1 + \sin x}$

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397. Suppose that $f(0) = 0 and f'(0) = 2$, and let $g(x) = f(-x + f(f(x)))$. The value of g' (0) is equal to _____

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398. If $y = \sqrt{\frac{1-x}{1+x}}$ find $\frac{dy}{dx}$ and prove that $\left(1-x^2\right)\frac{dy}{dx} + y = 0$

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399. If $g(x) = \frac{f(x)}{(x-a)(x-b)(x-c)}$,where f(x) is a polynomial of degree < 3 , then

$$\int g(x)dx = \begin{vmatrix} 1 & a & f(a)\log|x-a| \\ 1 & b & f(b)\log|x-b| \\ 1 & c & f(c)\log|x-c| \end{vmatrix} \div \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} + k$$

$$\frac{dg(x)}{dx} = \begin{vmatrix} 1 & a & -f(a)(x-a)^{-2} \\ 1 & b & -f(b)(x-b)^{-2} \\ 1 & c & -f(c)(x-c)^{-2} \end{vmatrix} : - \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$$

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400. If f(x) = cosx. cos2x. Cos4x. Cos8x.cos16x, then f '(pi/4) is :

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401. $f(x) = e^{-\frac{1}{x}}, where x > 0,$ Let for each positive integer n, P_n be the polynomial such that $\frac{d^n f(x)}{dx^n} = P_n\left(\frac{1}{x}\right)e^{-\frac{1}{x}}$ for all $x > 0$. Show that $P_{n+1}(x) = x^2\left[P_n(x) - \frac{d}{dx}P_n(x)\right]$

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402. If $a_i, b_i \in N$ for i 1,2,3, then coefficient of x in the determinant;

$$\begin{vmatrix} (1+x)^{a_1b_1} & (1+x)^{a_1b_2} & (1+x)^{a_1b_3} \\ (1+x)^{a_2b_1} & (1+x)^{a_2b_2} & (1+x)^{a_2b_3} \\ (1+x)^{a_3b_1} & (1+x)^{a_3b_2} & (1+x)^{a_3b_3} \end{vmatrix}$$

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403. If

$$\frac{d}{dx}\left[\left(x^m - A_1x^{m-1} + A_2x^{m-2} - \ldots\ldots + (-1)^m A_m\right)e^x\right] = x^m e^x,$$

find the value of A_r

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404. If $y = \begin{vmatrix} \sin x & \cos x & \sin x \\ \cos x & -\sin x & \cos x \\ x & 1 & 1 \end{vmatrix}$ find $\frac{dy}{dx}$.

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405. Let $f(x) and g(x)$ be two function having finite nonzero third-order derivatives $f'''(x)$ and $g'''(x)$ for all $x \in R$. If $f(x).\, g(x) = 1$ for all $x \in R,$ then prove that $\frac{f'''}{f'} - \frac{g'''}{g'} = 3\left(\frac{f''}{f} - \frac{g''}{g}\right).$

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406. Differentiate $\log \sin x$ w.r.t. $\sqrt{\cos x}$.

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407. If $\frac{\cos x}{2}\frac{\cos x}{2^2}\frac{\cos x}{2^3}\ldots\infty = \frac{\sin x}{x},$ then find the value of $\frac{1}{2^2}\frac{\sec^2 x}{2} + \frac{1}{2^4}\frac{\sec^2 x}{2^2} + \frac{1}{2^6}\frac{\sec^2 x}{2^3} + \ldots\infty$

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408. Differentiate $\frac{\tan^{-1}\left(\sqrt{1+x^2}-1\right)}{x}$ w,r,t. $\tan^{-1}x$

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409. If $0<x<1,$ then="" prove="" that="" $(1-2x)=\left(1-x=x^2\right)+\frac{2x-4x^3}{1-x^2+x^4}+\frac{4x^3-8x^7}{1-x^4+x^8}+\ldots.\infty=\frac{1}{1+}$

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410. Find the derivative of f(tan x) w.r.t. g (sec x) at $x=\frac{\pi}{4},$ where f'(1)=2 and $g'\left(\sqrt{2}\right)=4.$

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411. If $f(x) = \cos^{-1}\left(\frac{1}{\sqrt{13}}(2\cos x - 3\sin x)\right) + \sin^{-1}\left(\frac{1}{\sqrt{13}}(2\cos x + 3\sin x)\right)$, then find $\frac{df(x)}{dx}$ at $x = \frac{3}{4}$.

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412. Find the derivative of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ w.r.t. $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$.

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413. If $|a_1 \sin x + a_2 \sin 2x + \ + a_n \sin nx| \leq |\sin x|$ for $x \in R$, then prove that $|a_1 + 2a_2 + 3a_3 + na_n| \leq 1$

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414. Find the derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ w.r.t $\sqrt{1-x^2}$ at $x = \frac{1}{2}$

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415. If $y = \left(\frac{1}{2}\right)^{n-1} \cos\left(n \cos^{-1} x\right)$, then prove that y satisfies the differential equation $\left(1 - x^2\right) \frac{d^2y}{dx^2} - x\frac{dy}{dx} + n^2 y = 0$

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416. If $y = f\left(x^3\right), z = g\left(x^5\right), f'(x) = \tan x, and g'(x) = \sec x,$ then find the value of $\lim_{x \to 0} \frac{\left(\frac{dy}{dz}\right)}{x}$

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417. If $x \in \left(0, \frac{\pi}{2}\right)$, then show that $\cos^{-1}\left(\frac{7}{2}(1 + \cos 2x) + \sqrt{\left(\sin^2 x - 48\cos^2 x\right)} \sin x\right) = x - \cos^{-1}(7\cos x$

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418. If $f(x) = \begin{vmatrix} x+a^2 & ab & ac \\ ab & x+b^2 & bc \\ ac & bc & x+c^2 \end{vmatrix}$, then prove that $f'(x) = 3x^2 + 2x\left(a^2+b^2+c^2\right)$.

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419. If $y = \cos^{-1}\left(\frac{2x}{1+x^2}\right), then \frac{dy}{dx} is$ (a) $\frac{-2}{1+x^2}$ for all x (b) $\frac{-2}{1+x^2}$ for all $|x| < 1$ (c) $\frac{2}{1+x^2}$ for $|x| > 1$ (d) none of these

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420. If $f(x)$, $g(x)$ and $h(x)$ are three polynomials of degree 2, then prove that $\phi(x) = \begin{vmatrix} f(x) & g(x) & h(x) \\ f'(x) & g'(x) & h'(x) \\ f''(x) & g''(x) & h''(x) \end{vmatrix}$ is a constant polynomial.

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421. If $f(x-y), f(x)f(y)$ and $f(x+y)$ are in A.P. for all $x, y,$ and $f(0) \neq 0,$ then (a) $f(4) = f(-4)$ (b) $f(2) + f(-2) = 0$ (c) $f'(4) + f'(-4) = 0$ (d) $f'(2) = f'(-2)$

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422. If $x^3 + y^3 + 3axy = 0, find \frac{dy}{dx}$

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423. If 1 is the twice repeated root of the equation $ax^3 + bx^2 + bx + d = 0, then$ (a) $a = b = d$ (b) $a + b = 0$ (c) $b + d = 0$ (d) $a = d$

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424. If $\log\left(x^2 + y^2\right) = 2\tan^{-1}\left(\frac{y}{x}\right),$ show that $\frac{dy}{dx} = \frac{x+y}{x-y}$

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425. If $y = b\tan^{-1}\left(\frac{x}{a} + \frac{\tan^{-1} y}{x}\right)$, find $\frac{dy}{dx}$.

