MATHS

BOOKS - MTG WBJEE MATHS (HINGLISH)

DERIVATIVES

Wb Jee Workout

1. The value of $\frac{dy}{dx}$ at $x=\frac{i}{2}$, where y is given by $y=x^{\sin x}+\sqrt{x}$ is

A. $1+\frac{1}{\sqrt{2\pi}}$

B. 1

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

D. $1 - \frac{1}{\sqrt{2\pi}}$

Answer: A

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2. If $f(x) = |x - 5|$ and $g(x) = f(f(x))\,\forall x > 10,$ then g' (x) equals

A. 1

B. -1

C. 0

D. None of these

Answer: A

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3. Let $f(x)$ be twice differentiable function such that $f'(0) = 2$, then, $\lim_{x \to 0} \frac{2f(x) - 3f(2x) + f(4x)}{x^2}$, is

A. 6

B. 3

C. 12

D. 0

Answer: A

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4. If $y = \log_a x$ then $\frac{dy}{dx} at x = e$ is

A. $\frac{1}{e \log_e a}$

B. $\frac{\log ea}{e}$

C. $e \log_e a$

D. None of these

Answer: A

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5. If $x^2 + y^2 = 4$, then $y\frac{dy}{dx} + x$ is equal to

A. 4

B. 0

C. 1

D. -1

Answer: B

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6. If $x^{mx^{mx^{mx \dots \text{to} \infty}}} = y^{ny^{ny^{ny \dots \text{to} \infty}}}$, then $\frac{dy}{dx} =$

A. $\frac{(m-n)}{m+n}\left(\frac{x}{y}\right)$

B. $\frac{m+n}{m-n}\left(\frac{y}{x}\right)$

C. $\frac{mx}{ny}$

D. $\frac{my}{mx}$

Answer: D

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7. Let $f(x) = x^{3/2} - \sqrt{x^2 + x^4}$, then

A. L.H.D. at $x = 0$ exists but R.D.H. at $x = 0$ does not exist

B. f (x) is differentiable at x =0

C. R.H.D. at $x = 0$ exists but L.H.D. at $x = 0$ does not exists

D. None of these

Answer: C

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8. If P (x) is a polynomial of degree less than or equal to 2 and S is the set of all such polynomials so that $P(0) = 0, P(1) = 1,$ and $P'(x) > 0 \forall x \in [0.1],$ then

A. $S = \phi$

B. $S = ax + (1 - a)x^2 \forall a \in (0, 2)$

C. $S = ax + (1 - a)x^2 \, \forall a \in (0, \infty)$

D. $S = ax + (1 - a)x^2 \, \forall a \in (0, 1)$

Answer: B

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9. The value of c in Rolle's theorem for the function

$f(x) = \cos 2\left(x - \frac{\pi}{4}\right)$ in $\left[0, \frac{\pi}{2}\right]$ is

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

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

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

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

Answer: D

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10. Rolle's theorem is not applicable to the function $f(x) = |x|$ for $-2 \leq x \leq 2$ becaue

A. f is continuous for $-2 \leq x \leq 2$

B. f is continous for $-2 \leq x \leq 2$

C. $f(-2) = f(2)$

D. f is not a constnat function

Answer: D

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11. If $f(x) = x(x-1)(x-2), 0 \le x \le 4$ and the poind ξ satisfies mean values theorem for f (x), then

A. $< \xi < 1$

B. $\xi > 3$

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

D. $1 < \xi < 3$

Answer: B

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12. $f(x) = \begin{cases} \frac{\sin^3 x^2}{x}, x \ne 0 \text{ is} \\ 0, x = -0 \end{cases}$

A. continous but not derivable at x =0

B. neither continous nor differentiable at $x = 0$

C. continuous and differentiable at $x = 0$

D. None of these

Answer: C

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13. If $f'(2) = 1$, then $\lim_{h \to 0} \frac{f(2+h^2) - f(2-h^2)}{2h^2}$ is equal to

