Multiple Choice Questions

[MHT-CET 2022] (online shift)

1. The angle between the curves $y = \sin x$ and $y = \cos x$, $0 < x < \frac{\pi}{2}$ is

a) $\tan^{-1}(3\sqrt{3})$ b) $\tan^{-1}(2\sqrt{2})$ c) $\tan^{-1}(3\sqrt{2})$ d) $\tan^{-1}(\sqrt{2})$

2. If $y = 4x - 5$ is a tangent to the curve $y^2 = px^3 + q$ at $(2, 3)$ then

a) $p = -2, q = -7$ b) $p = 2, q = -7$ c) $p = 2, q = 7$ d) $p = -2, q = 7$

3. The function, $f(x) = x\sqrt{1-x}$, where $x \in (0, 1)$ has local maximum at $x = ..$

a) $\frac{3}{4}$ b) $\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{4}$

4. The maximum value of the function $f(x) = 3x^3 - 18x^2 + 27x - 40$ on the set $S = \{x \in R / x^2 + 30 \le 11x\}$ is

a) 810 b) 122 c) 222 d) 162

5. If the curves $y^2 = 6x$, $9x^2 + by^2 = 16$ intersect each other at right angles, then the value of b is

a) 6 b) 4 c) $7/2$ d) $9/2$

6. A spherical iron ball 10 cm in radius is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm^3/ min. When the thickness of ice is 5 cm, then the rate at which the thickness of ice decreases is

a) $\frac{1}{54\pi}$ cm/min b) $\frac{1}{36\pi}$ cm / min c) $\frac{1}{18\pi}$ cm / min d) $\frac{5}{6\pi}$ cm / min

7. Mrs. Rajani deposited ₹ 10,000 in a bank that pays 4% interest compounded annually then the amount she gets after 10 years is ₹ .... approximately. (Given $e^{(0.4)} = 1.49182$)

a) 15150 b) 14918 c) 16000 d) 13000

8. The curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$, $n \in N$ touches the line at the point (a, b), then the equation of the line is

a) $\frac{x}{a} - \frac{y}{b} = 7$ b) $\frac{x}{a} + \frac{y}{b} = 2$ c) $\frac{x}{a} + \frac{y}{b} = 1$ d) $\frac{x}{a} + \frac{y}{2b} = 1$

9. If the tangent to the curve $y = \frac{x}{x^2 - 3}$, $x \in R$, $(x \ne \pm\sqrt{3})$ at a point $(\alpha, \beta) \ne (0, 0)$ on it, is parallel to the line $2x + 6y - 11 = 0$, then

a) $|6\alpha + 2\beta| = 9$ b) $|2\alpha + 6\beta| = 11$ c) $|6\alpha + 2\beta| = 19$ d) $|2\alpha + 6\beta| = 19$

10. If the normal to the curve $y = f(x)$ at the point (3, 4) makes an angle $\left(\frac{3\pi}{4}\right)^C$ with positive x- axis, then F'(3) is equal to ...

a) -1 b) $\frac{4}{3}$ c) $-\frac{3}{4}$ d) 1

[MHT-CET 2021] (online shift)

11. A wire of length 20 units is divided into two parts such that the product of one part and cube of other part is maximum, then product of these parts is

a) 5 b) 75 c) 15 d) 70

12. The equation of the tangent to the curve $y = 4xe^x$ at $\left(-1, \frac{-4}{e}\right)$ is

a) $6x - \frac{e}{4}y = -5$ b) $x - \frac{e}{4}y = 0$ c) $x = -1$ d) $y = \frac{-4}{e}$

13. The surface area of spherical balloon is increasing at the rate 2 cm^2 / sec. Then rate of increase in the volume of the balloon is ...., when the radius of the balloon is 6 cm.

a) 4 cm^3 / sec b) 16 cm^3 / sec c) 36 cm^3 / sec d) 6 cm^3 / sec

14. The function $f(x) = \cot^{-1} x + x$ is increasing in the interval

a) $(-\infty, \infty)$ b) $(0, 3)$ c) $(1, \infty)$ d) $(-1, \infty)$

15. The curves $\frac{x^2}{a^2} + \frac{y^2}{4} = 1$ and $y^3 = 16x$ intersect each other orthogonally , then $a^2 =$

a) 2 b) $\frac{3}{4}$ c) $\frac{1}{2}$ d) $\frac{4}{3}$

16. The point on the curve $y^2 = 2(x - 3)$ at which the normal is parallel to the line $y - 2x + 1 = 0$ is

a) $\left(\frac{-1}{2}, -2\right)$ b) $\left(\frac{3}{2}, 2\right)$ c) $(5, 2)$ d) $(5, -2)$

