MATHS

BOOKS - NCERT MATHS (HINGLISH)

CONTINUITY AND DIFFERENTIABILITY

Continuity And Differentiability

1. Examine continuity of the function $f(x) = x^3 + 2x^2 - 1$ at $x = 1$.

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2. $f(x) = \begin{cases} 3x + 5 & \text{if } x \geq 2 \\ x^3 & \text{if } x \leq 2 \end{cases}$ at $x = 2$

A. $f(x)$ is discontinuous at $x = 2$.

B. $f(x)$ is continuous at $x = 2$.

C. Can not be determined

D. None of these

Answer: A

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3. $f(x) = \begin{cases} \frac{1-\cos 2x}{x^2} & \text{if } x \neq 0 \\ 5 & \text{if } x = 0 \end{cases}$ at $x = 0$.

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4. $f(x) = \begin{cases} \frac{2x^2-3x-2}{x-2} & \text{if } x \neq 2 \\ 5 & \text{if } x = 2 \end{cases}$ at $x = 2$.

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5. $f(x) = \begin{cases} \frac{|x-4|}{2(x-4)} & \text{if } x \neq 4 \\ 0 & \text{if } x = 4 \end{cases}$ at $x = 4$.

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6. $f(x) = \begin{cases} |x|\cos' \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ at $x = 0$.

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7. Find that the function is continuous or discontinuous at the indicated point $f(x) = \begin{cases} |x-a|\sin \frac{1}{x-a} & \text{if } x \neq a \\ 0 & \text{if } x = a \end{cases}$ at $x = a$

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8. $f(x) = \begin{cases} \frac{e^{1/x}}{1+e^{1/x}} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ atx = 0`

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9. $\begin{cases} \frac{x^2}{2} & \text{if } 0 \leq x \leq 1 \\ 2x^2 - 3x + \frac{3}{2} & \text{if } l < x \leq 2 \end{cases}$ at $x = 1$

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10. $f(x) = |x| + |x-1|$ at $x = 1$.

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11. $f(x) = \begin{cases} 3x-8 & \text{if } x \leq 5 \\ 2k & \text{if } x > 5 \end{cases}$ at $x = 5$

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12. $f(x) = \begin{cases} \frac{2^{x+2}-16}{4^x-16} & \text{if } x \neq 2 \\ k & \text{if } x = 2 \end{cases}$,$x = 2$.

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13. $f(x) = \begin{cases} \frac{\sqrt{1+kx}-\sqrt{1-kx}}{x} & \text{if } -1 \leq x < 0 \\ \frac{2x+1}{x-1} & \text{if } 0 \leq x \leq 1 \end{cases}$ at $x = 0$. f(x) is continuous then find k

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14. The value of k for which the function defined as

$$f(x) = \begin{cases} \frac{1-\cos kx}{x \sin x} & \text{if } x \neq 0 \\ \frac{1}{2} & \text{if } x = 0 \end{cases}$$ continuous at $x = 0$

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15. Prove that the function f defined by $f(x) = \begin{cases} \frac{x}{|x|+2x^2} & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases}$

remains discontinuous at $x = 0$, regardings the choice iof k.

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16. Find the values of a and b sucht that the function f defined by

$$fx = \begin{cases} \frac{x-4}{|x-4|} + a & \text{if } x < 4 \\ a + b & \text{if } x = 4 \\ \frac{x-4}{|x-4|} + b & \text{if } x > 4 \end{cases}$$

is a continous function at $x = 4$.