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426. Let $y = \sqrt{x + \sqrt{x + \sqrt{x + \infty}}}$, $\frac{dy}{dx}$ is equal to

(a) $\frac{1}{2y - 1}$

(b) $\frac{x}{x + 2y}$

(c) $\frac{1}{\sqrt{1 + 4x}}$

(d) $\frac{y}{2x + y}$

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427. If $y = \sqrt{\sin x + y}$, then find $\frac{dy}{dx}$

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428. $f(x) = |x^2 - 3|x| + 2|$. Then which of the following is/are true

$f'(x) = 2x - 3$ for x in $(0, 1) \cup (2, \infty)$

$f'(x) = 2x + 3$ for x in $(-\infty, -2) \cup (-1, 0)$

$f'(x) = -2x - 3$ for x in (-2,-1)`

None of these

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429. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, prove that $\frac{dy}{dx} = \frac{-1}{(1+x)^2}$

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430. If $x^3 - 2x^2y^2 + 5x + y - 5 = 0$ and $y(1) = 1$, then (a)$y'(1) = \frac{4}{3}$ (b) $y'(1) = -\frac{4}{3}$ (c)$y''(1) = -8\frac{22}{27}$ (d) $y'(1) = \frac{2}{3}$

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431. If $x^y = e^{x-y}$, Prove that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

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432. Let $f(x) = \frac{\sqrt{x-2\sqrt{x-1}}}{\sqrt{x-1}-1}x$. Then (a) $f'(10) = 1$ (b) $f'\left(\frac{3}{2}\right) = -1$ (c)domain of f(x) is x ≥ 1 (d)range of $f(x) is (-2, -1) \cup (2, \infty)$

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433. If $\sqrt{x} + \sqrt{y} = 4$, $find\left(\frac{dx}{dy}\right) at (y = 1)$.

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434. If $y=\frac{x^4-x^2+1}{x^2+\sqrt{3}x+1}$ and $\frac{dy}{dx}=ax+b$, then the value of a+b is

(a)$\cot\left(\frac{\pi}{8}\right)$ (b) $\cot\left(\frac{5\pi}{12}\right)$ (c) $\tan\left(\frac{5\pi}{12}\right)$ (d) $\tan\left(\frac{5\pi}{8}\right)$

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435. If $xy+y^2=\tan x+y$,then find $\frac{dy}{dx}$

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436. Find $\frac{dy}{dx}$ for $y=\sin^{-1}(\cos x)$

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437. If $y=\sqrt{x+\sqrt{y+\sqrt{x+\sqrt{y}+\ldots\infty}}}$ then $\frac{dy}{dx}$ equal to

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438. If $y = x^{\log x \hat{}}\left((\log(\log \dot{x}))\right), then \frac{dy}{dx} is$

$\frac{y}{x}\left(1nx^{\infty x-1}\right) + 21nx1n(1nx)\Big)$ $\frac{y}{x}(\log x)^{\log(\log x)}(2\log(\log x)+1)$

$\frac{y}{x1nx}\left[(1nx)^2 + 21n(1nx)\right]$ $\frac{y}{x}\frac{\log y}{\log x}[2\log(\log x)+1]$

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439. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \to \infty}}}$,prove that $\frac{dy}{dx} = \frac{\cos x}{2y-1}$

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440. The nth derivative of xe^x vanishes when (a)$x = 0$ (b) $x = -1$ (c) $x = -n$ (d) $x = n$

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441. If $x = a\left(\cos t + \frac{1}{2}\log\tan^2 t\right)$ and $y = a\sin t$ then find $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$

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442. or,find the derivatives of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at x=0.

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443. If $x^m y^n = (x+y)^{m+n}, provethat\frac{dy}{dx} = \frac{y}{x}.$

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444. Let $g(x) = f(x)\sin x, wheref(x)$ is a twice differentiable function on $(-\infty, \infty)$ such that $f'(-\pi) = 1$. The value of $|g''(-\pi)|$ equals

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445. If $x = a\cos^3\theta, y = a\sin^3\theta$, then find the value of $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$

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446. If $x = \sqrt{a^{\sin^{-1}t}}$ and $y = \sqrt{a^{\cos^{-1}t}}$ show that $\frac{dy}{dx} = -\frac{y}{x}$.

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447. If $\frac{x}{a} + \frac{y}{b} = \sqrt{2}$ touches the ellipses $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then find the ecentricity angle θ of point of contact.

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448. If $y = f\left(\frac{2x-1}{x^2+1}\right)$ and $f'(x) = \sin x^2$, then find $\frac{dy}{dx}$

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449. Let $y = x^3 - 8x + 7$ and $x = f(t)$. If $\frac{dy}{dt} = 2$ and $x = 3att = 0$, then $\frac{dx}{dt}$ at t = 0 is given by`

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450. If $x = \frac{2t}{1+t^2}, y = \frac{1-t^2}{1+t^2}, then$ find $\frac{dy}{dx}$.

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451. If $f_r(x), g_r(x), h_r(x), r = 1, 2, 3$ are polynomials such that $f_r(a) = g_r(a) = h_r(a), r = 1, 2, 3$ and

$F(x) = \begin{vmatrix} f_1(x) & f_2(x) & f_3(x) \\ g_1(x) & g_2(x) & g_3(x) \\ h_1(x) & h_2(x) & h_3(x) \end{vmatrix}$ then $F'(x) at x = a$ is_____

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452. Find $\frac{dy}{dx}$ if $x = a(\theta - \sin\theta)$ and $y = a(1 - \cos\theta)$.

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453. If $f(x) = (\log)_x(\log x), then f'(x)$ at $x = e$ is equal to (a) $\frac{1}{e}$ (b) e (c) 1 (d) zero

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454. Differentiate $\tan^{-1}\left(\frac{x}{1+\sqrt{(1-x^2)}}\right)$ $+\left\{2\tan^{-1}\sqrt{\left(\frac{1-x}{1+x}\right)}\right\} w.r.t.\ x$

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455. If $x = a\sec^3\theta$ and $y = a\tan^3\theta$, find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$.

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456. Differentiate $(\log x)^{\cos x}$ with respect to x.

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457. Find the differential equation of the curves given by $y = Ae^{2x} + Be^{-2x}$ where A and B are parameters.

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458. If $f(x) = x\sin x,$ then find $f'\left(\frac{\pi}{2}\right)$

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459. about to only mathematics

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460. If $y = \sqrt{\log\left\{\sin\left(\frac{x^2}{3} - 1\right)\right\}}$, *then* find $\frac{dy}{dx}$.

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461. Find $\frac{dy}{dx}$ of $y = x^3$

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462. Find $\frac{dy}{dx}$ for $y = \sin\left(x^2 + 1\right)$.

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463. Let $f(x) = x + \dfrac{1}{2x + \dfrac{1}{2x + \frac{1}{2x}}}$ Compute the value of $f(5)$.

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464. $y = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$. Find $\frac{dy}{dx}$.

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465. Find y' of $y = 5x^5$

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466. $y = \sin^{-1}\left(\frac{1}{\sqrt{1+x^2}}\right) + \cos^{-1}\left(\frac{1}{\sqrt{1+x^2}}\right)$. find $\frac{dy}{dx}$.

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467. If $x^2 + y^2 = R^2 (where R > 0) and k = \frac{y''}{\sqrt{(1+y'^2)^3}}$ then find k in terms of R alone.

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468. $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right)$, where $-1 < x < 1$, find $\frac{dy}{dx}$

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469. Find the derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ w.r.t $\sqrt{1-x^2}$ at $x = \frac{1}{2}$

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470. $y = \tan^{-1}\left(\frac{a\cos x - b\sin x}{b\cos x + a\sin x}\right)$, where $-\frac{\pi}{2} < x < \pi$ and $\frac{a}{b}\tan x > -1$. Find $\frac{dy}{dx}$

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471. If f(9)=9 ,f'(9)=4, $\lim_{x\to 9}\frac{\sqrt{f(x)}-3}{\sqrt{x}-3} = ?$

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472. Find the sum of the series $1 + 2x + 3x^2 + ... (n-1)x^{n-2}$ using differentiation.

