Multiple Choice Questions

[MHT-CET 2022] (ONLINE SHIFT)

1. If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx} = ...$

a) e^{x-y} b) e^{y-x} c) $-e^{y-x}$ d) $-e^{x-y}$

2 If $y = \sin^{-1}\left(\frac{5x + 12\sqrt{1-x^2}}{13}\right)$, then $\frac{dy}{dx} = ...$

a) $\frac{x}{\sqrt{1-x^2}}$ b) $\frac{2}{\sqrt{1-x^2}}$ c) $\frac{-1}{\sqrt{1-x^2}}$ d) $\frac{-x}{\sqrt{1-x^2}}$

3. If $y = \sec^{-1}\left(\frac{x + x^{-1}}{x - x^{-1}}\right)$, then $\frac{dy}{dx} = ...$

a) $\frac{-2}{1+x^2}$ b) $\frac{-1}{1+x^2}$ c) $\frac{2}{1-x^2}$ d) $\frac{1}{1+x^2}$

4. If $xy = \tan^{-1}(xy) + \cot^{-1}(xy)$, then $\left(\frac{dy}{dx}\right)_{(4,2)} = ...$

where $x, y \in R$

a) -2 b) $\frac{1}{2}$ c) $-\frac{1}{2}$ d) 2

5. If $x = \sqrt{a^{\sin^{-1} t}}$ and $y = \sqrt{a^{\cos^{-1} t}}$, then $\frac{dy}{dx} = ...$

a) $\frac{y}{x}$ b) $-\frac{x}{y}$ c) $\frac{x}{y}$ d) $-\frac{y}{x}$

6. $\frac{d}{dx}\left(\sqrt{\frac{1-\tan x}{1+\tan x}}\right) = ...$

a) $\frac{-\sec^2 x}{(1+\tan x)^{3/2}(1-\tan x)^{1/2}}$ b) $\frac{-\sec^2 x}{(1-\tan^2 x)^{1/2}}$

c) $\frac{\sec^2 x}{(1+\tan x)^{3/2}(1-\tan x)^{1/2}}$ d) $\frac{\sec^2 x}{(1-\tan^2 x)^{1/2}}$

7. If $y = e^{4x} + 2e^{-x}$ satisfies the equation $\frac{d^2y}{dx^2} + A\frac{dy}{dx} + By = 0$, then values of A and B are respectively

a) $-3, -4$ b) $4, 3$ c) $3, 4$ d) $-4, -3$

16. If $x^y \cdot y^x = 16$, then $\frac{dy}{dx}$ (2, 2) is

a) -1 b) 0 c) 1 d) 2

17. If $f(x) = \operatorname{cosec}^{-1}\left[\frac{10}{6\sin(2^x) - 8\cos(2^x)}\right]$, then $f'(x) = \ldots\ldots$

a) $2^x \log 2$ b) -1 c) $\log 2$ d) 2^x

18. If $y = x\tan y$, then $\frac{dy}{dx} = \ldots\ldots$

a) $\frac{\tan x}{x - y^2}$ b) $\frac{y}{x - x^2 - y^2}$ c) $\frac{\tan x}{x - x^2 - y^2}$ d) $\frac{\tan y}{y - x}$

19. If $y = \log_{10} x + \log_x 10 + \log_x x + \log_{10} 10$, then $\frac{dy}{dx} = \ldots\ldots$

a) $\frac{1}{x\log_e 10} + \frac{1}{x\log_{10} e}$ b) $\frac{1}{x\log_e 10} + \frac{\log_e 10}{x(\log_{10} e)^2}$

c) $\frac{1}{x\log_e 10} - \frac{1}{x\log_{10} e}$ d) $\frac{1}{x\log_e 10} - \frac{\log_e 10}{x(\log(x)^2}$

20. If $\sin^2 x + \cos^2 y = 1$, then $\frac{dy}{dx} = \ldots\ldots$

a) $\frac{\sin^2 x}{\sin^2 y}$ b) $\frac{\sin^2 y}{\sin 2x}$ c) $\frac{\sin 2x}{\sin 2y}$ d) $\frac{-\sin^2 y}{\sin^2 x}$

[MHT-CET 2020] (ONLINE SHIFT)