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17. Given the function $f(x) = \frac{1}{x+2}$. Find the points of discontinuity of the function $f(f(x))$

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18. Find all point of discontinuity of the function $f(t) = \frac{1}{t^2+t-2}$, where $t = \frac{1}{x-1}$

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19. Show that the function $f(x) = |\sin x + \cos x|$ is continuous at $x = \pi$

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20. Examine the differentiability of f, where f is defined by $f(x) = \begin{cases} x[x] & \text{if } 0 \leq x < 2 \\ (x-1)x & \text{if } 2 \leq x < 3 \end{cases}$ at $x = 2$

A. Not differentiable at $x = 2$

B. Differentiable at $x = 2$

C. None of these

D. Can not say

Answer: A

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21. If $f(x) = x^2 \sin' \frac{1}{x}$, where $x \neq 0$, then the value of the function f at $x = 0$, so that the function is continuous at $x = 0$ is

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22. Examine the differentiability of f, where f is defined by $f(x) = \begin{cases} 1+x & \text{if } x \leq 2 \\ 5-x & \text{if } x > 2 \end{cases}$ at $x = 2$.

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23. Show that $f(x) = |x-3|$ is continuous but not differentiable at $x = 3$.

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

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25. Differentiate $2^{\cos^2 x}$

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26. Differentiate $\frac{8^x}{x^8}$

A. $\frac{8^x}{x^8}\left(\log 4 - \frac{8}{x}\right)$

B. $\frac{8^x}{x^8}\left(\log 8 - \frac{8}{x}\right)$

C. $\frac{8}{x^8}\left(\log 8 - \frac{8}{x}\right)$

D. $\frac{8^x}{x^8}\left(\log 8 + \frac{8}{x}\right)$

Answer: B

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27. Differentiate $\log\left(x + \sqrt{a^2 + x^2}\right)$ with respect to x :

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28. Differentiate $\log\left[\log\left(\log x^5\right)\right]$

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29. Differentiate $\sin\sqrt{x} + \cos^2\sqrt{x}$

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30. Differentiate $\sin^n\left(ax^2 + bx + c\right)$

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31. Differentiate $\cos\left(\tan\sqrt{x+1}\right)$

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32. Differentiate $\sin x^2 + \sin^2 x + \sin^2\left(x^2\right)$

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33. Differentiate $\sin^{-1}\frac{1}{\sqrt{x+1}}$

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34. $(\sin x)^{\cos x}$

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35. Differentiate $\sin^m x \cdot \cos^n x$

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36. Differentiate $(x+1)^2(x+2)^3(x+3)^4$

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37. Simplify: `cos^(-1)((sinx+cosx)/(sqrt(2))),\ \ pi/4

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38. Differentiate `tan^(-1){sqrt((1-cosx)/(1+cosx))},\ -pi

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39. Differentiate $\tan^{-1}(\sec x + \tan x)$, `-pi/2

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40. Differentiate the following functions with respect to x : $\tan^{-1}\left(\frac{a+x}{1-ax}\right)$ (ii) `tan^(-1)((acosx-bsinx)/(bcosx+asinx)),\ -pi/2-1`

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41. Differentiate $\cos^{-1}\left(4x^3 - 3x\right)$ with respect to x , if $x \in \left(\frac{1}{2}, 1\right)$

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42. Differentiate `tan^(-1)((3a^2x-x^3)/(a^3-3a x^2)),\ -1/(sqrt(3))

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43. $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right), where$ `-1

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44. If $x = a\left(t+\frac{1}{t}\right)$ and $y = a\left(t-\frac{1}{t}\right)$, prove that $\frac{dy}{dx} = \frac{x}{y}$

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45. Find $\frac{dy}{dx}$, when $x = e^{\theta}\left(\theta+\frac{1}{\theta}\right)$ and $y = e^{-\theta}\left(\theta-\frac{1}{\theta}\right)$

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46. If $x = 3\cos\theta - \cos^3\theta\ y = 3\sin\theta - \sin^3\theta$ find $\frac{dy}{dx}$

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

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48. If $x = \frac{1+\log t}{t^2}$, $y = \frac{3+2\log t}{t}$, find $\frac{dy}{dx}$.

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49. If $x = e^{\cos 2t}$ and $y = e^{\sin 2t}$, prove that $\frac{dy}{dx} = -\frac{y\log x}{x\log y}$

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50. If $x = a\sin 2t(1+\cos 2t)$ and $y = b\cos 2t(1-\cos 2t)$, show that at $t = \frac{\pi}{4}, \frac{dy}{dx} = \frac{b}{a}$.