A. 0

B. 1

C. 2

D. $1/2$

Answer: B

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14. If $y^2 = P(x)$ is a polynomial of degree 3, then $2\left(\frac{d}{dx}\right)\left(y^2\frac{d\dot{^2}y}{dx^2}\right)$ is equal to $P^x + P'(x)$ (b) $P^x\dot{P}^x$ $P(x)\dot{P}^x$ (d) a constant

A. $p^m + p$'

B. p'p'

C. pp'

D. a constnat

Answer: C

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15. Find the value of c in Rolle's theorem for the function $f(x) = \cos 2x$ on $[0, \pi]$ is

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

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

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

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

Answer: B

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16. If $y = \log_5(\log_7 x)$, then find $\frac{dy}{dx}$

A. $\frac{1}{x\log 5.\log x}$

B. $\frac{-1}{x\log .5\log x}$

C. $\frac{1}{x\log x}$

D. $\frac{1}{x\log 7.\log x}$

Answer: A

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17. If $y=\frac{A}{x}-Bx^2$, then $x^2\frac{d^2y}{dx^2}=$

A. $2y$

B. y^2

C. y^3

D. y^4

Answer: A

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18. $f(x) = \sin^{-1}\left(\frac{1+x^2}{2x}\right)$ is

A. differentiable at $x = 1$

B. continous $\forall x \in R$

C. neither continuous nor differentiable at $x = 1$

D. continous but not differentiable at $x = 1$

Answer: C

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19. If for a continuous function $f, f(0) = f(1) = 0, f'(1) = 2 and y(x) = f(e^x)e^{f(x)}$, then $y'(0)$ is equal to a. 1 b. 2 c. 0 d. none of these

A. 0

B. 1

C. 2

D. None of these

Answer: A

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20. If $y = \tan^{-1}\sqrt{\dfrac{1-\sin x}{1+\sin x}}$, then the vluae of $\dfrac{dy}{dx}$ at $x = \dfrac{\pi}{2}$ is

A. $-1/2$

B. $1/2$

C. 1

D. -1

Answer: A

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21. If $y=\sqrt{f(x)+\sqrt{f(x)+\sqrt{f(x)+\ldots.(\infty)}}}$ then $\frac{dy}{dx}$ equals

A. $\frac{f(x)}{2y-1}$

B. $\frac{1}{f(x)(2y-1)}$

C. $\frac{f'(x)}{2y-1}$

D. None of these

Answer: C

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22. If a + b + c = 0 then the quadratic equation $3ax^2 + 2bx + c = 0$ has

A. at least one root in $[0, 1]$

B. one root in $[2, 3]$ and the other in $[-2, -1]$

C. imaginary roots

D. None of these

Answer: A

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23. Find the value of c in Lagrange's mean value theorem for the function $f(x) = \log_e x$ on [1,2].

A. $\log 2$

B. $1 - e$

C. $\log_2 e$

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

Answer: C

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24. If $\frac{x}{x^2 - 3x + 2}$, find $\frac{d^2y}{dx^2}$.

A. $\frac{2}{(x-1)^3} + \frac{2}{(x-2)^3}$

B. $\frac{1}{(x-1)^3}+\frac{1}{(x-1)^3}$

C. $\frac{2}{(x-1)^3}+\frac{2}{(x+2)^3}$

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

Answer: D

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25. If $f(5)=7 \text{ and } f'(5)=7, \text{ then } It_{x\to 5}\frac{xf(5)-5f(x)}{x-5}$ is given by

A. 35

B. -35

C. 28

D. -28

Answer: D

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26. If the function of $f(x) = \left[\frac{(x-5)^2}{A}\right]\sin(x-5) + a\cos(x-2)$, where$[\cdot]$ denotes the greatest integer function, is continuous and differentiable in (7, 9), then

A. $\forall \in [8, 64]$

B. $A \in (0, 8]$

C. $A \in [64, \infty)$

D. None of these

Answer: C

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27. If $xy = e - e^y$ then $\frac{d^2y}{dx^2} at x = 0$ is

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

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

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

D. None of these

Answer: C

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28. Let $f(x) = |\sin x|$ then $f(x)$ is