21. If $x = \log t$ and $y + 1 = \frac{1}{t}$, then $e^{-x}\frac{d^2x}{dy^2} + \frac{dx}{dy} = \ldots\ldots$

a) -4 b) -1 c) 0 d) 2

22. If $\tan u = \sqrt{\frac{1-x}{1+x}}$, $\cos v = 4x^3 - 3x$, then $\frac{du}{dv} = \ldots\ldots$

a) 2 b) $\frac{1}{6}$ c) 1 d) $\frac{1}{2}$

23. If $y = \left(\frac{x^2}{x+1}\right)^x$ and $\frac{dy}{dx} = y\left[g(x) + \log\left(\frac{x^2}{x+1}\right)\right]$, then $g(x) = \ldots\ldots$

a) $\frac{x^2}{x+1}$ b) $\frac{x-1}{x+2}$ c) $\frac{x+2}{x+1}$ d) $x\log\left(\frac{x^2}{x+1}\right)$

24. If $x^2 + y^2 = t + \frac{1}{t}$, $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $\frac{dy}{dx} = \ldots\ldots$

a) $-\frac{y}{x}$ b) $-\frac{x}{2y}$ c) $\frac{x}{2y}$ d) $\frac{y}{x}$

33. If $x=\sqrt{a^{\sin^{-1}t}}$, $y=\sqrt{a^{\cos^{-1}t}}$, then $\frac{dy}{dx}=.....$

a) $-\frac{x}{y}$ b) $\frac{y}{x}$ c) $-\frac{y}{x}$ d) $\frac{x}{y}$

34. If $x^y=e^{x-y}$, then $\frac{dy}{dx}$ at $x=1$ is

a) 0 b) e c) 1 d) -1

35. If $y=\tan^{-1}\left(\frac{1-\cos 3x}{\sin 3x}\right)$, then $\frac{dy}{dx}=.....$

a) $-\frac{3}{2}$ b) $\frac{1}{2}$ c) $-\frac{1}{2}$ d) $\frac{3}{2}$

36. If $y=\sin\left[2\tan^{-1}\sqrt{\frac{1-x}{1+x}}\right]$ then $\frac{dy}{dx}=.....$

a) $\frac{-x}{\sqrt{1-x^2}}$ b) $\frac{-x}{1+x^2}$ c) $\frac{x}{1+x^2}$ d) $\frac{x}{\sqrt{1-x^2}}$

37. If $y=3e^{2x}+2e^{3x}$ and $\frac{d^2y}{dx^2}+p\frac{dy}{dx}+qy=0$ then $p+q=.....$

a) 11 b) 12 c) 6 d) 1

38. If $\log_{10}\left(\frac{x^3-y^3}{x^3+y^3}\right)=2$ and $\frac{dy}{dx}=k\frac{x^2}{y^2}$, then $k=.....$

a) $\frac{99}{101}$ b) $-\frac{101}{99}$ c) $-\frac{99}{101}$ d) $\frac{101}{99}$

39. If $y=4^{\log_2 \sin x}+9^{\log_3 \cos x}$, then $\frac{dy}{dx}=.....$

a) $\cos x+\sin x$ b) 1 c) 0 d) $\frac{1}{\sin x}+\frac{1}{\cos x}$

40. If $y=\log[\sec(e^x)]$, then $\frac{dy}{dx}=.....$

a) $\frac{x\tan(e^x)}{e^x}$ b) $-e^x\tan(e^x)$ c) $e^x\tan(e^x)$ d) $-\frac{x\tan(e^x)}{e^x}$

[MHT-CET 2018]

41. If $\log_{10}\left(\frac{x^3-y^3}{x^3+y^3}\right)=2$, then $\frac{dy}{dx}=......$

a) $\frac{x}{y}$ b) $-\frac{y}{x}$ c) $-\frac{x}{y}$ d) $\frac{y}{x}$

42. If $y=(\tan^{-1}x)^2$ then $(x^2+1)^2\frac{d^2y}{dx^2}+2x(x^2+1)\frac{dy}{dx}=.....$

a) 4 b) 2 c) 1 d) 0

50. If $y=e^{m\sin^{-1}x}$ and $(1-x^2)\left(\frac{dy}{dx}\right)^2=\wedge y^2$ then $\wedge=$

a) m b) $-m$ c) m^2 d) $-m^2$

51. If $\log_{10}\left(\frac{x^2-y^2}{x^2+y^2}\right)=2$ then $\frac{dy}{dx}=.....$

a) $-\frac{99x}{101y}$ b) $\frac{99x}{101y}$ c) $-\frac{99y}{101x}$ d) $\frac{99y}{101x}$