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51. If $x = 3\sin t - \sin 3t$, $y = 3\cos t - \cos 3t$, find $\frac{dy}{dx}$ at $t = \frac{\pi}{3}$.

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52. Differentiate $\frac{x}{\sin x}$ w.r.t . $\sin x$.

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53. Differentiate $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right) wr\dot{a}n^{-1}x, where x \neq 0.$

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54. If $\sin(xy) + \frac{y}{x} = x^2 - y^2$, find $\frac{dy}{dx}$.

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55. Find $\frac{dy}{dx}$ if $\sec(x + y) = xy$

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56. Find $\frac{dy}{dx}$ if, $\tan^{-1}\left(x^2 + y^2\right) = a$

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57. If $\left(x^2 + y^2\right)^2 = xy$, find $\frac{dy}{dx}$

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58. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, find $\frac{dy}{dx}$ and $\frac{dx}{dy}$. Also, show that $\frac{dy}{dx}\frac{dx}{dy} = 1$.

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59. If $x = e^{x/y}$, prove that $\frac{dy}{dx} = \frac{x - y}{x \log x}$

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

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61. If

$y = (\cos x)^{\cos x} \hat{} (\cos x) \wedge ((((\infty)))), prove that \frac{dy}{dx} = -\frac{y^2 \tan x}{(1 - y \log \cos x)}$

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62. If $\sin(a+y)+\sin a.\cos(a+y)=0$. Prove that : $\frac{dy}{dx}=\left(\frac{\sin^2(a+y)}{\sin a}\right)$

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

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64. If $y=\tan^{-1}x$, find $\frac{d^2y}{dx^2}$ in terms of y alone.

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65. Verify Rolles theorem for function $f(x)=x(x-1)^2$ on $[0,\ 1]$

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66. Verify Rolles theorem for function $f(x) = s \in^4 x + \cos^4 x$ on $\left[0, \frac{\pi}{2}\right]$

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67. Verify Rolles theorem for function $f(x) = \log\left(x^2 + 2\right) - \log 3$ on $[-1, 1]$

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68. Verify Rolles theorem for the function: $f(x) = x(x+3)e^{-x/2}$ on $[-3, 0]$.

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69. Verify Rolles theorem for the function $f(x) = \sqrt{4 - x^2}$ on $[-2, 2]$.

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70. Discuss the applicability of Rolles theorem on the function `f(x)= {x^2+1,\ \ \ \ w h e n\ 0lt=xlt=1 3-x ,\ \ \ \ w h e n\ 1

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71. Using Rolle's theorem find the point in $(0, 2\pi)$ on the curve $y = \cos x - 1$, where tangent is parallel to x axis.

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72. Using Rolle's theroem, find the point on the curve $y = x(x - 4), x \in [0, 4]$, where the tangent is parallel to X-axis.

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73. Verify mean value theorem for the function $f(x) = \frac{1}{4x - 1}$ in $[1, 4]$

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74. Verify mean value theorem for the function $f(x) = x^3 - 2x^2 - x + 3$ in $[0, 1]$

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75. Verify Rolles theorem for function $f(x) = \sin x - \sin 2x$ on $[0, \pi]$

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76. Verify mean value theorem for the function $f(x) = \sqrt{25 - x^2}$ in $[1, 5]$

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77. Find the point on the parabola $y = (x - 3)^2$, where the tangent is parabola to the line joining (3,0) and (4,1

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78. Using mean value theorem, prove that there is a point on the curve $y = 2x^2 - 5x + 3$ between the points $A(1, 0)$ and $B(2, 1)$, where tangent is parallel to the chord AB. Also, find that point.

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79. Find the values of $aandb$ so that the function $f(x) = \{x^2 + 3x + a, \quad \text{if} \quad x \leq 1bx + 2, \quad \text{if} \quad x > 1$ is differentiable at each $x \in R$.