A. continous everwhere

B. non-differentiable at odd and even multiple of π

C. everywhere continuous but not-differentiable at $x = n\pi, n \in I$

D. All of these

Answer: D

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29. If $f(x) = x^a \log x$ and $f(0) = 0$ then the value of α for which Rolle's theorem can be applied in [0,1] is

A. -2

B. 1

C. 0

D. $1/2$

Answer: D

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30. $y = \log\left[\frac{x + \sqrt{x^2 + 25}}{\sqrt{x^2 + 25} - x}\right], find \frac{dy}{dx}$

A. $\frac{-2}{\sqrt{x^2 + 25}}$

B. $\frac{1}{\sqrt{x^2 + 25}}$

C. $\frac{2}{\sqrt{x^2 + 25}}$

D. $\frac{-1}{\sqrt{x^2 + 25}}$

Answer: C

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31. Let $f(x)=\tan^{-1}x$. Then, $f'(x)+f''(x)$ is $=0$, when x is equal to

A. 0

B. 1

C. I

D. $-i$

Answer: B

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32. If $x=e^t\sin t, y=e^t\cos t,$ then $\frac{d^2y}{dx^2}$ at $t=\pi$ is

A. $2e^{\pi}$

B. $\frac{1}{2}e^{\pi}$

C. $\frac{1}{2e^{\pi}}$

D. $\frac{2}{e^{\pi}}$

Answer: D

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33. Let $y = \left(\frac{3^x - 1}{3^x + 1}\right)\sin x + \log_e(1 + x), x \succ 1$ then at x=0 , $\frac{dy}{dx} =$

A. 1

B. 0

C. -1

D. -2

Answer: A

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34. Let $f(x) = x^2|x|$ then the set of values where is three times differentiable is.

A. Infinite

B. 2

C. 3

D. None of these

Answer: A

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35. Let $g(x) = \begin{cases} e^{2x}, & \forall x < 0 \\ e^{-2x}, & \forall x \geq 0 \end{cases}$. Then g (x|) does not satisfy the condition

A. continuous $\forall x \in R$

B. not differentiable at $x = 0$

C. continuous $\forall x \in R$ and non differentiable at $x = 0$

D. g (x) is continuous and differentiable everywhere

Answer: D

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36. If $\sqrt{x+y} - \sqrt{y-x} = c,$ then $\frac{d^2y}{dx^2}$ equals

A. $\frac{2}{c^2}$

B. $\frac{-2}{c^2}$

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

D. $\frac{-2}{c}$

Answer: A

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37. The second order derivative of $a\sin^3 t$ w.r.t, $a\cos^3 t$ at $t=\frac{\pi}{4}$ is

A. 2

B. $\frac{1}{12a}$

C. $\frac{4\sqrt{2}}{3a}$

D. $\frac{3a}{4\sqrt{2}}$

Answer: C

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38. If

$$\sqrt{y-\sqrt{y-\sqrt{y-......till\infty}}}=\sqrt{x+\sqrt{x+\sqrt{x+.......till\infty}}}$$

then $\frac{dy}{dx}=$

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

B. $\frac{y-x+1}{y-x-1}$

C. $\frac{y-x-1}{y-x+1}$

D. None of these

Answer: B

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39. If $f(x)=\frac{\sin 4\pi\left[\pi^2 x\right]}{7+[x]^2}$, $[.]$ denotes ghe greatest integer function, then f (x) is

A. continuous $Aax,$ but f '(x) does not exist.

B. discontinuous at some x.

C. f"(x) exist Aax

D. f"(x) exist but f"(x) does not exists for some values

Answer: C

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

A. $\frac{-2}{1+x^2}\ \forall|x|>1$

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

C. $\frac{-2}{1+x^2} \forall -\infty < x < \infty$

D. None of these

Answer: D

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41. If $f(x) = \ln_x$(ln x), then f'(e) =

A. 0

B. 1

C. e

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

Answer: D

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42. $y=[\log_x(\log_e x)](\log_e x)$ then $\frac{dy}{dx}$ equals