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473. If $f(x)$ satisfies the relation $f\left(\frac{5x-3y}{2}\right) = \frac{5f(x)-3f(y)}{2} \forall x, y \in R,$ and $f(0) = 3 and f'(0) = 2,$ then the period of $\sin(f(x))$ is (a)2π (b) π (c) 3π (d) 4π

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474. $y = 4x^2 + e^{3x}$ find y'

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475. Instead of the usual definition of derivative $Df(x)$, if we define a new kind of derivative $D^{\cdot}F(x)$ by the formula $D \cdot f(x) = \lim_{h \to 0} \frac{f^2(x+h) - f^2(x)}{h}, where f^2(x)$ mean $[f(x)]^2$ and if $f(x) = x \log x$,then $D^{\cdot} f(x)|_{x=e}$ has the value (A)e (B) 2e (c) 4e (d) none of these

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476. Simplify $y = \tan^{-1}\left(\frac{x}{1+\sqrt{1-x^2}}\right)$

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477. If $y = |\cos x| + |\sin x|, then\left(\frac{dy}{dx}\right) at x = \frac{2\pi}{3}$ is

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478. $y = \ln x + e^{2x}$ find y'

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479. If g is the inverse function of $f and f'(x) = \sin x, then g'(x)$ is (a) $\cos ec\{g(x)\}$ (b) $\sin\{g(x)\}$ (c) $-\frac{1}{\sin\{g(x)\}}$ (d) none of these

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480. Find $\frac{dy}{dx}$ for the function: $y = \sin x + \ln x$

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481. If $x = \varphi(t), y = \psi(t), then \frac{d^2y}{dx^2}$ is (a) $\frac{\varphi'\psi'' - \psi'\varphi''}{(\varphi')^2}$ (b) $\frac{\varphi'\psi'' - \psi'\varphi''}{(\varphi')^3}$ (c) $\frac{\varphi''}{\psi''}$ (d) $\frac{\psi''}{\varphi''}$

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482. If $y=(1+x)\left(1+x^2\right)\left(1+x^4\right)\ldots\left(1+x^{2^n}\right)$, then find $\frac{dy}{dx}atx=0.$

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483. $f(x)=e^x-e^{-x}$ then find $f'(x)$

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484. Find $\frac{dy}{dx}$ for the function: $y=\sqrt{\sin\sqrt{x}}$

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485. If $y=\frac{\sqrt{a+x}-\sqrt{a-x}}{\sqrt{a+x}+\sqrt{a-x}}$,then $\frac{dy}{dx}$is equal to (a)$\frac{ay}{x\sqrt{a^2-x^2}}$ (b) $\frac{ay}{\sqrt{a^2-x^2}}$ (c)$\frac{ay}{x\sqrt{a^2-x^2}}$ (d) none of these

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486. Find $\frac{dy}{dx}$ for the function: $y = e^x + \cos x$

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487. Find $\frac{dy}{dx}$ for the function: $y = x^3 + e^{2x}$

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488. Find $\frac{dy}{dx}$ for the function: $y = \log \sqrt{\sin \sqrt{e^x}}$

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489. Let $g(x)$ be the inverse of an invertible function $f(x)$, which is differentiable for all real x. Then $g''(f(x))$ equals. (a) $-\frac{f''(x)}{(f'(x))^3}$ (b) $\frac{f'(x)f''(x) - (f'(x))^3}{f'(x)}$ (c) $\frac{f'(x)f''(x) - (f'(x))^2}{(f'(x))^2}$ (d) none of these

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490. Find $\frac{dy}{dx}$ for the function: $y = x^{\frac{1}{2}} + \sin 2x$

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491. Find $\frac{dy}{dx}$ for the function: $y = \sin 5x$

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492. Differentiate the function $f(x) = x^{99}$ with respect to x.

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493. If f(x)=x+tanx and g(x) is the inverse of f(x), then differentiation of g(x) is (a) $\frac{1}{1+[g(x)-x]^2}$ (b) $\frac{1}{2-[g(x)+x]^2}$ (c) $\frac{1}{2+[g(x)-x]^2}$ (d) none of these

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494. Find $\frac{dy}{dx}$ for $y = \cos 55x$

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495. Find $\frac{dy}{dx}$ for $y = e^{6x}$

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496. Let f: $R \to R$ be a one-one onto differentiable function, such that $f(2) = 1$ and $f'(2) = 3$. Then, find the value of $\left(\frac{d}{dx}\left(f^{-1}(x)\right)\right)_{x=1}$

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497. If

$''(x) = -f(x)$ and $g(x) = -f'(x)$ and $F(x) = \left(f\left(\frac{x}{2}\right)\right)^2 + \left(g\left(\frac{x}{2}\right)\right)$

and given that f(5)=5, then f(10) is equal to

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498. Find $\frac{dy}{dx}$ for the function: $y = \sin 4x - \left(\frac{1}{x^4}\right)$

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499. Find $\frac{dy}{dx}$ for the function: $y = \sin 2x - x^4 + e^{-3x}$

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500. If $x = a\cos\theta, y = b\sin\theta,$ then prove that $\frac{d^3y}{dx^3} = -\frac{3b}{a^3}\cos ec^4\theta\cot\theta.$

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501. If $y = x\log\left\{\frac{x}{(a+bx)}\right\}$, then show that $x^3\frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^2.$

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502. A function $f: R \to R$ satisfies the equation $f(x+y) = f(x)f(y)$ for all$x, y \in R$ and $f(x) \neq 0$ for all $x \in R$. If $f(x)$ is differentiable at $x = 0 and f'(0) = 2,$ then prove that $f'(x) = 2f(x)$.

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503. If $u = x^2 + y^2$ and $x = s + 3t, y = 2s - t,$ then $\frac{d^2u}{ds^2}$ is (a) $\frac{5}{2}t$ (b) $20t^8$ (c) $\frac{5}{16t^6}$ (d) none of these

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504. If $f(x) = (1+x)^n,$ then the value of $f(0) + f'(0) + \frac{f''(0)}{2!} + \frac{f'''(0)}{3!} + \ldots\ldots\frac{f^n(0)}{n!}$.

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505. If $f(x) = \sin x + e^x,$ then $f''(x)$

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506. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is

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507. If $f(x) = \left| x^{\cap} !2 \cos x \frac{\cos(n\pi)}{2} 4 \sin x \frac{\sin(n\pi)}{2} 8 \right|$ then find the value of $\frac{d^n}{dx^n}([f(x)])_{x=0} n \dot{\in} z.$

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508. Let $f\left(\frac{x+y}{2}\right) = \frac{f(x)+f(y)}{2}$ for all real x and y. If $f'(0)$ exits and equals -1 and $f(0) = 1$, then find $f(2)$.

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509. If $y^{\frac{1}{m}} = \left(x + \sqrt{1+x^2}\right), then\left(1+x^2\right)y_2 + xy_1$ is (where y_r represents the rth derivative of y w.r.t. x. (a)m^2y (b) my^2 (c) m^2y^2 (d) none of these

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510. Suppose the function $f(x) - f(2x)$ has the derivative 5 at $x = 1$ and derivative 7 at $x = 2$. The derivative of the function $f(x) - f(4x)$ at x=1 has the value equal to

(a) 19 (b) 9 (c) 17 (d) 14

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511. $f(x) + f(y) = f\left(\frac{x+y}{1-xy}\right)$,for all$x, y \in R.(xy \neq 1)$,and $\lim_{x \to 0} \frac{f(x)}{x} = 2$.Find$f\left(\sqrt{3}\right)$and $f'(-2)$.

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512. Let $f: R \to R$ satisfying $|f(x)| \leq x^2$, $\forall x \in R$ be differentiable at $x = 0$. Then find $f'(0)$.

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513. If $f(x) = \sin^{-1} \cos x$, then the value of $f(10) + f'(10)$ is (a) $11 - \frac{\pi}{2}$ (b) $\frac{\pi}{2} - 11$ (c) $\frac{5\pi}{2} - 11$ (d) none of these

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514. If $(\sin x)(\cos y) = \frac{1}{2}$, then $\frac{d^2y}{dx^2}$ at $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$ is (a) -4 (b) -2 (c) -6 (d) 0

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515. Suppose $p(x) = a_0 + a_1 x + a_2 x^2 + \ldots + a_n x^n$. If $|p(x)| \leq \left|e^{x-1} - 1\right| \leq 1$ then prove |a1 + 2a2 +..... + n an| ≤ 1.

