MATHS

BOOKS - DISHA PUBLICATION MATHS (HINGLISH)

LIMITS AND DERIVATIVES

Jee Main 5 Years At A Glance

1. For each $t \in R$ let $[t]$ be the greatest integer less than or equal to t then $\lim_{x \to 0^+} x\left(\left[\frac{1}{t}\right] + \left[\frac{2}{t}\right] + \ldots + \left[\frac{15}{t}\right]\right)$ (1) is equal to 0 (2) is equal to 15 (3) is equal to 120 (4) does not exist (in R)

A. is equal to 15

B. is equal to 120

C. does not exist (in R)

D. is equal to 0

Answer: B

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2. $\lim_{x->0} \frac{(27+x)^{\frac{1}{3}}-3}{9-(27+x)^{\frac{2}{3}}}$

A. $-\frac{1}{3}$

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

C. $-\frac{1}{6}$

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

Answer: C

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

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

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

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

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

Answer: C

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4. $\lim_{x \to \infty} \frac{x^2 + 7x + 10}{x^2 - 6x - 16}$ is equal to

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5. Let $p = \lim_{x \to 0^+} \left(1 + \tan^2 \sqrt{x}\right)^{\frac{1}{2x}}$ then log p is equal to`

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

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

C. 2

D. 1

Answer: A

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6. If $\lim_{x \to \infty} \left(1 + \frac{a}{x} - \frac{4}{x^2}\right)^{2x} = e^3$, the a is equal to

A. 2

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

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

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

Answer: B

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

A. 2

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

C. 4

D. 3

Answer: A

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8. Let f(x) be a polynomial of degree four having extreme values at x=1 and x=2. If $\lim_{x \to 0} \left(1 + \frac{f(x)}{x^2}\right) = 3,$ then f(2) is equal to

A. 0

B. 4

C. -8

D. -4

Answer: A

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9. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{\sin^2 x}$ is equal to :

A. 2

B. 3

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

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

Answer: C

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Exercise 1 Concept Builder Topic 1

1. If $\lim_{n \to \infty} \frac{1 - (10)^n}{1 + (10)^{n+1}} = -\frac{\alpha}{10}$, then the value of α is

A. 2

B. -1

C. 1

D. 0

Answer: C

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2. $\lim_{n \to \infty} \frac{5^{n+1} + 3^n - 2^{2n}}{5^n + 2^n + 3^{2n+3}}$

A. 5

B. 3

C. 1

D. 0

Answer: D

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3. $\lim_{x \to 0} \left[\frac{\sin[x-3]}{[x-3]} \right]$ where $[.]$ denotes greatest integer function is

A. 0

B. 1

C. does not exist

D. sin 1

Answer: C

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4. If value of $\lim_{x \to a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}$ is equal to $\frac{2\sqrt{3}}{m}$, where m is equal to

A. 2

B. 8

C. 9

D. 3

Answer: C

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

A. Both I and II are true

B. Only I is true

C. Only II is true

D. Both I and II are false

Answer: C

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

A. 1

B. 0

C. 2

D. 3

Answer: A

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7. If $3-\frac{x^2}{12} \leq f(x) \leq 3+\frac{x^3}{9}$ for all $x \neq 0$, then the value of $\lim_{h \to 0} f(x)$ is equal to

A. -1

B. 1

C. 2

D. 0

Answer: B

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8. $\lim_{x \to \infty} \frac{a^n - b^n}{a^n - b^n}$, where $1 < b < a$, is equal to

A. -1

B. 1

C. 2

D. 0

Answer: B

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

A. 1

B. 0

C. e-1

D. e+1

Answer: C

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10. If $f(x) = \begin{cases} 2x+3 & x \leq 0 \\ 3(x+1) & x > 0 \end{cases}$ then the value of $\lim_{x \to 0} f(x)$ is

A. 0

B. 6

C. 2

D. 3

Answer: D

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

A. 0

B. 1

C. 2

D. 3

Answer: D

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12. If $a_1 = 1 and a_{n+1} = \frac{4 + 3a_n}{3 + 2a_n}, n \geq 1, and$ if $(\lim)_{n \infty \to} a_n = a,$ then find the value of a.