17. The function $f(x) = \frac{\lambda \sin x + 6\cos x}{2\sin x + 3\cos x}$ is increasing if

a) $\lambda > 2$ b) $\lambda < 4$ c) $\lambda \geq 4$ d) $\lambda > 1$

18. If $x = -2$ and $x = 4$ are the extreme points of $y = x^3 - \alpha x^2 - \beta x + 5$ then,

a) $\alpha = 3, \beta = 24$ b) $\alpha = -24, \beta = -3$ c) $\alpha = -3, \beta = -24$ d) $\alpha = 24, \beta = 3$

19. The equation of tangent to the curve $y = \sqrt{2}\sin\left(2x + \frac{\pi}{4}\right)$ at $x = \frac{\pi}{4}$ is

a) $2x + y - \pi/2 - 1 = 0$ b) $2x - y - \pi/2 + 1 = 0$

c) $x + y - \pi/2 - 1 = 0$ d) $x - y - \pi/2 + 1 = 0$

30. The minimum value of $f(x) = a^2 \cos^2 x + b^2 \sin^2 x$ if $a^2 > b^2$ is
a) b^2 b) $a^2 - b^2$ c) a^2 d) $a^2 + b^2$

[MHT-CET 2019]

31. If $f(x) = 3x^3 - 9x^2 - 27x + 15$, then the maximum value of $f(x)$ is
a) -30 b) -66 c) 66 d) 30

32. The equation of normal to the curve $y = \log e^x$ at the point P (1, 0) is
a) $x + y = 1$ b) $2x + y = 2$ c) $x - y = 1$ d) $x - 2y = 1$

33. The function $f(x) = x^3 - 3x$ is
a) decreasing in $(-\infty, -1) \cup (1, \infty)$ and increasing in $(-1, 1)$
b) decreasing in $(0, \infty)$ and increasing in $(-\infty, 0)$
c) increasing in $(-\infty, -1) \cup (1, \infty)$ and decreasing in $(-1, 1)$
d) increasing in $(0, \infty)$ and decreasing in $(-\infty, 0)$

34. Using differentiation, approximate value of $f(x) = x^2 - 2x + 1$ at $x = 2.99$ is
a) 9.96 b) 4.98 c) 5.98 d) 3.96

35. If $f(x) = x + \frac{1}{x}$, $x \neq 0$, then local maximum and minimum values of function f are
a) 1 and -1 b) 2 and -2 c) -1 and 1 d) -2 and 2

36. The minimum value of the function $f(x) = x \log x$ is
a) $-e$ b) e c) $1/e$ d) $-1/e$

37. The slope of normal to the curve $x = \sqrt{t}$ and $y = t - \frac{1}{\sqrt{t}}$ at $t = 4$ is
a) $\frac{17}{4}$ b) $\frac{-17}{4}$ c) $\frac{4}{17}$ d) $\frac{-4}{17}$

38. A particle is moving in straight line with velocity $\frac{ds}{dt} = s + 1$, then the time required by the particle to travel a distance of 99 m is
a) log 100 b) 2 c) log 10 d) log 200

39. Using differentiation, the approximate value of sin 46°, given that $1° = 0.0175^c$ is
a) 0.07194 b) 0.7194 c) $\frac{1.0175}{\sqrt{2}}$ d) $\frac{0.0175}{\sqrt{2}}$

40. If Roll's Theorem holds for the function $f(x) = \cos x + \sin x + 7$, $x \in [0, 2\pi]$ and $0 < c < 2\pi$, such that $F'(c) = 0$, then the number of possible values of c is
a) 1 b) 2 c) 0 d) 3

[MHT-CET 2018]

41. If $f(x) = \frac{x}{x^2 + 1}$ is increasing function then the value of x lies in
a) R b) $(-\infty, -1)$ c) $(1, \infty)$ d) $(-1, 1)$

117. Let C be a curve given by $y(x) = 1+\sqrt{4x-3}$, $x > \frac{3}{4}$. If P is a point on C, such that the tangent at P has slope $\frac{2}{3}$, then a point through which the normal at P passes is

a) $(3, -4)$ b) $(4, -3)$ c) $(2, 3)$ d) $(1, 7)$

118. The distance s in meters covered by a body in t seconds is given by $s = 3t^2 - 8t + 5$. The body will stop after

a) 1 sec b) 4 sec c) $\frac{4}{3}$ sec d) $\frac{3}{4}$ sec

119. If a bullet is shot horizontally and its distance s cm at time t seconds is given by $s = 1200t - 15t^2$, then the distance covered by the bullet when it comes to rest, is

a) 48000 cms b) 24000 cms c) 4800 cms d) 2400 cms

120. The equation of motion of a particle is $s = at^2 + bt + c$. If the displacement after 1 seconds is 20 meter, velocity after 2 seconds is 30 meter/sec and the acceleration is 10 meter/sec^2, then

a) $a - c = b$ b) $a + c = b$ c) $a + c = 2b$ d) $a + c = 3b$

121. After t seconds, the acceleration of a particle which starts from rest and moves in a straight line is $\left(8-\frac{t}{5}\right)$ cm/sec^2, then the velocity of the particle at the instant, when the acceleration is zero, is.