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516. Let $f(x+y)=f(x)f(y)$ for all $xandy\cdot$ Suppose $f(5)=2andf'(0)=3.$ Find $f'(5)\cdot$

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517. A function f satisfies the condition $f(x)=f'(x)+f''(x)+f'''(x)....,$ where $f(x)$ is an indefinitely differentiable function and dash denotes the order of derivatives. If $f(0)=1$,then $f(x)$ is

(a)$e^{\frac{x}{2}}$ (b) e^{x} (c) e^{2x} (d) e^{4x}

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518. Let $f(xy)=f(x)f(y)\,\forall x,y\in R$ and f is differentiable at $x=1$ such that $f'(1)=1.$ Also, $f(1)\neq 0,\ f(2)=3.$ Then find $f'(2)$

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519. Let $f(x)$ be a polynomial of degree 3 such that $f(3)=1, f'(3)=-1, f''(3)=0, and f'''(3)=12.$ Then the value of $f'(1)$ is

(a)12 (b)23 (c) -13 (d) none of these

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520. Find $\frac{dy}{dx}$ for the functions: $y=x^3e^x\sin x$

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521. $\frac{d}{dx}\left[\tan^{-1}\left(\frac{\sqrt{x}(3-x)}{1-3x}\right)\right] is$

(a) $\frac{1}{2(1+x)\sqrt{x}}$ (b) $\frac{3}{(1+x)\sqrt{x}}$ (c) $\frac{2}{(1+x)\sqrt{x}}$ (d) $\frac{3}{2(1+x)\sqrt{x}}$

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522. If

$$y = \tan^{-1}\left(\frac{1}{1+x+x^2}\right) + \tan^{-1}\left(\frac{1}{x^2+3x+3}\right) + \tan^{-1}\left(\frac{1}{x^2+5x+7}\right)$$

upto n terms, then find the value of $y'(0)$

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523. Let $g(x)$ be the inverse of an invertible function $f(x)$ which is differentiable at $x = c$. Then $g'(f(x))$ equal. (a) $f'(c)$ (b) $\frac{1}{f'(c)}$ (c) $f(c)$ (d) none of these

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524. If $\sqrt{1-x^6} + \sqrt{1-y^6} = a\left(x^3 - y^3\right)$ then prove that $\frac{dy}{dx} = \frac{x^2}{y^2}\sqrt{\frac{1-y^6}{1-x^6}}$

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525. Let $f: R \to R$ be such that f (1) = 3 and f' (1) = 6 Then, $\lim_{x \to 0} \left(\frac{f(1+x)}{f(1)} \right)^{\frac{1}{x}}$ equals

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526. if cos y=x cos (a+y), $(a \neq 0)$, then show that $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$

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527. Let $f(x) = \begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$, where p is a constant. Then $\frac{d^3}{dx^3}(f(x))$ at $x = 0$ is

(a)p (b) $p - p^3$ (c)$p + p^3$ (d) independent of p

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528. Find $\frac{dy}{dx}$ for $y = \sin^{-1}(\cos x)$

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529. True or False -The derivative of an even function is always an odd function.

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530. If $y = \sqrt{(a-x)(x-b)} - (a-b)\tan^{-1}\sqrt{\frac{a-x}{x-b}} then \frac{dy}{dx}$ is equals to

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531. Let $F(x) = f(x)g(x)h(x)$ for all real x, where $f(x)$, $g(x)$, and $h(x)$ are differentiable functions. At some point x_0, $F'(x_0) = 21F(x_0)$, $f'(x_0) = 4f(x_0)$, $g'(x_0) = -7g(x_0)$, and $h'(x_0) = kh(x_0)$. Then k is_____

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532. Find $\frac{dy}{dx}$ for $y = \tan^{-1}\left\{\frac{1-\cos x}{\sin x}\right\}$.

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533. If $x = y + \sin^2 x$ then at $x = 0, \frac{dy}{dx} =$

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534. $f(x) = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ then f'(x)=

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535. If $f(x) = |x-2| and g(x) = f[f(x)], then g'(x) =$ _____ for x>20

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536. Find $\frac{dy}{dx}$ for $y = \tan^{-1}\sqrt{\frac{\sec^2 x}{\cos ec^2 x}}$

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537. If $y = (\sin x)^{\tan x}$, $then \frac{dy}{dx} =$ (a)$(\sin x)^{\tan x}\left(1 + \sec^2 x \log \sin x\right)$ (b)$\tan x(\sin x)^{\tan x - 1}\cos x$ (c)$(\sin x)^{\tan x}$ (d)$\sec^2 x \log \sin x$ $\tan x(\sin x)^{\tan x - 1}$

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538. If $y = \sin^{-1}\left(\sqrt{1 - x^2}\right)$ and $0 < x < 1$, then find $\frac{dy}{dx}$

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539. Suppose that $f(x)$ is a quadratic expresson positive for all real x If $g(x) = f(x) + f'(x) + f''(x)$, then for any real x (where $f'(x)$ and

$f''(x)$ represent 1st and 2nd derivative, respectively).

(a)$g(x) < 0$ (b). $g(x) > 0$ (c). $g(x) = 0$ (d). $g(x) \geq 0$

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540. If $y = \cos^{-1} x$,find $\frac{d^2y}{dx^2}$.

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541. If $y^2 = P(x)$, where P(x) is a polynomial of degree 3, then $2\frac{d}{dx}\left(y^3 \frac{d^2y}{dx^2}\right)$

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542. If $g(x) = \begin{vmatrix} f(x+c) & f(x+2c) & f(x+3c) \\ f(c) & f(2c) & f(3c) \\ f'(c) & f'(2c) & f'(3c) \end{vmatrix}$, where c is a constant, then $\lim_{x \to 0} \frac{g(x)}{x}$ is equal to

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543. If $f(a)=2, f'(a)=1, g(a)=-1, g'(a)=2,$ then the value of $\lim_{x \to a} \frac{g(x)f(a)-g(a)f(x)}{x-a}$ is (a) -5 (b) $\frac{1}{5}$ (c) 5 (d) none of these

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544. If $x=a(\cos t+t\sin t)$ and $y=a(\sin t-t\cos t)$, find $\frac{d^2y}{dx^2}$

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545. Prove that $\frac{2^{(\log)_{2\frac{1}{4}}x}-3^{(\log)_{27}\left(x^2+1\right)^3}-2x}{7^{4(\log)_{49}x}-x-1}>0$

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546. $(\lim)_{h \to 0} \frac{(e+h)^{1n(e+h)}-e}{h} is_-$

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547. If $(x-a)^2+(y-b)^2=c^2$, for some $c>0$, prove that

$$\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$$

is a constant independent of a and b.

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548. if $y=\left(x^2-1\right)^m$, then the $(2m)th$ differential coefficient of y is

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549. If function f satisfies the relation $f(x)\cdot f'(-x)=f(-x)\cdot f'(x)$ for all x ,and f(0)=3, and if f(3)=3, then the value of $f(-3)$ is _____

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550. If $y = \frac{a + bx^{\frac{3}{2}}}{x^{\frac{5}{4}}} and y' = 0 at x = 5$, then the value of $\frac{a^2}{b^2}$ is_____

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551. If $y = e^{a \cos^{-1} x}, -1 \leq x < 1, show that$

$$(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2 y = 0$$

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552. Let

$f(x) = (x - 1)(x - 2)(x - 3)...(x - n), n \in N, and f'(n) = 5040.$

Then the value of n is_____

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553. If $y = \frac{(ax + b)}{(x^2 + c)}$, then find $\frac{dy}{dx}$.

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554. If $y = x \log\{\frac{x}{(a+bx)}\}$, then show that $x^3 \frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^2$.

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555. y=f(x), where f satisfies the relation $f(x+y) = 2f(x) + xf(y) + y\sqrt{f(x)}, \forall x, y \varepsilon R$ and f'(0)=0.Then f(6)is equal _____

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556. If $x^2 + y^2 = t - \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $x^3 y\frac{dy}{dx} =$

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

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557. Prove that $\frac{d^n}{dx^n}\left(e^{2x} + e^{-2x}\right) = 2^n\left[e^{2x} + (-1)^n e^{-2x}\right]$

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558. If $e^y(x+1)=1$, prove that $\frac{d^2y}{dx^2}=\left(\frac{dy}{dx}\right)^2$

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559. $y=\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right.$ show that $\frac{dy}{dx}=\frac{1}{2\sqrt{1-x^2}}$

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560. If $y=\cos^{-1}(\cos x)$,then $\frac{dy}{dx}$ at x=$\frac{5\pi}{4}$ is equal to

(a)1 (b)-1 (c)0 (d)4

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561. If $y = \cos^{-1}(\cos x)$,then $\frac{dy}{dx}$ at x=$\frac{5\pi}{4}$ is equal to

(a)1 (b)-1 (c)0 (d)4

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562. If $\sin^{-1}\left(\frac{x^2 - y^2}{x^2 + y^2}\right) = \log a, then \frac{dy}{dx}$ is equal to (a) $\frac{x}{y}$ (b) $\frac{y}{x^2}$ (C) $\frac{x^2 - y^2}{x^2 + y^2}$ (d) $\frac{y}{x}$

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563. If $y = \tan^{-1}\sqrt{\frac{x+1}{x-1}}, then \frac{dy}{dx} is$ (a) $\frac{-1}{2|x|\sqrt{x^2-1}}$ (b) $\frac{-1}{2x\sqrt{x^2-1}}$ (c) $\frac{1}{2x\sqrt{x^2-1}}$ (d) none of these

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564. If $y = \cos^{-1}\left(\frac{5\cos x - 12\sin x}{13}\right), where x \in \left(0, \frac{\pi}{2}\right)$, then $\frac{dy}{dx}$ is.