A. $\sqrt{2}$

B. $-\sqrt{2}$

C. 2

D. None of these

Answer: A

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

A. equal to 1

B. equal to 0

C. does not exist

D. None of these

Answer: B

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

A. ∞

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

C. 0

D. $\frac{1}{32}$

Answer: D

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15. $\lim_{x \to 0} \frac{\cos ax - \cos bx}{\cos cx - 1}$ is equal to $\frac{m}{n}$, where m and n are respectively

A. $a^2 + b^2, c^2$

B. $c^2, a^2 + b^2$

C. $a^2 - b^2, c^2$

D. $c^2, a^2 - b^2$

Answer: C

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Exercise 1 Concept Builder Topic 2

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

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

A. $\sec x(x \tan x + 1)$

B. $x \tan x + \sec x$

C. $x \sec x + \tan x$

D. None of these

Answer: A

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2. $\lim_{x \to 1} (\log_2 2x)^{\log_x^5}$ is equal to

A. $\log_2 5$

B. $e^{\log_2 5}$

C. e

D. 0

Answer: B

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

A. $\frac{1}{8\sqrt{3}}$

B. $\frac{1}{4\sqrt{3}}$

C. 0

D. None of these

Answer: A

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

A. 1

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

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

D. 2

Answer: B

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5. Evaluate $\lim_{x \to \pi/6} \frac{2\sin x - 1}{x - \frac{\pi}{6}}$

A. 3

B. $\sqrt{3}$

C. 1

D. -1

Answer: B

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6. $\lim_{x \top i/4} \frac{1 - \cot^3 x}{2 - \cot x - \cot^3 x}$, is

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

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

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

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

Answer: A

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

A. f(x) f(y)

B. f(x)+f(y)

C. f(x)-f(y)

D. None of these

Answer: B

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8. $\lim_{x \to 0} \left(\frac{10 \sin 9x}{9 \sin 10x}\right)\left(\frac{8 \sin 7x}{7 \sin 8x}\right)\left(\frac{6 \sin 5x}{5 \sin 6x}\right)\left(\frac{4 \sin 3x}{3 \sin 4x}\right)\left(\frac{\sin x}{\sin 2x}\right) =$

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9. The value of the limit $\lim_{x \to \infty} \left(\frac{x^2 - 1}{x^2 + 1}\right)^{x^2}$ equal to

A. e^2

B. e^{-2}

C. e

D. e^{-1}

Answer: B

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10. The value of $\lim_{x \to 0} \frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{x^2}$ is

A. 1

B. -1

C. 0

D. does not exist

Answer: A

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11. $m, n, \in 1^+$, then $\lim_{x \to 0} \frac{\sin x^n}{(\sin x)^m}$ equals

A. 1, if n=m

B. $-1, \quad \text{if} \quad n > m$

C. $\frac{n}{m}$

D. None of these

Answer: A

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

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13. The limit $\lim_{x \to 2} \frac{2^x + 2^{3-x} - 6}{\sqrt{2}^{-x} - 2^{1-x}}$ is equal to

A. 1

B. 2

C. 4

D. 8

Answer: D

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14. If the value of $\lim_{x \to 0} \frac{\sqrt{2+x} - \sqrt{2}}{x}$ is equal to $\frac{1}{a\sqrt{2}}$ then 'a' equals

A. 1

B. 2

C. 3

D. 4

Answer: B

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15. Value of $\lim_{x \to 0} \frac{a^{\sin x} - 1}{\sin x}$ is

A. log a

B. sin x

C. log(sin x)

D. cos x

Answer: A

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Exercise 1 Concept Builder Topic 3