*** MHT-CET was not conducted in 2014, 2015 as admissions to Maharashtra Engineering colleges were based on JEE Exam**

[MHT-CET 2015] (JEE-2015)

52. Let k be a non-zero real number.

If $f(x)=\begin{cases}\dfrac{(e^x-1)^2}{\sin\left(\frac{x}{k}\right)\log\left(1+\frac{x}{4}\right)} & x\neq 0\\ 12 & x=0\end{cases}$

is a continuous function, then the value of k is

a) 4 b) 1 c) 3 d) 2

53. If F : R $\longrightarrow$ R is a function defined by $f(x)=[x]\cos\left(\frac{2x-1}{2}\right)\pi$, where $[x]$ denotes the greatest integer function, then F is

a) continuous for every real x
b) discontinuous only at $x=0$
c) discontinuous only at non-zero integral values of x
d) continuous only at $x=0$

[MHT-CET 2014] (JEE-2014)

54. Let F : R $\longrightarrow$ R be a function such that $|f(x)|\leq x^2$, for all $x\in$ R, then at $x=0$, F is

a) continuous but not differentiable
b) continuous as well as differentiable
c) neither continuous nor differentiable
d) differentiable but not continuous

55. Let $f(x)=x|x|, g(x)=\sin x$ and $h(x)=(g\,o f)x$, then

a) $h(x)$ is not differentiable at $x=0$

b) $h(x)$ is differentiable at $x=0$, but $h'(x)$ is not continuous at $x=0$

c) $h'(x)$ is continuous at $x=0$ but it is not differentiable at $x=0$

d) $h'(x)$ is differentiable at $x=0$

176. If $\log_e y = 3\sin^{-1}x$, then $(1-x^2)y'' - xy'$ at $x = \frac{1}{2}$ is equal to

a) $9e^{\frac{\pi}{6}}$ b) $3e^{\frac{\pi}{6}}$ c) $3e^{\frac{\pi}{2}}$ d) $9e^{\frac{\pi}{2}}$

177. If $(a+bx)e^{\frac{y}{x}} = x$, then $x^3\frac{d^2y}{dx^2} =$

a) $x\frac{dy}{dx} - y$ b) $x\frac{dy}{dx} + y$ c) $\left(x\frac{dy}{dx} - y\right)^2$ d) $\left(x\frac{dy}{dx} + y\right)^2$

178. Let $y = \log_e\left(\frac{1-x^2}{1+x^2}\right), -1 < x < 1$. Then at $x = \frac{1}{2}$ the value of $225(y' - y'')$ is equal to

a) 736 b) 732 c) 742 d) 746

179. The function represented by $x = \sin t$, $y = ae^{\sqrt{2}t} + be^{\sqrt{2}t}$, $t \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ satisfies the equation $(1-x^2)y'' - xy' = ky$, then the value of k is

a) -1 b) 0 c) 1 d) 2

[MHT - CET 2025]

180. If $f(x) = 3x^3 + 2x^2 f'(1) + x f''(2) + f'''(3)$, then $f(x) =$

a) $\frac{1}{7}(3x^3 - 90x^2 + 72x + 18)$ b) $\frac{1}{7}(21x^3 - 90x^2 + 72x + 126)$

c) $3x^3 - 90x^2 + 72x + 18$ d) $3x^3 - 45x^2 + 36x + 9$

181. If $f(x) = 2(\cos x + i\sin x)(\cos 3x + i\sin 3x) \ldots (\cos(2n-1)x + i\sin(2n-1)x)$, where $n \in N$ then $f''(x) =$

a) $-n^2 f(x)$ b) $n^2 f(x)$ c) $-n^4 f(x)$ d) $n^4 f(x)$

182. If $f(x) = \sqrt{1+\cos^2 x^2}$, then $f'\left(\frac{\sqrt{\pi}}{2}\right) =$

a) $\frac{\sqrt{\pi}}{6}$ b) $\frac{\pi}{\sqrt{6}}$ c) $-\sqrt{\frac{\pi}{6}}$ d) $\sqrt{\frac{\pi}{6}}$