A. $\frac{1}{x\log_x\log_x x}$

B. $\frac{1}{x\log_e x}$

C. 0

D. None of these

Answer: B

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43. If $y^{y^{y^{\cdot^{\cdot^{\infty}}}}}=\log_e(x+\log_e(x+\ldots.))$, then $\frac{dy}{dx}at\left(x=e^2-2, y\sqrt{2}\right)$ is

A. $\dfrac{\log\left(\frac{e}{2}\right)}{2\sqrt{2}(e^2-1)}$

B. $\dfrac{\log 2}{2\sqrt{2}(e^2-1)}$

C. $\dfrac{\sqrt{2}\log\frac{e}{2}}{(e^2-1)}$

D. None of these

Answer: A

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44. Let $f(x)=\begin{cases} x, & x<1 \\ 2-x|, & 1<x\leq 2\text{then} f(x) is \\ -2+3x-x^2, & x>2 \end{cases}$

A. differentiable at $x=1$

B. differentiable at $x=2$

C. differentiable at $x=1$ and $x=2$

D. None of these

Answer: B

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45. For $-\frac{\pi}{2} < x < \frac{3\pi}{2}$, the vlaue of $\left\{\tan^{-1}\frac{\cos x}{1+\sin x}\right\}$ is equal to

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

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

C. 1

D. $\frac{\sin x}{(1+\sin x)^2}$

Answer: B

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46. If $y=\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$, then $y'(1)=$

A. $1/4$

B. $1/2$

C. $-1/4$

D. $-1/2$

Answer: A

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47. If $f(x)$ and $g(x)$ are twice differentiable functions on $(0, 3)$ satisfying,

$f''(x) = g''(x)$, $f'(1) = 4$, $g'(1) = 6$, $f(2) = 3$, $g(2) = 9$,

then $f(1) - g(1)$ is

A. 4

B. -4

C. 0

D. -2

Answer: B

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48. Let

$$f(x) = \begin{cases} -3, & -3 \le x < 0 \\ x^2 - 3, & 0 < x \le 3 \end{cases} \text{ and } g(x) = |f(x)| + f(|x|),$$

then which of the following is true ?

A. at $x = 0, g(x)$ is continuous as well as differentiable

B. $atx = \sqrt{3}, g(x)$ is continuous but not differentiable

C. $atx = 2, g(x)$ is neither continuous nor differentiable

D. None of these

Answer: A::B

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49. Which of the following functions is differentiable at x = 0?

A. $\cos|x| + |x|$

B. $\cos|x| - |x|$

C. $\sin|x| + |x|$

D. $\sin|x| - |x|$

Answer: A::B::C

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50. For the function $f(x) = \begin{cases} \frac{x}{1+e^{1/x}}, & x \neq 0 \\ 0\ , & x = 0 \end{cases}$, the derivative from the right, $f'(0^+)$= ... and the derivative from the left, $f'(0^-)$ = ...

A. $(f'(0^+) = 1$

B. $f'(0^+) = 0$

C. $f'(0^-) = 1$

D. $f'(0^-) = 0$

Answer: A::C

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51. Let $f(x)$ be twice differentiable functin such that $f''(x) > 0$ in $[0, 1]$. Then

A. $f(0) + f(1) = 2f(c), \; < c < 1$

B. $f(x) + f(1) = 2f\left(\frac{1}{2}\right)$

C. $f(0) + f(1) > 2f\left(\frac{1}{2}\right)$

D. $f(0) + f(1) < 2f\left(\frac{1}{2}\right)$

Answer: B::C

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52. Let $f(x) = \min\{x, x^2\}$, for every $x \in R$. Then

A. f (x) is continuous for all x

B. f (x) is diffentiable for all x

C. $f'(x) = 1$ for $x > 1$

D. f (x) is not differentiable at two values of x

Answer: B

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53. The function f (x) = 1+ $|\sin x|$ is

A. discontinuous

B. continuous everywhere

C. differentiable everywhere

D. not differentiable at infinite number of points

Answer: B

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54. The differentiation of $\sin^3 x + \cos^3 x$ with respect to $\sin x + \cos x$ is

A. $\sin x \cos x$

B. $-3 \sin x \cos x$

C. $-\sin x \cos x$

D. $3 \sin^2 x \cos^2 x$

Answer: B

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55. If x = $a \cos^3 \theta, y = a \sin^3 \theta then \sqrt{1 + \left(\frac{dy}{dx}\right)^2}$ =?