a) 80 cm/sec b) 160 cm/sec c) 320 cm/sec d) 480 cm/sec

122. A point moves on the arc of parabola $y = 2x^2$. Its abscissa increases at the rate of 2 units/sec. At the instant, the point is passing through (1, 2), its distance from origin is increasing at the rate of

a) $\frac{18}{5}$ units/sec b) $\frac{36}{5}$ units/sec c) $\frac{18}{\sqrt{5}}$ units/sec d) $\frac{36}{\sqrt{5}}$ units/sec

123. A ladder 5 meters in length is leaning against a wall. The bottom of ladder is pulled along ground away from the wall at the rate of 2 meters/sec. How fast the height on the wall descending when foot of ladder is 4 meters away from wall ?

a) $\frac{2}{3}$ meters/sec b) $\frac{4}{3}$ meters/sec c) $\frac{5}{3}$ meters/sec d) $\frac{8}{3}$ meters/sec

124. A ladder 5 meters long rests against a vertical wall. If its top slides downwards at the rate of 10 cm/sec, then the foot of the ladder is sliding at the rate of --- meter/sec, when it is 4 meters away from the wall.

a) 0.0075 b) 0.075 c) 0.75 d) 7.5

125. A square is contracting at uniform rate 3 cm^2/sec, then the rate at which the perimeter is decreasing, when the side of the square is 15 cm, is

a) $\frac{1}{5}$ cm/sec b) $\frac{2}{5}$ cm/sec c) $\frac{1}{10}$ cm/sec d) $\frac{3}{10}$ cm/sec

126. A spherical snow ball is melting to decrease its volume at the rate of 8 cm^3/sec. If its radius is 2 cm, then its radius is decreasing at the rate of

a) $\frac{1}{\pi}$ cm/sec b) $\frac{1}{2\pi}$ cm/sec c) π cm/sec d) 2π cm/sec

141. Let $f(x) = x^3 - 4x^2 + 8x + 11$, if LMVT is applicable on $f(x)$ in [0, 1], value of c is

a) $\frac{4-\sqrt{7}}{3}$ b) $\frac{4-\sqrt{5}}{3}$ c) $\frac{4+\sqrt{7}}{3}$ d) $\frac{4+\sqrt{5}}{3}$

142. If mean value theorem holds for the function $f(x) = (x-1)(x-2)(x-3), x \in [0, 4]$, then value of c is

a) $2 \pm \sqrt{2}$ b) $2 \pm \sqrt{3}$ c) $2 \pm \frac{2}{\sqrt{3}}$ d) $2 \pm \frac{4}{\sqrt{3}}$

143. The value of c for which the conclusion of mean value theorem holds for the function $f(x) = \log_e x$ on the interval [1, 3] is

a) $\log_3 e$ b) $\log_e 3$ c) $\frac{1}{2}\log_e 3$ d) $2\log_3 e$

144. The function $f(x) = 2x^3 - 6x + 5$ is an increasing function, if

a) $-1 < x < 1$ b) $0 < x < 1$ c) $-1 < x < -\frac{1}{2}$ d) $x < -1$ or $x > 1$

145. The interval in which the function $f(x) = x^x$, $x > 0$, is strictly increasing is

a) $(0, \infty)$ b) $\left(0, \frac{1}{e}\right]$ c) $\left[\frac{1}{e}, \infty\right)$ d) $\left[\frac{1}{e^2}, 1\right)$

146. The length of the longest interval in which the function $f(x) = 3\sin x - 4\sin^3 x$ is increasing, is

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

147. The function $f(x) = \cot^{-1} x + x$ is increasing in the interval

a) $(-\infty, \infty)$ b) $(-1, \infty)$ c) $(0, 3)$ d) $(1, \infty)$

148. If $f(x) = \frac{\log x}{x}$ $(x > 0)$, then it is increasing in

a) $(0, e)$ b) $(0, \infty)$ c) (e, ∞) d) $(-\infty, \infty)$

149. If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$

a) $f(x)$ is bounded b) $f(x)$ has a local maxima
c) $f(x)$ is strictly increasing function d) $f(x)$ is strictly decreasing function

150. Let $f(x) = \frac{x}{\sqrt{a^2+x^2}} - \frac{d-x}{\sqrt{b^2+(d-x)^2}}$, $x \in \mathrm{R}$, where a, b, d are non-zero real constants. Then

a) f' is not continuous function of x b) f is an increasing function of x
c) f is a decreasing function of x d) f is neither increasing nor decreasing function of x