183. If $f(x) = \frac{\sin^2 x}{1+\cot x} + \frac{\cos^2 x}{1+\tan x}$, then $f'\left(\frac{\pi}{6}\right) =$

a) 0 b) $\frac{1}{2}$ c) $-\frac{1}{2}$ d) $\frac{\sqrt{3}}{2}$

184. If $f(1) = 3, f'(1) = 2$, then $\frac{d}{dx}(\log(f(e^x + 2x)))$ at $x = 0$ is

a) $\frac{2}{3}$ b) $\frac{3}{2}$ c) 2 d) 0

185. If $y = \log_3(\log_3 x)$, then at $x = 3$, $\frac{dy}{dx} =$

a) $\frac{1}{3}(\log 3)^{-3}$ b) $\frac{1}{3}(\log 3)$ c) $\frac{1}{3}(\log 3)^2$ d) $\frac{1}{3}(\log 3)^{-2}$

186. If $y = \log_e x^3 + 3\sin^{-1}x + kx^2$ and $y'\left(\frac{1}{2}\right) = 2\sqrt{3}$, then $k =$

a) -6 b) 6 c) 1 d) $2\sqrt{3}$

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

a) $\frac{x}{\sqrt{1+x^2}\left(x^2-2\sqrt{1+x^2}+1\right)}$ b) $\frac{x}{\sqrt{1+x^2}\left(x^2-2\sqrt{1+x^2}+3\right)}$

c) $\frac{x}{\sqrt{1+x^2}\left(x^2-2\sqrt{1+x^2}+2\right)}$ d) $\frac{x}{\sqrt{1+x^2}\left(x^2+2\sqrt{1+x^2}-3\right)}$

188. If $y = \sin^2\left(\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right)$, then $\frac{dy}{dx} =$

a) $-\frac{1}{4}$ b) $\frac{1}{2}$ c) -1 d) 1

189. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)+\sec^{-1}\left(\frac{1+x^2}{1-x^2}\right)$, then at $x = \sqrt{3}$, $\frac{dy}{dx} =$

a) 1 b) 0 c) $\frac{1}{2}$ d) $\frac{1}{4}$

190. If $y = \tan^{-1}\left(\frac{12x-64x^3}{1-48x^2}\right)$, then $\frac{dy}{dx} =$

a) $\frac{3}{1+16x^2}$ b) $\frac{4}{1+16x^2}$ c) $\frac{12}{1+16x^2}$ d) $\frac{1}{1+16x^2}$

191. If $y = \tan^{-1}\left(\frac{1}{1+x+x^2}\right)+\tan^{-1}\left(\frac{1}{x^2+3x+3}\right)+\tan^{-1}\left(\frac{1}{x^2+5x+7}\right)$, then $y'(0) =$

a) $-\frac{1}{10}$ b) $-\frac{9}{10}$ c) $\frac{1}{10}$ d) $\frac{9}{10}$

192. If $f(\theta) = \cos\theta_1 \cdot \cos\theta_2 \cdot \cos\theta_3 \cdot \ldots \cdot \cos\theta_n$, then $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 + \ldots + \tan\theta_n =$

a) $-\frac{f'(\theta)}{f(\theta)}$ b) $\frac{f'(\theta)}{f(\theta)}$ c) $-\frac{f''(\theta)}{f'(\theta)}$ d) $\frac{f''(\theta)}{f'(\theta)}$

193. If $y = (1-x)(2-x)\ldots(n-x)$, then at $x = 1$, $\frac{dy}{dx} =$

a) $(n-1)!$ b) $n!$ c) $(-1)(n-1)!$ d) $(-n)(n-1)!$

194. If $y = x^{(x^x)}$, then $\frac{dy}{dx} =$

a) $x^{(x^x)}(x^x+1+\log x)$ b) $x^{(x^x)}(x^x+\log x)$

c) $x^{(x^x)}(x^x+x^{x-1}\log x(1+\log x))$ d) $x^{(x^x)}(x^{x-1}+x^x\log x(1+\log x))$