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

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81. If $x = \sin t, y = \sin pt$, prove that

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

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82. If $y = x^{\tan x} + \sqrt{\frac{x^2+1}{2}}$, find $\frac{dy}{dx}$

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83. If $f(x) = 2x$ and $g(x) = \frac{x^2}{2} + 1$, then which of the following can be a discontinuous functions?

A. $f(x) + g(x)$

B. $f(x) - g(x)$

C. $f(x).\, g(x)$

D. $\frac{g(x)}{f(x)}$

Answer: D

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84. The function $f(x) = \frac{4 - x^2}{4x - x^3}$ is

A. discontinuous at only one point

B. discontinuous at exactly two points

C. discontinuous at exactly three points

D. None of the above

Answer: C

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85. The set of points where the function f given by $f(x) = |2x - 1|$ sinx is differentiable is

A. R

B. $R - \left\{\frac{1}{2}\right\}$

C. $(0, \infty)$

D. None of these

Answer: B

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86. The function $f(x) = \cot x$ is discontinuous on set

A. $\{x = n\pi : n \in Z\}$

B. $\{x = 2n\pi : n \in Z\}$

C. $\left\{x = (2n+1)\frac{\pi}{2}, n \in Z\right\}$

D. $\left\{x = \frac{n\pi}{2}, n \in Z\right\}$

Answer: A

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87. The function $f(x) = e^{|x|}$ is

A. continuous everywhere but not differentiable at $x = 0$

B. continuous and differentiable everywhere

C. not continuous at $x = 0$

D. None of the above

Answer: A

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88. if $f(x) = x^2 \sin\left(\frac{1}{x}\right), x \neq 0$ then the value of the function f at $x = 0$ so that the function is continuous at $x = 0$

A. 0

B. -1

C. 1

D. None of the above

Answer: A

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89. If $f(x) = \begin{cases} mx + 1 & \text{if } x \leq \frac{\pi}{2} \\ \sin x + n & \text{if } x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, then

A. $m = 1, n = 0$

B. $m = \frac{n\pi}{2} + 1$

C. $n = \frac{m\pi}{2}$

D. $m = n = \frac{\pi}{2}$

Answer: C

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90. If $f(x) = |\sin x|$, then

A. f is everywhere differentiable

B. f is everywhere continuous but not differentiable at $x = n\pi, n \in Z$

C. f is everywhere continuous but not differentiable at $x = (2n+1)\frac{\pi}{2}, n \in Z$

D. None of the above

Answer: B

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

A. $\frac{4x^3}{1-x^4}$

B. $\frac{-4x}{1-x^4}$

C. $\frac{1}{4-x^4}$

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

Answer: B

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92. If $y = \sqrt{\sin x + y}$, then $\frac{dy}{dx}$ is equal to

A. $\frac{\cos x}{2y - 1}$

B. $\frac{\cos x}{1 - 2y}$

C. $\frac{\sin x}{1 - 2y}$

D. $\frac{\sin x}{2y - 1}$

Answer: A

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93. The derivative of $\cos^{-1}\left(2x^2 - 1\right)$ w.r.t. $\cos^{-1} x$ is

A. 2

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

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

D. $1 - x^2$

Answer: A

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94. If $x = t^2$ and $y = t^3$, then $\frac{d^2y}{dx^2}$ is equal to

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

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

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

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

Answer: B

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95. The value of c in Rolle's theorem for the function $f(x) = x^3 - 3x$ in the interval $[0, \sqrt{3}]$ is

A. 1

B. -1

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

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

Answer: A

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96. For the function $f(x) = x + \frac{1}{x}, x \in [1, 3]$, the value of c for mean value therorem is

A. 1

B. $\sqrt{3}$

C. 2

D. None of these

Answer: B

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97. An example of a function which is continuous every where but fails to be differentiable exactly at two point is â€¦â€¦.

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98. Derivative of x^2 w.r.t. x^3 is

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

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100. For the curve $\sqrt{x}+\sqrt{y}=1$, $\frac{dy}{dx}$ at $(1/4,\ 1/4)$ is $1/2$ (b) 1 (c) -1 (d) 2

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101. Rolle's theorem is applicable for the function $f(x)=|x-1|$ in $[0,2]$.