A. $\tan^2\theta$

B. $|\sec\theta|$

C. $\sec^2\theta$

D. None of these

Answer: B

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Wb Jee Previous Years Questions

1. Let $f(x) = \begin{cases} x^2 - 3x + 2, & x < 2 \\ x^3 - 6x^2 + 9x + 2, & x \geq 2 \end{cases}$

Then

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

B. f is continuous at $x = 2$

C. f is continuous but not differentiable at $x = 2$

D. f is continuous and differentiable at $x = 2$

Answer: C

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2. Let $f(x) = a \sin|x| + be^{|x|}$ is differentiable when

A. $3a + b = 0$

B. $3a - b = 0$

C. $a + b = 0$

D. $a - b = 0$

Answer: C

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3. Let R be the set of all real number and $f:[-1,1] \to R$ is difined by

$$f(x)=\begin{cases}x\sin\frac{1}{x}, & x\neq 0\\ 0, & x=0\end{cases}.$$ Then

A. f satisfgies the conditions of Rolle's theorem on $[-1,1]$

B. f satifsies the conditions of Lagrange's Mean Value Theorem on $[-1,1]$

C. f satisfies the conditions of Rolle's theorem on $[0,1]$

D. f satisfies the conditions of Lagrange's Mean Value Theorem on $[0,]$

Answer: D

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4. Suppose that $f(x)$ is a differentiable function such that $f'(x)$ is continuous, $f'(0) = 1$ and $f''(0)$ does not exist. Let $g(x) = xf'(x)$, Then

A. $g'(0)$ does not exist

B. $g'(0) = 0$

C. $g'(0) = 1$

D. $g'(0) = 2$

Answer: C

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5. For all real values of a_0, a_1, a_2, a_3 satisfying $a_0 + \frac{a_1}{2} + \frac{a_2}{3} + \frac{a_3}{4} = 0,$ the equation $a_0 + a_1x + a_2x^2 + a_3x^3 = 0$ has a real root in the interval

A. `[0,1]

B. $[-1, 0]$

C. $[1, 2]$

D. $[-2, -1]$

Answer: A

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6. If $y = (1+x)(1+x^2)(1+x^4)(1+x^{2n})$, then find $\frac{dy}{dx} at x = 0.$

A. 0

B. -1`

C. 1

D. 2

Answer: C

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7. If y=f(x) is an odd differentiable function defined on $(-\infty, \infty)$ such that $f'(3) = -2thenf'(-3)$ equals -

A. 0

B. 1

C. 2

D. 4

Answer: C

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8. If $f(x) = \tan^{-1}\left[\frac{\log\left(\frac{e}{x^2}\right)}{\log(ex^2)}\right] + \tan^{-1}\left[\frac{3+2\log x}{1-6\log x}\right]$

then the vlaue of $f''(x)$ is

A. x^2

B. x

C. 1

D. 0

Answer: D

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9. Consider the non-constant differentiable function f of one variable which obeys the relation $\frac{f(x)}{f(y)} = f(x-y). If f'(0) = p \text{ and } f'(5) = q,$ then $f'(-5)$ is

A. $\frac{p^2}{q}$

B. $\frac{q}{p}$

C. $\frac{p}{q}$

D. q

Answer: A

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10. if $f(x) = \log_5 \log_3 x$ then $f'(e)$ is equal to

A. $e \log_e 5$

B. $e \log_e 3$

C. $\dfrac{1}{e \log_e 5}$

D. $\dfrac{1}{e \log_e 3}$

Answer: C

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11. Let $F(x) = e^x, G(x) = e^{-x}$ and $H(x) = G(F(x))$, where x is a real variable. Then $\dfrac{dH}{dx} at x = 0$ is