1. $\lim_{h \to 0} \frac{f(2h + 2 + h^2) - f(2)}{f(h - h^2 + 1) - f(1)}$ given that f'(2) = 6 and f'(1) = 4,

A. does not exist

B. $-3/2$

C. $3/2$

D. 3

Answer: D

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2. The value of $\lim_{x \to 0} \frac{e^x + \log(1+x) - (1-x)^{-2}}{x^2}$ is equal to

A. 0

B. -3

C. -1

D. Infinity

Answer: B

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3. If $f(a) = 2, f'(a) = 1, g(a) = 3, g'(a) = -1,$ then $\lim_{x \to a} \frac{f(a)g(x) - f(x)g(a)}{x - a}$ is equal to

A. 6

B. 1

C. -1

D. -5

Answer: D

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4. If $f(x) = \begin{cases} x - [x], & x \notin I \\ 1, & x \in I \end{cases}$ where I is an integer and [.] represents the greatest integer function and

$g(x) = \lim_{n \to \infty} \frac{\{f(x)\}^{2n} - 1}{\{f(x)\}^{2n} + 1}$, then

(a) Draw graphs of f(2x), g(x) and g{g(x)} and discuss their continuity.

(b) Find the domain and range of these functions.

(c) Are these functions periodic ? If yes, find their periods.

A. 0

B. 1

C. -1

D. None of these

Answer: C

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5. $\lim_{n \to \infty} \frac{n^p \sin^2(n!)}{n+1}, 0 < p < 1,$ is equal to-

A. 0

B. ∞

C. 1

D. None of these

Answer: A

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6. $\lim_{x \to 0^+} \log_{\tan x}(\tan 2x)$ is equal to

A. 1

B. `-1

C. 0

D. None of these

Answer: A

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7. $\lim_{x \to 0} \frac{\sin x^4 - x^4 \cos x^4 + x^{20}}{x^4\left(e^{2x^4} - 1 - 2x^4\right)}$ is

A. 0

B. $-1/6$

C. $1/6$

D. does not exist

Answer: C

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8. The limit of the series $\sum_{r=1}^{n} \frac{r}{1+r^2+r^4}$ as n approaches infinity, is

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

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

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

D. 1

Answer: A

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9. $\lim_{x \to \infty} \left(\cos \frac{2}{x}\right)^{x^2} =$

A. e^{-1}

B. e^{-4}

C. $\left(1 + e^{-2}\right)$

D. e^{-2}

Answer:

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10. if $\lim_{x \to \infty} \left(1 + \frac{\lambda}{x} + \frac{\mu}{x^2}\right)^{2x} = e^2$ then

A. $\lambda = -1, \mu = 2$

B. $\lambda = 2, \mu = 1$

C. $\lambda = 1, \mu =$ any real number

D. $\lambda = \mu =$ any real number

Answer: C

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11. $\lim_{x \to \infty} \frac{x^2 + 5x + 6}{x^2 - x - 6}$

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12. $\lim_{x \to -\infty} \frac{x^5 \tan\left(\frac{1}{\pi x^2}\right) + 3|x|^2 + 7}{|x|^3 + 7|x| + 8}$

A. $-\frac{1}{\pi}$

B. 0

C. ∞

D. does not exist

Answer: A

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13. $\lim_{x \to [a]} \frac{e^x - \{x\} - 1}{\{x\}^2}$ Where {x} denotes the fractional part of x and [x] denotes the integral part of a.