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102. If f is continuous on its domain D; then $|f|$ is also continuous on D

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103. If f is continuous on its domain D; then $|f|$ is also continuous on D

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104. The composition of two continuous function is a continuous function.

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105. Trigonometric and inverse trigonometric functions are differentiable in their respective domain.

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106. If $f.\ g$ is continuous at $x = 0$, then f and g are separately continuous at $x = 0$.

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107. Examine contnuity of the function $f(x) = x^3 + 2x^2 - 1$ at $x = 1$.

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108. $f(x) = \begin{cases} 3x+5 & \text{if } x \geq 2 \\ x^3 & \text{if } x \leq 2 \end{cases}$ at $x = 2$

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109. $f(x) = \begin{cases} \frac{1-\cos 2x}{x^2} & \text{if } x \neq 0 \\ 5 & \text{if } x = 0 \end{cases}$ at $x = 0.$

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110. $f(x) = \begin{cases} \frac{2x^2-3x-2}{x-2} & \text{if } x \neq 2 \\ 5 & \text{if } x = 2 \end{cases}$ at $x = 2.$

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111. $f(x) = \begin{cases} \frac{|x-4|}{2(x-4)} & \text{if } x \neq 4 \\ 0 & \text{if } x = 4 \end{cases}$ at $x = 4.$

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112. $f(x) = \begin{cases} |x|\cos\frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ at $x = 0$.

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113. $f(x) = \begin{cases} |x|\sin\frac{1}{x-a} & \text{if } x \neq 0 \\ 0 & \text{if } x = a \end{cases}$ at $x = a$

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114. $f(x) = \begin{cases} \frac{e^{1/x}}{1+e^{1/x}} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ at $x = 0$

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115. $\begin{cases} \frac{x^2}{2} & \text{if } 0 \leq x \leq 1 \\ 2x^2 - 3x + \frac{3}{2} & \text{if } l < x \leq 2 \end{cases}$ at $x = 1$

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116. $f(x) = |x| + |x-1|$ at $x = 1$.

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117. $f(x) = \begin{cases} 3x - 8 & \text{if } x \leq 5 \\ 2k & \text{if } x > 5 \end{cases}$ at $x = 5$

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118. If

$f(x) = \left\{ \frac{2^{x+2} - 16}{4^x - 16}, \quad \text{if } x \neq 2k, \quad \text{if } x = 2iscont \in uousatx = 2, f \in \right.$

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119. $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x} & \text{if } -1 \leq x < 0 \\ \frac{2x+1}{x-1} & \text{if } 0 \leq x \leq 1 \end{cases}$ at $x = 0$.

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120. $f(x) = \begin{cases} \frac{1-\cos kx}{x \sin x} & \text{if} \quad x \neq 0 \\ \frac{1}{2} & \text{if} \quad x = 0 \end{cases}$ at $x = 0$

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121. Prove that the function f defined by $f(x) = \begin{cases} \frac{x}{|x| + 2x^2} & \text{if} \quad x \neq 0 \\ k & \text{if} \quad x = 0 \end{cases}$

remains discontinuous at $x = 0$, regardings the choice iof k.

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122. Find the values of a and b sucht that the function f defined by

$$fx = \begin{cases} \frac{x-4}{|x-4|} + a & \text{if} \quad x < 4 \\ a + b & \text{if} \quad x = 4 \\ \frac{x-4}{|x-4|} + b & \text{if} \quad x > 4 \end{cases}$$

is a continous function at $x = 4$.

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123. If the function $f(x) = \frac{1}{x+2}$, then find the points of discountinuity of the composite function $y = f\{f(x)\}$.

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124. Find all point of discountinuity of the function $f(t) = \frac{1}{t^2+t-2}$, where $t = \frac{1}{x-1}$.

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125. Show that the function $f(x) = |\sin x + \cos x|$ is continuous at $x = \pi$.