151. If $5f(x) + 4f\left(\frac{1}{x}\right) = x^2 - 2, \forall x \neq 0$ and $y = 9x^2 f(x)$, then y is strictly increasing in

a) $\left(0, \frac{1}{\sqrt{5}}\right) \cup \left(\frac{1}{\sqrt{5}}, \infty\right)$ b) $\left(-\frac{1}{\sqrt{5}}, 0\right) \cup \left(\frac{1}{\sqrt{5}}, \infty\right)$

c) $\left(-\frac{1}{\sqrt{5}}, 0\right) \cup \left(0, \frac{1}{\sqrt{5}}\right)$ d) $\left(-\infty, \frac{1}{\sqrt{5}}\right) \cup \left(0, \frac{1}{\sqrt{5}}\right)$

152. The function $f(x) = 2x^3 - 9x^2 + 12x + 2$ is decreasing in the interval

a) $[1, 2]$ b) $[1, 2)$ c) $(1, 2]$ d) $(1, 2)$

173. A poster is to be printed on a rectangular sheet of paper of area 18 sq. meters. The margins at the top and bottom of 75 cm each and at the sides 50 cm each are left. Then the dimensions of the sheet so that the space available for printing is maximum are

a) 3 m, 6 m b) 6 m, 3 m c) $2\sqrt{3}$ m, $3\sqrt{3}$ m d) $3\sqrt{3}$ m, $2\sqrt{3}$ m

174. A wire of length 2 units is cut into two parts which are bent respectively to form a square of side = x units and a circle of radius = r units. If the sum of areas of the square and the circle so formed is minimum, then

a) $2x = (\pi + 4) r$ b) $(4 - \pi) x = \pi r$ c) $x = 2r$ d) $2x = r$

175. An open tank with a square bottom, to contain 4000 cubic cm of liquid is to be constructed. The dimensions of the tank, so that the surface area of the tank is minimum are

a) square bottom = 40 cm, height = 10 cm b) square bottom = 20 cm, height = 10 cm
c) square bottom = 10 cm, height = 40 cm d) square bottom = 5 cm, height = 160 cm

176. Twenty meters of wire is available for fencing of a flower-bed in the form of a circular sector. Then the maximum area (in sq. m) of the flower-bed is

a) 30 b) 12.5 c) 10 d) 25

177. The maximum volume (in cu. meter) of the right circular cone having slant height 3 meter is

a) $3\sqrt{3}\pi$ b) 6π c) $2\sqrt{3}\pi$ d) $\frac{4\pi}{3}$

178. Let x_0 be the point of local minima of $f(x) = \bar{a} \cdot (\bar{b} \times \bar{c})$, where $\bar{a} = x\hat{i} - 2\hat{j} + 3\hat{k}$, $\bar{b} = -2\hat{i} + x\hat{j} - \hat{k}$, $\bar{c} = 7\hat{i} - 2\hat{j} + x\hat{k}$, then value of $\bar{a} \cdot \bar{b}$ at $x = x_0$ is

a) – 15 b) – 12 c) 12 d) 15

[MHT - CET 2025]

179. The equation of tangent to the curve $y = \cos(x + y)$ where $-2\pi \le x \le 2\pi$ and which is parallel to the line $x + 2y = 0$, is

a) $2x + 4y + \pi = 0$ b) $2x + 4y - \pi = 0$ c) $2x + 4y - 3\pi = 0$ d) $2x - 4y + 3\pi = 0$

180. Angle between the the curves $xy = 6$ and $x^2 y = 12$ is

a) $\tan^{-1}\left(\frac{3}{11}\right)$ b) $\tan^{-1}\left(\frac{11}{3}\right)$ c) $\tan^{-1}\left(\frac{2}{11}\right)$ d) $\tan^{-1}\left(\frac{1}{11}\right)$

181. If the curves $y^2 = 6x$ and $9x^2 + by^2 = 16$ intersect each other at right angle, then $b =$

a) 4 b) 6 c) $\frac{7}{2}$ d) $\frac{9}{2}$

182. The equation of normal to the curve $x = \sqrt{t}$ and $y = t - \frac{1}{\sqrt{t}}$ at $t = 4$ is

a) $8x + 34y = 135$ b) $8x + 6y = 37$ c) $8x + 2y = 23$ d) $34x - 8y = 40$

183. If the line $ax + by + c = 0$ is normal to the curve $xy = 1$, then

a) $a > 0, b > 0$ b) $a > 0, b < 0$ c) $a < 0, b < 0$ d) $a = 0, b = 0$

184. The normal to the curve $x = 9(1 + \cos\theta)$, $y = \sin\theta$ at θ always passes through the fixed point

a) (9, 0) b) (8, 9) c) (0, 9) d) (9, 8)