A. 0

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

C. e-2

D. None of these

Answer: D

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14. $\lim_{x \to 0} x \log \sin x$ is equal to

A. zero

B. ∞

C. 1

D. cannot be determined

Answer: A

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15. Value of the $\lim_{x \to -2} \frac{\tan \pi x}{x+2} + \lim_{x \to \infty} \left(1 + \frac{1}{x^2}\right)^x$ is

A. $\pi + 1$

B. $\pi - 1$

C. $\pi / 2 + 1$

D. $\pi / 3 - 1$

Answer: A

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Exercise 1 Concept Builder Topic 4

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

A. $\sin\left(\frac{2x+1}{x^2+1}\right)^2\left[\frac{2+2x-2x^2}{x^2+1}\right]$

B. $\sin\left(\frac{2x-1}{x^2-1}\right)^2\left[\frac{2+2x-2x^2}{x^2+1}\right]$

C. $\sin\left(\frac{2x-1}{x^2+1}\right)^2\left[\frac{2+2x-2x^2}{x^2+1}\right]$

D. $\sin\left(\frac{2x+1}{x^2-1}\right)^2\left[\frac{2+2x-2x^2}{x^2+1}\right]$

Answer: C

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2. Write the value of the derivative of $f(x) = |x-1| + |x-3|$ at $x = 2$

.

A. 2

B. 1

C. 0

D. -2

Answer: C

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3. If f(x)=$2\sin x - 3x^4 + 8$, then find f'(x) is

A. $2\sin x - 12x^3$

B. $2\cos x - 12x^3$

C. $2\cos x + 12x^3$

D. $2\sin x + 12x^3$

Answer: B

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4. If $f(x) = \sqrt{x^2 - 10x + 25}$, then the derivative of $f(x)$ in the interval [0, 7] is (a) 1 (b) -1 (c) 0 (d) none of these

A. 1

B. -1

C. 0

D. None of these

Answer: D

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5. If $y = x \tan \frac{x}{2}$, then value of $(1 + \cos x)\frac{dy}{dx} - \sin x$ is

A. $-x$

B. x^2

C. x

D. None of these

Answer: C

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6. Let $f(x) = \alpha(x)\beta(x)\gamma(x)$ for all real x, where $\alpha(x), \beta(X)$ and $\gamma(x)$ are differentiable functions of x. If f'(2)=18 f(2), $\alpha'(2) = 3\alpha(2), \beta'(2) = -4\beta(2)$ and $\gamma'(2) = k\gamma(2)$, then the value of k is

A. 14

B. 16

C. 19

D. None of these

Answer: C

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

A. f'(1)

B. $\frac{f'(1)}{n}$

C. n.f'(1)

D. $\frac{n}{f'(1)}$

Answer: B

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8. If f be a function given by f(x) $= 2x^2 + 3x - 5$. Then f'(0)=mf'(-1), where m is equal to

A. -1

B. -2

C. -3

D. -4

Answer: C

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9. If $f(t) = \frac{1-t}{1+t}$ then the value of f'(1/t) is

A. $\frac{-2t^2}{(t+1)^2}$

B. $\frac{2t}{(t+1)^2}$

C. $\frac{2t^2}{(t-1)^2}$

D. $\frac{-2t^2}{(t-1)^2}$

Answer: A

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10. If $y = \left(1+\frac{2}{x}\right)\left(1+\frac{2}{x}\right)\left(1+\frac{3}{x}\right)\ldots\left(1+\frac{n}{x}\right)$

$x \neq 0$, then $\frac{dy}{dx}$ when x = - 1 is

A. n!

B. (n-1)!

C. $(n-1)^n(n-1)!$

D. $(-1)^n n!$

Answer: C

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11. If $f(x)$ is a polynomial function satisfying $f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(4) = 65, then f \in df(6)$.

A. AP

B. GP

C. HP

D. None of these

Answer: B

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12. the derivative of $y = (1-x)(2-x)\ldots\ldots\ldots(n-x)$ at $x = 1$ is equal to

A. 0

B. (-1) (n-1)!

C. n!-1

D. $(-1)^{n-1}(n-1)!$

Answer: B

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13. If : $3f(x) - 2f\left(\frac{1}{x}\right) = x, \quad \text{then:} \quad f'(2) =$

A. $\frac{2}{7}$

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

C. 2

D. $\frac{7}{2}$

Answer: B

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14. Which of the following is/are true?