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

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565. The derivative of $y = (1-x)(2-x)\ldots.(n-x)$ at $x = 1$ is

(a)0 (b) $(-1)(n-1)!$ (c)$n! - 1$ (d) $(-1)^{n-1}(n-1)!$

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566. If $y = \sqrt{\frac{1-x}{1+x}}$ find $\frac{dy}{dx}$ and prove that $\left(1-x^2\right)\frac{dy}{dx} + y = 0$

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567. $\frac{d^{20}}{dx^{20}}(2\cos x \cos 3x)$ is equal to (a)$2^{20}\left(\cos 2x - 2^{20}\cos 3x\right)$ (b) $2^{20}\left(\cos 2x + 2^{20}\cos 4x\right)$ (c)$2^{20}\left(\sin 2x + 2^{20}\sin 4x\right)$ (d) $2^{20}\left(\sin 2x - 2^{20}\sin 4x\right)$

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568. Differentiate $x^2 + 1$ with respect to x .

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569. Let $g(x) = \begin{cases} \dfrac{x^2 + x\tan x - x\tan 2x}{ax + \tan x - \tan 3x}, & x \neq 00, x = 0 \end{cases}$ If $g'(0)$ exists and is equal to nonzero value b, then $52\dfrac{b}{a}$ is equal to ____

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570. Given $y = \sin 2x + x^3$, $\dfrac{dy}{dx}$

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571. Find the derivative of $f(x) = e^{4x} + \cos 3x$

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572. A nonzero polynomial with real coefficient has the property that $f(x) = f'(x)\dot{f}'(x)$. If a is the leading coefficient of $f(x)$, then the value of $1/2a)$ is___

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573. Suppose $f(x) = e^{ax} + e^{bx}$, where $a \neq b$, and that $f''(x) - 2f'(x) - 15f(x) = 0$ for all x. Then the value of $\frac{|ab|}{3}$ is ___

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574. Let $z = (\cos x)^5 and y = \sin x$. Then the value of $2\frac{d^2z}{dy^2} at x = \frac{2\pi}{9}$ is_____.

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575. A function is reprersented parametrically by the equations $x = \frac{1+t}{t^3}; y = \frac{3}{2t^2} + \frac{2}{t}$ then the value of $\left|\frac{dy}{dx} - x\left(\frac{dy}{dx}\right)^3\right|$ is_____

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576. Let f be a twice differentiable function such that f"(x) = -f(x) , and f'(x) = g(x) , $h(x) = [f(x)]^2 + [g(x)]^2$ Find h(10), if h(5) = 11

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577. Let $y = e^{x\sin x^3} + (tanx)^x$ Find $\frac{dy}{dx}$

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578. If $ax^2 + 2hxy + by^2 = 1, then \frac{d^2y}{dx^2}$ is (a) $\frac{h^2 - ab}{(hx+by)^2}$ (b) $\frac{ab - h^2}{(hx+by)^2}$ $\frac{h^2 + ab}{(hx+by)^2}$ (d) none of these

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579. If $y = \sin px$ and y_n is the nth derivative of y, then $\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix} is$

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

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580. A function f, defined for all positive real numbers, satisfies the equation $f(x^2) = x^3$ for every $x > 0$. Then the value of $f'(4)$ is (a)12(b) 3 (c) $3/2$ (d) cannot be determined

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581. If $y = x - x^2$, then the derivative of y^2 with respect to x^2 is (a) $1 - 2x$ (b) $2 - 4x$ (c)$3x - 2x^2$ (d) $1 - 3x + 2x^2$

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582. The first derivative of the function $\left[\cos^{-1}\left(\sin\sqrt{\frac{1+x}{2}}\right)+x^x\right]$ with respect to x at $x=1$ is (a)$3/4$ (b) 0 (c)$1/2$ (d) $-1/2$

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583. The function $f(x)=e^x+x,$ being differentiable and one-to-one, has a differentiable inverse $f^{-1}(x)\cdot$ The value of $\frac{d}{dx}\left(f^{-1}\right)$ at the point $f(\log 2)$ is (a)$\frac{1}{1n2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) none of these

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584. Let $h(x)$ be differentiable for all x and let $f(x)=(kx+e^x)h(x)$, where k is some constant. If $h(0)=5, h'(0)=-2, and f'(0)=18,$ then the value of k is (a)5 (b) 4 (c) 3 (d) 2.2.

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585. Suppose $y = e^{ax} + e^{bx}$, find y''

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586. If $y = \frac{(a-x)\sqrt{a-x} - (b-x)\sqrt{x-b}}{\left(\sqrt{a-x} + \sqrt{x-b}\right)}$, then $\frac{dy}{dx}$ wherever it is defined is (a) $\frac{x + (a+b)}{\sqrt{(a-x)(x-b)}}$ (b) $\frac{2x - a - b}{2\sqrt{a-x}\sqrt{x-b}}$ (c) $-\frac{(a+b)}{2\sqrt{(a-x)(x-b)}}$ (d) $\frac{2x + (a+b)}{2\sqrt{(a-x)(x-b)}}$

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587. If $y = 7x^5$, then $\frac{dy}{dx}$

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588. The nth derivative of the function $f(x) = \frac{1}{1-x^2}[wherex \in (-1, 1)]$ at the point $x = 0$ where n is even

is (a) 0 (b) $n!$ (c) ${}^{n}C_{2}$ (d) ${}^{2n}C_{2}$

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589. Let $u(x)$ and $v(x)$ be differentiable functions such that $\frac{u(x)}{v(x)} = 7$. If $\frac{u'(x)}{v'(x)} = p$ and $\left(\frac{u(x)}{v(x)}\right)' = q$, then $\frac{p+q}{p-q}$ has the value of (a) 1 (b) 0 (c) 7 (d) -7

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590. Statement 1: Let $f: R \to R$ be a real-valued function $\forall x, y \in R$ such that $|f(x) - f(y)| \leq |x - y|^3$. Then $f(x)$ is a constant function. Statement 2: If the derivative of the function w.r.t. x is zero, then function is constant.

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591. Statement 1: For $f(x) = \sin x$, $f'(\pi) = f'(3\pi)$

Statement 2: For $f(x) = \sin x$, $f(\pi) = f(3\pi)$.

a. Statement 1 and Statement 2, both are correct and Statement 2 is the correct explanation for Statement 1

b. Statement 1 and Statement 2, both are correct and Statement 2 is not the correct explanation for Statement 1

c. Statement 1 is correct but Statement 2 is wrong.

d. Statement 2 is correct but Statement 1 is wrong.

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592. $f: R^+ \to R$ is a continuous function satisfying $f\left(\frac{x}{y}\right) = f(x) - f(y) \forall x, y \in R^+$.If f'(1)=1,then (a)f is unbounded (b) $\lim_{x \to 0} f\left(\frac{1}{x}\right) = 0$ (c) $\lim_{x \to 0} \frac{f(1+x)}{x} = 1$ (d) $\lim_{x \to 0} x.\, f(x) = 0$

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593.