A. 1

B. -1

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

D. $-e$

Answer: C

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12. IF $y = e^{m \sin^{-1} x}\Big)$ and $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - ky = 0,$ then k is equal to

A. m^2

B. 2

C. $c-1$

D. $-m^2$

Answer: A

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13. Let $f(x)=\begin{cases}\frac{x^p}{(\sin x)^q}, & 0<x\leq\frac{\pi}{2}\\ 0, & x=0\end{cases}, (p, q\in R)$. Then Lagrange's mean value theorem is applicable to f(x) in closed interval $[0, x]$,

A. for all p,q

B. only when $p>q$

C. only when $p<q$

D. for no alue of p,q

Answer: B

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14. For all twice differentiable functions $f : R \to R$, with $f(0) = f(1) = f'(0) = 0$

A. $f'(0) = 0$

B. f'(c) =0 for some $c \in R$

C. if $c \neq 0$, then $f'(c) \neq 0$

D. $f'(x) > 0$ for some $x \neq 0$

Answer: B

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15. Let $f_1(x) = e^x, f_2(x) = e^{f_1(x)}, \ldots\ldots, f_{n+1}(x) = e^{f_n(x)}$ for all $n \geq 1$. Then for any fixed n, $\frac{d}{dx} f_n(x)$ is

A. $f_n(x)$

B. $f_n(x) f_{n-1}(x)$

C. $f_n(x) f_{n-1}(x), \ldots.., f_1(x)$

D. $f_n(x) \ldots. F_1(x) e^x$

Answer: C

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16. Let $f:[a, b] \rightarrow R$be differentiable on $[a, b] \& k \in R$. Let $f(a)=0=f(b)$. Also let $J(x)=f'(x)+k f(x)$. Then

A. $J(x)>0$ for all $x \in [a, b]$

B. $J(x)>0$ for all $x \in [a, b]$

C. $J(x)=0$haa at least one root in (a,b)

D. $J(x)=0$ through (a,b)

Answer: C

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17. Let $f(x) > 0$ for all x and f'(x) exists for all x. If f is the inverse functin of h and $h'(x) = \frac{1}{1 + \log x}$. Then $f'(x)$ will be

A. $1 + \log(f(x))$

B. $1 + f(x)$

C. $1 - \log(f(x))$

D. $\log f(x)$

Answer: A

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18. Applying Largrange's mean value theorem for a suitable function $f(x)$ in $[0, h]$, we have

$f(h) = f(0) + hf'(\theta h), 0 < \theta < 1.$

Then for $f(x) = \cos x$, the vlaue of $\lim_{h \to 0^+} \theta$ is

A. 1

B. 0

C. $1/2$

D. $1/3$

Answer: B

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19. The number of points at which the function $f(x) = \max\{a - x, a + x, b\}, -\infty < x < \infty, 0 < a < b$ cannot be differentiable is :

A. 0

B. 1

C. 2

D. 3

Answer: B

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20. Let f be arry continuously differentiable function on $[a, b]$ and twice differentiable on $(a. b)$ such that

$f(a) = f(a) = 0$ and $f(b) = 0$. Then

A. $f''(a) = 0$

B. $f'(x) = 0$ for some $x \in (a, b)$

C. $f''(x) = 0$ for some $x \in (a, b)$

D. $f'''(x) = 0$ for some $x \in (a, b)$

Answer: B::C

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21. If $f(x) = x^n, n$ being a non-negative integer,then the values of n for which $f'(\alpha + \beta) = f'(\alpha) + f'(\beta) for all \alpha, \beta > 0$ is

A. 1

B. 2

C. 0

D. 5

Answer: B::C

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22. Let $f: [1, 3] \rightarrow R$ be a continuous function that is differentiable in $(1, 3)$ and $f'(x) = |f(x)|^2 + 4$ for all $x \in (1, 3)$. Then,

A. $f(3) - f(1) = 5$ is true

B. $f(3) - f(1) = 5$ is false

C. $f(3) - f(1) = 7$ is false

D. $f(3) - f(1) < 0$only at one point of $(1, 3)$

Answer: B::C

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