I. The derivative of $f(x) = 1 + x + x^2 + \ldots\ldots + x^{50}$ at x=1 is 1250.

II. The derivative of $f(x) = \frac{x+1}{x}$ is $\frac{1}{x^2}$.

A. Both I and II are true

B. Only I is true

C. Only II is true

D. Both I and II are false

Answer: D

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15. If $f(x) = (ax + b)\sin x + (cx + d)\cos x$, then the values of a b, c and d such that $f(x) = x\cos x$ for all x, then (a + b + c + d)is

A. b=c=0, a=d==1

B. b=d=0, a=c=1

C. c=d=0, a=b=1

D. None of these

Answer: A

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Exercise 2 Concept Applicator

1. If : $f(x) \begin{matrix} = 1, & \ldots \text{ x is rational} \\ = 0, & \ldots \text{x is irrational} \end{matrix}$ then : $\lim_{x \to 0} f(x) =$

A. 0

B. 1

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

D. None of these

Answer: B

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2. For $x \in R$, $\lim_{x \to \infty} \left(\frac{x-3}{x+2}\right)^x =$

A. e

B. e^{-1}

C. e^{-5}

D. e^5

Answer: C

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3. If $y = \left(1 + x^{\frac{1}{4}}\right)\left(1 + x^{\frac{1}{2}}\right)\left(1 - x^{\frac{1}{4}}\right)$, then what is $\frac{dy}{dx}$ equal to ?

A. 1

B. -1

C. x

D. $\sqrt{x}$

Answer: B

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4. If $\lim_{x \to 0} \frac{(\sin nx)[(a - n)nx - \tan x]}{x^2} = 0$, then the value of a.

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

B. $n - \frac{1}{n}$

C. $n + \frac{1}{n}$

D. None

Answer: C

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

A. e

B. e^2

C. e^{-1}

D. 1

Answer: B

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6. If $y = \frac{1}{1 + x^{\beta - \alpha} + x^{\gamma - \alpha}} + \frac{1}{1 + x^{\alpha - \beta} + x^{\gamma - \beta}} + \frac{1}{1 + x^{\alpha - \gamma} + x^{\beta - \gamma}}$, then $\frac{dy}{dx}$ is equal to-

A. 0

B. 1

C. $(\alpha+\beta+\gamma)x^{\alpha+\beta+\gamma-1}$

D. None of these

Answer: A

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

A. $1/6$

B. 1

C. 10

D. 100

Answer: D

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

A. $1/6$

B. $-1/12$

C. $2/3$

D. $1/3$

Answer: B

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9. Let α and β be the distinct root of $ax^2 + bx + c = 0$ then $\lim_{x \to 0} \frac{1 - \cos(ax^2 + bx + c)}{(x - \alpha)^2}$ is equal to

A. 0

B. $\frac{1}{2}(\alpha - \beta)^2$

C. $\frac{a^2}{2}(\alpha - \beta)^2$

D. None of these

Answer: C

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10. If $\lim_{x \to 1} \frac{ax^2 + bx + c}{(x-1)^2} = 2$ then $\lim_{x \to 1} \frac{(x-a)(x-b)(x-c)}{(x+1)} =$

A. 2

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

C. 4

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

Answer: D

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

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

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

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

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

Answer: A

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12. For the function $f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + ... \frac{x^2}{2} + x + 1$, f'(1)=mf ' (0), where m is equal to

A. 50

B. 0

C. 100

D. 200

Answer: C

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13. The value of $\lim_{x \to 0} \frac{(4^x - 1)^3}{\sin. \frac{x^2}{4} \log(1 + 3x)}$,is

A. $\frac{4}{3}(\ln 4)^2$

B. $\frac{4}{3}(\ln 4)^3$

C. $\frac{3}{2}(\ln 4)^2$

D. $\frac{3}{2}(\ln 4)^3$

Answer: B

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14. If $f(x)+f(y)=f\left(\frac{x+y}{1-xy}\right)$ for all $x, y \in R(xy \neq 1)$ and $\lim_{x \to 0} \frac{f(x)}{x}=2$, then