$f_n(x) = e^{f_{n-1}(x)}$ for all $n \in N$ and $f_0(x) = x$, then $\frac{d}{dx}\{f_n(x)\}$ is

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594. Suppose $f$and g are functions having second derivative f'' and g'' everywhere. If $f(x)g(x) = 1$ for all x and f' and g' are never zero, then $\frac{f''(x)}{f'(x)} - \frac{g''(x)}{g'(x)}$ is equal (a)$\frac{-2f'(x)}{f}$ (b) $\frac{-2g'(x)}{g(x)}$ (c)$\frac{-f'(x)}{f(x)}$ (d) $\frac{2f'(x)}{f(x)}$

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595. If $y = e^{-x}\cos x and y_n + k_n y = 0, where y_n = \frac{d^{ny}}{dx^n} and k_n$ are constants $\forall n \in N,$ then $k_4 = 4$ (b) $k_8 = -16$ $k_{12} = 20$ (d) $k_{16} = -24$

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596. If a function is represented parametrically be the equations $x = \frac{1 + (\log)_e t}{t^2}; y = \frac{3 + 2(\log)_e t}{t}$, then which of the following statements are true?

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597. Prove $(a + b + c)(ab + bc + ca) > 9abc$

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598. Statement 1: $f(x) = x + \cos x$ is increasing $\forall x \in R$. Statement 2: If $f(x)$ is increasing, then $f'(x)$ may vanish at some finite number of points.

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599. If $y = ae^{mx} + be^{-mx}$, then $\frac{d^2y}{dx^2}$ is equals to

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600. If $y = \cot^{-1}\left[\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right]$, $\left(0 < x < \frac{\pi}{2}\right)$, then $\frac{dy}{dx} =$

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601. If $y = \sqrt{\log x + \sqrt{\log x + \sqrt{\log x + \infty}}}$, *then* $\frac{dy}{dx}$ *is* (a) $\frac{x}{2y-1}$ (b) $\frac{x}{2y+1}$ (c) $\frac{1}{x(2y-1)}$ (d) $\frac{1}{x(1-2y)}$

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602. $\frac{d^n}{dx^n}(\log x) = ?$ (a) $\frac{(n-1)!}{x^n}$ (b) $\frac{n!}{x^n}$ (c) $\frac{(n-2)!}{x^n}$ (d) $(-1)^{n-1}\frac{(n-1)!}{x^n}$

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603. If $y = \sec\left(\tan^{-1} x\right), then \frac{dy}{dx} at x = 1$ is

(a) $\cos\left(\frac{\pi}{4}\right)$

(b) $\sin\left(\frac{\pi}{2}\right)$

(c) $\sin\left(\frac{\pi}{6}\right)$

(d) $\cos\left(\frac{\pi}{3}\right)$

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604. The differential coefficient of $f\left((\log)_e x\right)$ with respect to x, where $f(x) = (\log)_e x$, is

(a) $\frac{x}{(\log)_e x}$ (b) $\frac{1}{x}(\log)_e x$ (c) $\frac{1}{x(\log)_e x}$ (d) none of these

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605. If $u = f(x^3), v = g(x^2), f'(x) = \cos x, and g'(x) = \sin x, then \frac{du}{dv}$ is `

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606. If $f'(x) = \sqrt{2x^2 - 1}$ and $y = f(x^2), then \frac{dy}{dx} at x = 1$ is (a)2 (b) 1 (c) -2 (d) none of these

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607. if f(x) = $\sqrt{1 - \sin 2x}$, then f'(x) is equal to

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608. If $x = t\cos t, y = t + \sin t$. Then $\frac{d^2x}{dy^2}$ at $t = \frac{\pi}{2}$ is (a) $\frac{\pi + 4}{2}$ (b) $-\frac{\pi + 4}{2}$ (c) -2 (d) none of these

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609. If $x^3 + 3x^2 - 9x = c$ is of the form $(x - \alpha)^2(x - \beta)$, then c is equal to 27 b. -27 c. 5 d. -5

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610. If $y = f(x)$ is an odd differentiable function defined on $(-\infty, \infty)$ such that $f'(3) = -2, then|f'(-3)|$ equals_____.

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611. $f'(x) = \phi(x)$ and $\phi'(x) = f(x)$ for all x. Also,$f(3) = 5$ and $f'(3) = 4$. Then the value of $[f(10)]^2 - [\phi(10)]^2$ is ____

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612. Match the value of x in column II where derivative of the function in column I is negative. Column I Column II $y = |x^2 - 2|x||$ p. $(1, 2)$ $y = |(\log)_e|x||$ q. $(-3, -2)$ $y = x\left[\frac{x}{2}\right], where[.]$ represent r. $(-1, 0)$ $y = |\sin x|$ s. $(0, 1)$

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613. If $y = \cos^{-1}\left(\frac{2x}{1+x^2}\right), then\frac{dy}{dx} is$ $\frac{-2}{1+x^2}$ for all x (b) $\frac{-2}{1+x^2}$ for all $|x| < 1$ $\frac{2}{1+x^2}$ for $|x| > 1$ (d) none of these

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614. Each question contains statements given in two columns which have to be matched. Statements a,b,c,d in column I have to be matched with statements p,q,r,s in column II. If the correct matches are a-p, q-s, b-q, r c-p, q and d-s, then the correctly bubbled $4x4$ matrix should be as follows: Figure Column I, Column II: Differential equation order 1, p.of all parabolas whose axis is the x-axis order 2, q.of family of curves

$y = a(x + a)^2$, where a is an arbitrary constant degree 1, r. $\left(1 + 3\frac{dy}{dx}\right)^{\frac{2}{3}} = \frac{4d^3y}{dx^3}$ degree 3, s. of family of curve $y^2 = 2c(x + \sqrt{c})$, where $c > 0$

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615. Suppose the function $f(x)$ satisfies the relation $f(x + y^3) = f(x) + f(y^3)\,\dot{\forall} x, y \in R$ and is differentiable for all x. Statement 1: If $f'(2) = a, then f'(-2) = a$ Statement 2: $f(x)$ is an odd function.

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616. If for some differentiable function $f(\alpha) = 0 and f'(\alpha) = 0$, Statement 1: Then sign of $f(x)$ does not change in the neighbourhood of $x = \alpha$ Statement 2: α is repeated root of $f(x) = 0$

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617. Statement 1: If differentiable function $f(x)$ satisfies the relation $f(x)+f(x-2)=0 \forall x \in R,$ and if $\left(\frac{d}{dx}f(x)\right)_{x=a}=b, then \left(\frac{d}{dx}f(x)\right)_{x=a+4000}=b.$

Statement 2: $f(x)$ is a periodic function with period 4.

(a) Statement 1 and Statement 2, both are correct. Statement 2 is the correct explanation for Statement 1

(b) Statement 1 and Statement 2, both are correct. Statement 2 is not the correct explanation for Statement 1

(c) Statement 1 is correct but Statement 2 is not correct.

(d) Both Statement 1 and Statement 2 are not correct.

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618. Let α be a repeated root of a quadratic equation $f(x)=0 and A(x), B(x), C(x)$ be polynomials of degrees 3, 4, and 5, respectively, then show that $|A(x)B(x)C(x)A(\alpha)B(\alpha)C(\alpha)A'(\alpha)B'(\alpha)C'(\alpha)|$ is divisible by $f(x)$, where prime $(')$ denotes the derivatives.