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126. Examine the differentiability of f, where f is defined by

$$f(x) = \begin{cases} x[x] & \text{if } 0 \leq x < 2 \\ (x-1)x & \text{if } 2 \leq x < 3 \end{cases} \text{ at } x = 2$$

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127. $f(x) = \begin{cases} x^2 \sin' \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ at $x = 0$.

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128. $f(x) = \begin{cases} 1 + x & \text{if } x \leq 2 \\ 5 - x & \text{if } x > 2 \end{cases}$ at $x = 2$.

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129. Show that $f(x) = |x - 5|$ is continuous but not differentiable at $x = 5$.

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130. A function $f: R \to R$ satisfies the equation $f(x + y) = f(x).\, f(y)$ for all $xy \in R$, $f(x) \neq 0$. Suppose that the function is differentiable at

$x = 0$ and $f'(0) = 2$, then prove that $f' = 2f(x)$.

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131. $2^{\cos^2 x}$

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132. $\frac{8^x}{x^8}$

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133. $\log\left(x + \sqrt{x^2 + a}\right)$

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134. $\log\left[\log\left(\log x^5\right)\right]$

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135. $\sin\sqrt{x} + \cos^2\sqrt{x}$

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136. $\sin^n\left(ax^2 + bx + c\right)$

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137. $\cos\left(\tan\sqrt{x+1}\right)$

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138. $\sin x^2 + \sin^2 x + \sin^2\left(x^2\right)$

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139. $\sin^{-1}, \frac{1}{\sqrt{x+1}}$

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140. $(\sin x)^{\cos x}$

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141. $\sin^m x . \cos^n x$

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142. $(x+1)^2(x+2)^3(x+3)^4$

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143. $\cos^{-1}\left(\frac{\sin x + \cos x}{\sqrt{2}}\right), -\frac{\pi}{4} < x < \frac{\pi}{4}$

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144. Differentiate $\tan^{-1}\left\{\sqrt{\frac{1-\cos x}{1+\cos x}}\right\}, \quad -\pi < x < \pi$ with respect to x :

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145. $\tan^{-1}(\sec x + \tan x), \frac{-\pi}{2} < x < \frac{\pi}{2}$

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146. Differentiate the following functions with respect to x : $\tan^{-1}\left(\frac{a+x}{1-ax}\right)$ (ii) `tan^(-1)((acosx-bsinx)/(bcosx+asinx)),\ -pi/2-1`

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147. If `y=sec^(-1)(1/(2x^2-1));0

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148. Differentiate `tan^(-1)((3a^2x-x^3)/(a^3-3a x^2)),\ -1/(sqrt(3))

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149. $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right), where$ `-1

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150. $x = t + \frac{1}{t}, y = t - \frac{1}{t}$

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151. $x = e^{\theta}\left(\theta + \frac{1}{\theta}\right), y = e^{-\theta}\left(\theta - \frac{1}{\theta}\right)$

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152. $x = 3\cos\theta - 2\cos^3\theta, y = 3\sin\theta - 2\sin^3\theta$

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153. $\sin x = \frac{2t}{1+t^2}, \tan y = \frac{2t}{1-t^2}$

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154. $x = \frac{1+\log t}{t^2}, y = \frac{3+2\log t}{t}$

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155. If $x = e^{\cos 2t}$ and $y = e^{\sin 2t}$, then move that $\frac{dy}{dx} = -\frac{y\log x}{x\log y}$.

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156. If $x = a\sin 2t(1+\cos 2t)$ and $y = b\cos 2t(1-\cos 2t)$, then show that $\left(\frac{dy}{dx}\right)_{t=\pi/4} = \frac{b}{a}$.

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157. If $x = 3\sin t - \sin 3t$, $y = 3\cos t - \cos 3t$, find $\frac{dy}{dx}$ at $t = \frac{\pi}{3}$.

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158. Differentiate $\frac{x}{\sin x}$ w.r.t . sinx.

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159. Differentiate $\tan^{-1}, \frac{\sqrt{1+x^2}-1}{x}$ w.r.t. $\tan^{-1} x$, when $x \neq 0$.