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

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

C. $\frac{3}{6}$

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

Answer: D

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

A. log 5 log 2

B. log 10

C. $\log\left(\frac{5}{2}\right)$

D. 0

Answer: A

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16. $\lim_{n \to \infty} \left\{ \frac{1}{1-n^2} + \frac{2}{1-n^2} + ... + \frac{n}{1-n^2} \right\}$ is equal to

A. 0

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

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

D. None of these

Answer: B

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17. If $z_r = \frac{\cos(\pi\alpha)}{n^2} + i\frac{\sin(r\alpha)}{n^2}$, where $r = 1, 2, 3.... , n, then \lim_{n \to \infty} z_1 z_2 z_3 ... z_n$ is equal to

A. $\cos\alpha + I\sin\alpha$

B. $\cos(\alpha/2) - I\sin(\alpha/2)$

C. $e^{I\alpha/2}$

D. $3_{e^{I\alpha}}\sqrt{}$

Answer: C

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18. If $f(x) = \begin{cases} |x| + 1 & x < 0 \\ 0 & x = 0 \\ |x| - 1 & x > 0 \end{cases}$ then $\lim_{x \to a}$ f(x) exists for all

A. $a \neq 1$

B. $a \neq 0$

C. $a \neq -1$

D. $a \neq 2$

Answer: B

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19. The value of $\lim_{\theta \to -\frac{\pi}{4}} \frac{\cos\theta + \sin\theta}{\theta + \frac{\pi}{4}}$ is

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

B. $\frac{-\pi}{4}$

C. $-\sqrt{2}$

D. $\sqrt{2}$

Answer: D

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20. Let $f(2) = 4$ and $f'(2) = 4$. Then $\lim_{x \to 2} \frac{xf(2) - 2f(x)}{x - 2}$ is equal to

A. 2

B. -2

C. -4

D. 3

Answer: C

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21. 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 :

A. 1

B. 2

C. 3

D. 4

Answer: C

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22. The value f $\lim_{x \to \frac{\pi}{2}} \left[1^{1/\cos^2 x} + 2^{1/\cos^2 x} + ... + n^{1/\cos^2 x}\right]^{\cos^2 x}$ is

A. 0

B. n

C. ∞

D. $\frac{n(n+1)}{2}$

Answer: B

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

A. $\frac{1}{8\sqrt{3}}$

B. $\frac{1}{4\sqrt{3}}$

C. 0

D. None of these

Answer: A

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24. $\left(\lim\right)_{x \to 0} \frac{\sin\left(\pi \cos^2 x\right)}{x^2}$ is equal to (1) $\frac{\pi}{2}$ (2) 1 (3) $-\pi$ (4) π

A. $-\pi$

B. π

C. $\pi/2$

D. 1

Answer: B

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25. 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=9/2

B. a=3 and b=9/2

C. a=-3 and b=-9/2

D. a=3 and b=-9/2

Answer: A

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26. If $\frac{d}{dx}\left(\frac{1+x^4+x^8}{1+x^2+x^4}\right) = ax^3 + bx$,then

A. a=4, b=2

B. a=4, b=-2

C. a=-2, b=4

D. None of these

Answer: B

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27. For the function $f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + ... \frac{x^2}{2} + x + 1$, f'(1)=mf ' (0), where m is equal to

A. 50

B. 0

C. 100

D. 200

Answer: C

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28. $\lim_{x \to \pi/2} (\sec x - \tan x)$ is equal to

A. 0

B. 2

C. 1

D. 3

Answer: A

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

A. 0

B. 1

C. -1

D. does not exist

Answer: A

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30. If $f(x) = |\cos x|, then f'\left(\frac{3\pi}{4}\right)$ is equal to

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

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

C. 1

D. None of these

Answer: B

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