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619. If $y = \{(\log)_{\cos x} \sin x\}\{(\log)_{\sin x} \cos x\}^{-1} + \sin^{-1}\left(\frac{2x}{1+x^2}\right)$, find $\frac{dy}{dx} atx = \frac{\pi}{4}$

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620. find $\frac{dy}{dx}, \left(\sqrt{\frac{1-\sin 2x}{1+\sin 2x}}\right)$ is equal to, $0 < x < \frac{\pi}{2}$

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621. If $y = \left(x + \sqrt{x^2+a^2}\right)^n, then \frac{dy}{dx}$ is (a) $\frac{ny}{\sqrt{x^2+a^2}}$ (b) $-\frac{ny}{\sqrt{x^2+a^2}}$ (c) $\frac{nx}{\sqrt{x^2+a^2}}$ (d) $-\frac{nx}{\sqrt{x^2+a^2}}$

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622. If $f(x) = \sqrt{1 + \cos^2(x^2)}, then f'\left(\frac{\sqrt{\pi}}{2}\right)$ is (a) $\frac{\sqrt{\pi}}{6}$ (b) $-\sqrt{\pi/6}$ (c)$1/\sqrt{6}$ (d) $\pi/\sqrt{6}$

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623. $\frac{d}{dx}\left(\cos^{-1}\sqrt{\cos x}\right)$ is equal to (a)$\frac{1}{2}\sqrt{1 + secx}$ (b) $\sqrt{1 + \sec x}$ (c) $-\frac{1}{2}\sqrt{1 + \sec x}$ (d) $-\sqrt{1 + \sec x}$

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624. If $f(0) = 0, f'(0) = 2,$ then the derivative of $y = f(f(f(x)))$ at $x = 0$ is 2 (b) 8 (c) 16 (d) 4

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625. If $y = ax^{n+1} + bx^{-n}, thenx^2\frac{d^2y}{dx^2}$ is equal to (a) $n(n-1)y$ (b) $n(n+1)y$ (c) ny (d) n^2y

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626. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots + \frac{x^n}{n!}, then \frac{dy}{dx}$ is equal to (a) y (b) $y + \frac{x^n}{n!}$ (c) $y - \frac{x^n}{n!}$ (d) $y - 1 - \frac{x^n}{n!}$

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627. If $y = a \sin x + b \cos x$, then $y^2 + \left(\frac{dy}{dx}\right)^2$ is a (a)function of x (b) function of$y$ (c)function of x and y (d) constant

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628. If $y = (\log)_{\sin x}(\tan x), then \left(\left(\frac{dy}{dx}\right)\right)_{\frac{\pi}{4}}$ is equal to (a)$\frac{4}{\log 2}$ (b) $-4 \log 2$ (c)$\frac{-4}{\log 2}$ (d) none of these

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629. If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}, then\left(1-x^2\right)\frac{dy}{dx}$ is equal to (a)$x+y$ (b) $1+xy$ (c)$1-xy$ (d) $xy-2$

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630. If $\left(\lim\right)_{x\,0\to}\frac{ae^x+b\cos x+ce^{-x}}{e^{2x}-2e^x+1}=4, then$ a.$a=2$ b. b=-4 c. $c=2$ d. $a+b+c=-8$

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631. If $\lim_{x\to\infty} x\log_e\left(\begin{vmatrix}\alpha/x & 1 & \gamma\\ 0 & 1/x & \beta\\ 1 & 0 & 1/x\end{vmatrix}\right)=-5.$ where α,β,γ are finite real numbers, then

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632. Evaluate: $\left(\lim\right)_{x\to\frac{3\pi}{4}}\frac{1+(\tan x)^{\frac{1}{3}}}{1-2\cos^2 x}$

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633. Let $f: R \to R$ be a differentiable function at x = 0 satisfying f(0) = 0 and f'(0) = 1, then the value of $\lim_{x \to 0} \frac{1}{x} . \sum_{n=1}^{\infty} (-1)^n . f\left(\frac{x}{n}\right)$, is

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634. $(\lim)_{x \overrightarrow{0}^+} \frac{1}{x\sqrt{x}} \left(a \tan^{-1} \frac{\sqrt{x}}{a} - b \frac{\tan^{-1}(\sqrt{x})}{b} \right)$ has the value equal to $\frac{a-b}{3}$ b. 0 c. $\frac{(a^2-b^2)}{6a^2b^2}$ d. $\frac{a^2-b^2}{3a^2b^2}$

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635. If $f'(a) = \frac{1}{4}, then (\lim)_{h \overrightarrow{0}} \frac{f(a+2h^2) - f(a-2h^2)}{f(a+h^3-h^2) - f(a-h^3+h^2)} =$

0 b. 1 c. -2 d. none of these

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636. The value of $\lim_{x \to 0} \frac{e^{x^2} - e^x + x}{1 - \cos 2x}$ is

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637. Evalaute $\lim_{x \to 1} \frac{1 + \log x - x}{1 - 2x + x^2}$

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638. The value of $\lim_{x \to 1} \frac{x^{\frac{1}{13}} - x^{\frac{1}{7}}}{\left(x^{\frac{1}{5}} - x^{\frac{1}{3}}\right)}$ is $\frac{44}{91}$ b. $\frac{45}{91}$ c. $\frac{45}{89}$ d. $\frac{40}{93}$

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639. If $f(x) = \left\{\frac{x}{s \in x}, x > 02 - x, x \leq 0\right.$ and $g(x) = \{x + 3, x < 1x^2 - 2x - 2, 1 \leq x < 2x - 5, x \geq 2$ Then the value of $\left(\lim\right)_{x\,0} \to g(f(x))$ a. is -2 b. is -3 c. is 1 d. does not exist

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640. If $k \in I$ sucht that $(\lim)_{x \to \infty} \left(\cos \frac{k\pi}{4}\right)^{2n} - \left(\cos - \frac{k\pi}{6}\right)^{2n} = 0,$ then (a) k must not be divisible by 24 (b) k is divisible by 24 of k is divisible neither by 4 nor by 6 (c)k must be divisible by 12 but not necessarily by 24 (d) none of these

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641. $\lim_{x \to \infty} \frac{\sum_{r=1}^{10} (x+r)^{2010}}{(x^{1006}+1)(2x^{1004}+1)} =$

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642. If $\lim_{x \to 0} \frac{f(x)}{x^2} = a$ and $\lim_{x \to 0} \frac{f(1-\cos x)}{g(x)\sin^2 x} = b$ (where $b \neq 0$), then $\lim_{x \to 0} \frac{g(1-\cos 2x)}{x^4}$ is

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643. The value of $\lim_{x \to \frac{\pi}{4}} \frac{\tan^3 x - tanx}{\cos\left(x + \frac{\pi}{4}\right)}$ is 8 b. -4 c. -8 d. -2

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644. $\left(\lim\right)_{x \frac{\vec{\pi}}{2}} \frac{(1 - \sin x)\left(8x^3 - \pi^3\right)\cos x}{(\pi - 2x)^4}$

a. $\frac{\pi^2}{6}$ b. $\frac{3\pi^2}{16}$ c. $\frac{\pi^2}{16}$ d. $-\frac{3\pi^2}{16}$

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645. The value of $\lim_{x \to \frac{\pi}{4}} \frac{\sqrt{1 - \sqrt{\sin 2x}}}{\pi - 4x}$ is

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646. The value of $\left(\lim\right)_{x \to \infty} \left(e^{\sqrt{x^{4+1}}} - e^{x^{2+1}}\right)$ is (a) 0 b. e c. $1/e$ d. $-\infty$

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647. If a_n and b_n are positive integers and $a_n + \sqrt{2}b_n = \left(2+\sqrt{2}\right)^n, then(\ \lim\ )_{n\to\infty}\left(\frac{a_n}{b_n}\right) =$ a. 2 b. $\sqrt{2}$ c. $e^{\sqrt{2}}$ d. e^2

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648. If $f(x) = \begin{cases} x+\frac{1}{2}, x<0 \\ 2x+\frac{3}{4}, x\geq 0 \end{cases}$, then $\left[(\ \lim\ )_{x\to 0} f(x)\right] =$ (where [.] denotes the greatest integer function)

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649. $(\ \lim\ )_{X\to(-7)} \frac{[x]^2+15[x]+56}{\sin(x+7)\sin(x+8)} =$ (where [.] denotes the greatest integer function) a. is 0 b. is 1 c. is -1 d. does not exist

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650. Let $L_1 = (\lim)_{x \to 4}(x-6)^x$ and $L_2 = (\lim)_{x \to 4}(x-6)^4$. Which of the following is true? Both $L_1 and L_2$ exists Neither $L_1 and L_2$ exists L_1 exists but L_2 does not exist L_2 exists but L_1 does not exist

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651. If $f: R \to R$ is defined by $f(x) = [x-3] + |x-4|$ for $x \in R$, then $\lim_{x \to 3} f(x)$ is equal to (where [.] represents the greatest integer function)

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652. If $[.]$ denotes the greatest integer function, then $(\lim)_{x \to 0} \frac{x}{a}\left[\frac{b}{x}\right]$ a. $\frac{b}{a}$ b. 0 c. $\frac{a}{b}$ d. does not exist

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653. $\lim_{x \to \frac{-1}{3}} \frac{1}{x}\left[\frac{-1}{x}\right] =$ (where [.] denotes the greatest integer function)