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160. $\sin(xy) + \frac{x}{y} = x^2 - y$

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161. $\sec(x + y) = xy$

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162. $\tan^{-1}\left(x^2 + y^2\right) = a$

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163. $\left(x^2 + y^2\right)^2 = xy$

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164. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, then show that $\frac{dy}{dx} \cdot \frac{dx}{dy} = 1$.

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165. If $x = e^{x/y}$, then prove that $\frac{dy}{dx} = \frac{x - y}{x \log x}$.

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

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167. If $y = (\cos x)^{(\cos x)^{(\cos x)^{\cdots\cdots\infty}}}$, then show that $\frac{dy}{dx} = \frac{y^2 \tan x}{y \log \cos x - 1}$

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168. If $x \sin(a+y) + \sin a . \cos(a+y) = 0$, then prove that

$$\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$$

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169. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$, then prove that

$$\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$$

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170. If $y = \tan^{-1} x$, then find $\frac{d^2y}{dx^2}$ in term of y alone.

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171. $f(x) = x(x-1)^2$ in $[0, 1]$

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172. $f(x) = \sin^4 x + \cos^4 x$ in $\left[0, \frac{\pi}{2}\right]$

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173. $f(x) = \log\left(x^2 + 2\right) - \log 3$in $[-1, 1]$

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174. verify Rolle's theorem for the function $f(x) = x(x+3)e^{-\frac{x}{2}}$ in $[-3, 0]$

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175. Verify Rolles theorem for the function $f(x) = \sqrt{4 - x^2}$ on $[-2,\ 2]$.

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176. Discuss the applicability of Rolle's theorem on the function given by

$$f(x) = \begin{cases} x^2 + 1 & \text{if } 0 \leq x \leq 1 \\ 3 - x & \text{if } 1 \leq x \leq 2 \end{cases}$$

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177. Find the points on the curve $y = (\cos x - 1)$ in $[0, 2\pi]$, where the tangent is parallel to $X -$ axis.

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178. Using Rolle's theroem, find the point on the curve $y = x(x - 4), x \in [0, 4]$, where the tangent is parallel to X-axis.

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179. $f(x) = \dfrac{1}{4x - 1}$ in $[1, 4]$

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180. $f(x) = x^3 - 2x^2 - x + 3$ in $[0, 1]$

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181. Values of c of Rolle's theorem for $f(x) = \sin x - \sin 2x$ on $[0, \pi]$

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182. $f(x) = \sqrt{25 - x^2}$ in $[1, 5]$

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183. Find the point on the parabola $y = (x - 3)^2$, where the tangent is parabola to the line joining (3,0) and (4,1

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184. Using mean value theorem, prove that there is a point on the curve $y = 2x^2 - 5x + 3$ between the points $A(1, 0)$ and $B, (2, 1)$, where tangent is parallel to the chord AB. Also, find that point.

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185. Find the values of p and q , so that $f(x) = \begin{cases} x^2 + 3x + p & \text{if } x \leq 1 \\ qx + 2 & \text{if } x > 1 \end{cases}$ is differentiable at $x = 1$

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186. If $x^m y^n = (x + y)^{m+n}$, Prove that $\frac{dy}{dx} = \frac{y}{x}$.

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187. If $x = \sin t$ and $y = \sin pt$, prove that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2 y = 0.$

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188. Find the values of $\frac{dy}{dx}$, if $y = x^{\tan x} + \sqrt{\frac{x^2+1}{2}}$.

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189. If $f(x) = 2x$ and $g(x) = \frac{x^2}{2} + 1$, then which of the following can be a discontinuous functions?

A. $f(x) + g(x)$

B. $f(x) - g(x)$

C. $f(x).\, g(x)$

D. $\frac{g(x)}{f(x)}$

Answer: D

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190. The function $f(x) = \frac{4 - x^2}{4x - x^3}$ is

A. discontinuous at only one point

B. discontinuous at exactly two points

C. discontinuous at exactly three points

D. None of the above

Answer: C

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191. The set of points where the function f given by $f(x) - |2x - 1|$ sinx is differentiable is

A. R

B. $R - \left(\frac{1}{2}\right)$

C. $(0, \infty)$

D. None of these

Answer: B

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192. The function $f(x) = \cot x$ is discontinuous on set

A. $\{x = n\pi : n \in Z\}$

B. $\{x = 2n\pi : n \in Z\}$

C. $\left\{x = (2n+1)\frac{\pi}{2}, n \in Z\right\}$

D. $\left\{x = \frac{n\pi}{2}, n \in Z\right\}$

Answer: A

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193. The function $f(x) = e^{|x|}$ is

A. continuous everywhere but not differentiable at $x = 0$

B. continuous and differentiable everywhere

C. not continuous at $x = 0$

D. None of the above

Answer: A

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194. If $f(x) = x^2 \sin' \frac{1}{x}$, where $x \neq 0$, then the value of the function f at $x = 0$, so that the function is continuous at $x = 0$ is

A. 0

B. -1

C. 1

D. None of the above

Answer: A

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195. If $f(x) = \begin{bmatrix} mx+1 & \text{if} & x \leq \frac{\pi}{2} \\ \sin x + n & \text{if} & x > \frac{\pi}{2} \end{bmatrix}$ is continuous at $x = \frac{\pi}{2}$, then

A. $m = 1, n = 0$

B. $m = \frac{n\pi}{2} + 1$

C. $n = \frac{m\pi}{2}$

D. $m = n = \frac{\pi}{2}$

Answer: C

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196. If $f(x) = |\sin x|$, then

A. f is everywhere differentiable

B. f is everywhere continuous but not differentiable at $x = n\pi, n \in Z$

C. f is ever ywhere continuous but not differentiable at

$$x = (2n+1)'\frac{\pi}{2}, n \in Z$$

D. None of the above

Answer: B

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

A. $\frac{4x^3}{1-x^4}$

B. $\frac{-4x}{1-x^4}$

C. $\frac{1}{4-x^4}$

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

Answer: B

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198. If $y = \sqrt{\sin x + y}$, then $\frac{dy}{dx}$ is equal to

A. $\frac{\cos x}{2y - 1}$

B. $\frac{\cos x}{1 - 2y}$

C. $\frac{\sin x}{1 - 2y}$

D. $\frac{\sin x}{2y - 1}$

Answer: A

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199. The derivative of $\cos^{-1}\left(2x^2 - 1\right)$ w.r.t. $\cos^{-1}$ is

A. 2

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

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

D. $1 - x^2$

Answer: A

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200. If $x = t^2$ and $y = t^3$, then $\frac{d^2y}{dx^2}$ is equal to

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

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

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

D. $\frac{3}{5t}$

Answer: B

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201. The value of c in Rolle's theorem for the function $f(x) = x^3 - 3x$ in the interval $[0, \sqrt{3}]$ is

A. 1

B. -1

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

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

Answer: A

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202. For the function $f(x) = x + \frac{1}{x}, x \in [1, 3]$, the value of c for mean value therorem is

A. 1

B. $\sqrt{3}$

C. 2

D. None of these

Answer: B

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203. An example of a function which is continuous every where but fails to be differentiable exactly at two point is â€¦â€¦.

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204. Derivative of x^2 w.r.t. x^3 is .....

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

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206. For the curve $\sqrt{x} + \sqrt{y} = 1$, $\frac{dy}{dx}$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$ is .....

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207. Rolle's theorem is applicable for the function $f(x) = |x - 1|$ in $[0, 2]$

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208. If f is continuous on its domain D; then $|f|$ is also continuous on D

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209. If f is continuous on its domain D; then $|f|$ is also continuous on D

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210. The composition of two continuous function is a continuous function.

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211. Trigonometric and inverse trigonometric functions are differentiable in their respective domain.

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212. If $f.\ g$ is continuous at $x = 0$, then f and g are separately continuous at $x = 0$.

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