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654. $\left(\lim\right)_{x \underset{\infty}{\to}} x^2 \sin\left((\log)_e \sqrt{\frac{\cos \pi}{x}}\right)$ a. 0 b. $\frac{\pi^2}{2}$ c. $\frac{\pi^2}{4}$ d. $\frac{\pi^2}{8}$

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655. $\lim_{x \to 0} \frac{1}{x^2}\begin{vmatrix} 1-\cos 3x & \log_e(1+4x) \\ \sin^{-1}(x^x -) & \tan^{-1}(2x) \end{vmatrix}$ is equal to

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656. If graph of the function $y = f(x)$ is continuous and passes through point $(3, 1)$ then $\left(\lim\right)_{x \to 3} \frac{(\log)_e(3f(x)-2)}{2(1-f(x))}$ is equal $\frac{3}{2}$ b. $\frac{1}{2}$ c. $-\frac{3}{2}$ d. $-\frac{1}{2}$

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657. $\lim_{x \to \infty} \left[x - \log_e \left(\frac{e^x + e^{-x}}{2} \right) \right] =$

a) $(\log)_e 4$ b. 0 c. ∞ d. $(\log)_e 2$

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658. The value of $\lim_{x \to 0} \frac{1 + \sin x - \cos x + \log(1 - x)}{x^3} is$

(a) $\frac{1}{2}$

(b) $-\frac{1}{2}$

(c) 0

(d) none of these

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659. If $\lim_{x \to \infty} \left(\frac{x+c}{x-c} \right)^x = 4$ then the value of e^c is

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660. If

$$f(x) = \lim_{n \to \infty} \frac{\left(x^2 + ax + 1\right) + x^{2n}\left(2x^2 + x + b\right)}{1 + x^{2n}} \text{ and } \lim_{x \to \pm 1} f(x)$$

exists, then

The value of b is

A. -1

B. 1

C. 0

D. 2

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661. If $\lim_{x \to 0} \left[1 + x + \frac{f(x)}{x}\right]^{\frac{1}{x}} = e^3$, then find the value of $1n\left(\lim_{x \to 0} \left[1 + \frac{f(x)}{x}\right]^{\frac{1}{x}}\right) is__$

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662. Let $f(x)$ be the fourth degree polynomial such that $f'(0) - 6, f(0) = 2 and (\lim)_{x \to 1} \frac{f(x)}{(x-1)^2} = 1$ The value of $f(2)$ is 3 b. 1 c. 0 d.2

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663. Let $f(x)$ be the fourth degree polynomial such that $f'(0) - 6, f(0) = 2 and (\lim)_{x \to 1} \frac{f(x)}{(x-1)^2} = 1$ The value of $f(2)$ is 3 b. 1 c. 0 d.2

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664. $(\lim)_{x \to 0}\left(\frac{\sqrt{1+x\sin x}-\sqrt{\cos 2x}}{\tan^2(x/2)}\right)$ is equal to $\frac{1}{6}$ b. 6 c.3 d. 2

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665. The value of $\lim_{x \to \infty} x^2\left(1-\cos.\frac{1}{x}\right)$ is

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666. $\lim_{x \to 0}\frac{\cos x-1}{x}$ is equal to

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667. $\lim x \to \left(2^+\right)\{x\}\frac{\sin(x-2)}{(x-2)^2} =$ (where [.] denotes the fractional part function) a. 0 b. 2 c. 1 d. does not exist

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

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669. If

$$f(x) = \lim_{n \to \infty} \frac{\left(x^2 + ax + 1\right) + x^{2n}\left(2x^2 + x + b\right)}{1 + x^{2n}} \text{ and } \lim_{x \to \pm 1} f(x)$$

exists, then

The value of b is

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670. $\lim_{x \to 0} \frac{e^{5x} - 1}{3x}$

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671. $\lim_{x \to \left(\frac{\pi}{2}\right)} (1 - \sin x)\tan x =$

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672. The value of $\lim_{x \to 3} \frac{\left(x^3 + 27\right)(\log)_e(x-2)}{x^2 - 9}$ is a. 9 b. 18 c. 27 d. 1/3

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673. If $(\lim)_{x \to 0} \frac{e^{ax} - e^x - x}{x^2} = b$ (finite), then $a = 2, b = 0$ b. $a = 0, b = \frac{3}{2}$ c. $a = 2, b = \frac{3}{2}$ d. $a = 0, b = 2$

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674. If $\lim_{x \to 0} \frac{x^3}{\sqrt{a+x}(bx - \sin x)} = 1, a > 0$, then $a + b$ is equal to

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675. $\lim_{x \to 0} \left[\frac{\sin^{-1} x}{\tan^{-1} x}\right] =$ (where $[.]$ denotes the greatest integer function)

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676. The value of $\lim_{x \to \frac{\pi}{4}} \frac{\sqrt{1 - \sqrt{\sin 2x}}}{\pi - 4x}$ is

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677. $\lim_{x \to 0} \left(\frac{\sin x}{x} \right)$

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678. If $f(x) = x \left(\frac{e^{|x| + [x]} - 2}{|x| + [x]} \right)$ then (where [.] represents the greatest integer function) $\left(\lim \right)_{x \vec{0}^+} f(x) = -1$ b. $\left(\lim \right)_{x \vec{0}^-} f(x) = 0$ c. $\left(\lim \right)_{x \vec{0}^{\square}} f(x) = -1$ d. $\left(\lim \right)_{x \vec{0}^{\square}} f(x) = 0$

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679. If $A = \lim_{x \to 0} \frac{\sin^{-1}(\sin x)}{\cos^{-1}(\cos x)}$ and $B = \lim_{x \to 0} \frac{[|x|]}{x}$, then

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680. Let $f(x) = \lim_{m \to \infty} \left\{ \lim_{n \to \infty} \cos^{2m}(n!\pi x) \right\}$, where $x \in R$. Then prove that $f(x) = \{1$, if x is rational and 0, if x is irrational

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681. $\lim_{x \to \infty} \left\{ (e^x + \pi^x)^{\frac{1}{x}} \right\} =$ where {.} denotes the fractional part of x is equal to

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682. Let $f(x) = (\lim)_{x \to \infty} \frac{\tan^{-1}(\tan x)}{1 + \left((\log)_e x\right)^n}, x \neq (2n+1)\frac{\pi}{2}$ then `AA1 e ,f(x)` is a constant function

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683. Assume that $\lim_{\theta \to -1} f(\theta)$ exists and $\frac{\theta^2+\theta-2}{\theta+3} \leq \frac{f(\theta)}{\theta^2} \leq \frac{\theta^2+2\theta-1}{\theta+3}$ holds for certain interval containing the point $\theta = -1$ then $\lim_{\theta \to -1} f(\theta)$

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

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685. Let $f: R \vec{R}$ be such that $f(a) = 1, f'(a) = 2.$ Then $(\lim)_{x \vec{0}} \left(\frac{f^2(a+x)}{f(a)} \right)^{1/x}$ is a. e^2 b. e^4 c. e^{-4} d. $1/e$

A. e^2

B. e^4

C. e^-4

D. 1/e

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686. If $f(n) = \lim_{x \to 0} \left\{ \left(1 + \sin\frac{x}{2}\right)\left(1 + \sin\frac{x}{2^2}\right)...\left(1 + \sin\frac{x}{2^n}\right) \right\}^{\frac{1}{x}}$ then find $\lim_{n \to \infty} f(n)$.

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687. If $a > 0, b > 0$ then $(\lim)_{n \to \infty} \left(\frac{a - 1 + b^{\frac{1}{n}}}{a} \right)^n = b^{1/a}$ b. $a^{\frac{1}{b}}$ c. a^b d. b^a

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688. $(\lim)_{x \to 0} \frac{\log\left(e^x \hat{} \, 2 + 2\sqrt{x}\right)}{tan\sqrt{x}}$ is equal to 0 b. 1 c. 2 d. e^2

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689. If $f(x) = (\lim)_{n \to \infty} \left(\cos\left(\frac{x}{\sqrt{n}}\right)\right)^n$, then the value of $(\lim)_{x \to 0} \frac{f(x) - 1}{x}$ is 0 b. 1 c. 2 d. $3/2$

A. 0

B. 1

C. 2

D. 3/2

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