MHT-CET 2020 Question Paper

14th October 2020

1. $y = c^2 + \frac{c}{x}$ is the solution of the differential equation.

(A) $x^4\left(\frac{dy}{dx}\right)^2 - x\left(\frac{dy}{dx}\right) + y = 0$

(B) $x^4\left(\frac{dy}{dx}\right)^2 + x\left(\frac{dy}{dx}\right) + y = 0$

(C) $x^4\left(\frac{dy}{dx}\right)^2 - x\left(\frac{dy}{dx}\right) - y = 0$

(D) $x^4\left(\frac{dy}{dx}\right)^2 + x\left(\frac{dy}{dx}\right) - y = 0$

2. The contrapositive of the statement 'If Raju is courageous, then he will join Indian Army', is

(A) If Raju does not join Indian Army, then he is not courageous.

(B) If Raju join Indian Army, then he is not courageous

(C) If Raju join Indian Army, then he is courageous.

(D) If Raju does not join Indian Army, then he is courageous.

3. The area of the region bounded by the curve $y = \log x$, x-axis and the lines $x = 1$, $x = e$ is

(A) $\frac{1}{2}$ sq. units (B) $\frac{1}{e}$ sq. units

(C) 4 sq. units (D) 1 sq. units

4. If the population grows at the rate of 8% per year, then the time taken for the population to be doubled is (given log 2 = 0.6912)

(A) 10.27 years (B) 6.8 years

(C) 8.64 years (D) 4.3 years

5. If $f(x) = \frac{81^x - (9)^x}{(k)^x - 1}$ if $x \neq 0$

$= 2$ if $x = 0$

is continuous at $x = 0$, then the value of k is

(A) 2 (B) 4

(C) 9 (D) 3

6. If $P(A) = \frac{2}{5}$, $P(B) = \frac{1}{4}$ and $P(A \cup B) = \frac{1}{2}$, then $P(A' \cup B') =$

(A) $\frac{17}{20}$ (B) $\frac{3}{20}$

(C) $\frac{1}{2}$ (D) $\frac{1}{4}$

7. If $u = \tan^{-1}\left(\frac{\sqrt{1-x^2}-1}{x}\right)$ and $v = \tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$, then $\frac{du}{dv}$ at $x = 0$ is

(A) 1 (B) $\frac{-1}{8}$

(C) $\frac{1}{4}$ (D) $\frac{1}{8}$

8. If the elements of matrix A are the reciprocals of elements of matrix $\begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega^2 \end{bmatrix}$, where ω is complex cube root of unity, then

(A) A^{-1} does not exist (B) $A^{-1} = I$

(C) $A^{-1} = A^2$ (D) $A^{-1} = A$

9. A die is thrown 100 times, then the standard deviation of getting an even number is

(A) 5 (B) 15

(C) 20 (D) 10

10. The general solution of $\tan 3x = 1$ is

(A) $x = n\left(\frac{\pi}{3}\right)+\left(\frac{\pi}{12}\right)$, $n \in Z$

(B) $x = n\pi$, $n \in Z$

(C) $x = n\pi + \frac{\pi}{4}$, $n \in Z$

(D) $x = n\pi \pm \frac{\pi}{4}$, $n \in Z$

11. If $\frac{1-\tan\theta}{1+\tan\theta} = \frac{1}{\sqrt{3}}$, where $\theta \in \left(0, \frac{\pi}{2}\right)$, then $\theta =$

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{12}$ (D) $\frac{\pi}{3}$

12. If $\int_0^1 (5x^2 - 3x + k)\,dx = 0$, then k =

(A) $\frac{-1}{6}$ (B) $\frac{1}{6}$

(C) $\frac{-1}{3}$ (D) $\frac{1}{3}$

13. A metal wire 108 meters long is bent to form a rectangle. If the area of the rectangle is maximum, then its dimensions are

(A) 28 m, 28 m (B) 26 m, 26 m

(C) 27 m, 27 m (D) 25 m, 25 m

14. If the lines given by $\bar{r}=2\hat{i}+\lambda(\hat{i}+2\hat{j}+m\hat{k})$ and $\bar{r}=\hat{i}+\mu(2\hat{i}+\hat{j}+6\hat{k})$ are perpendicular, then the value of m is
(A) $\frac{2}{3}$ (B) $\frac{-2}{3}$
(C) $\frac{-3}{2}$ (D) $\frac{3}{2}$

15. If $f(x) = [x]^2 - 5[x] + 6 = 0$, where $[x]$ denotes greatest integer function then $x \in$
(A) $[2, 4)$ (B) $[2, 4]$
(C) $(2, 4]$ (D) $(2, 4)$

16. $\int \frac{e^x}{\sqrt{x}}(1+2x)dx =$
(A) $\frac{\sqrt{x}}{2}e^x + c$ (B) $\frac{1}{\sqrt{x}}e^x + c$
(C) $2\sqrt{x}e^x + c$ (D) $\sqrt{x}e^x + c$

17. The eccentricity of the hyperpola $16x^2 - 3y^2 - 32x - 12y - 44 = 0$ is
(A) $\sqrt{\frac{13}{19}}$ (B) $\sqrt{\frac{19}{3}}$
(C) $\frac{13}{\sqrt{19}}$ (D) $\frac{\sqrt{19}}{3}$

18. The length of the perpendicular from the point P(a, b) to the line $\frac{x}{a}+\frac{y}{b}=1$ is
(A) $\left|\frac{\sqrt{a^2+b^2}}{ab}\right|$ units (B) $\left|\frac{a^2}{\sqrt{a^2+b^2}}\right|$ units
(C) $\left|\frac{b^2}{\sqrt{a^2+b^2}}\right|$ units (D) $\left|\frac{ab}{\sqrt{a^2+b^2}}\right|$ units

19. $\int \frac{x^2}{(x+1)(x+2)^2}dx =$
(A) $\log|x+1| + \frac{4}{x+2} + c$
(B) $\log|x+1| + \frac{1}{x+2} + c$
(C) $\log|x+1| - \frac{4}{x+2} - \frac{3}{(x+2)^2} + c$
(D) $\log|x+1| - \frac{4}{x+2} + \frac{3}{(x+2)^2} + c$

20. If $\frac{d^2y}{dx^2} = \sin x + e^x$; $y(0) = 3$ and $\frac{dy}{dx}$ at $x = 0$ is 4, then the equation of the curve is
(A) $y = 4 + 2x + e^x + \sin x$
(B) $y = 2 + 3x + e^x - \sin x$
(C) $y = 2 + 4x + e^x - \sin x$
(D) $y = 4 + 2x + e^x - \sin x$

21. If the vectors $\bar{a},\bar{b},\bar{c}$ are non coplanar, then $\frac{[\bar{a}+2\bar{b}\ \ \bar{b}+2\bar{c}\ \ \bar{c}+2\bar{a}]}{[\bar{a}\ \bar{b}\ \bar{c}]} =$
(A) 3 (B) 9 (C) 8 (D) 6

22. The centre and radius of a circle $x = 4a\left(\frac{1-t^2}{1+t^2}\right)$, $y = \frac{8at}{1+t^2}$, are respectively
(A) (0, 0) and 2a units
(B) (0, 0) and a units
(C) (0, 0) and 4a units
(D) (0, 0) and 3a units

23. The cumulative distribution function of a continuous random varibale X is given by $F(X = x) = \frac{\sqrt{x}}{2}$, then $P[X > 1]$ is
(A) $\frac{1}{3}$ (B) $\frac{1}{4}$
(C) $\frac{1}{\sqrt{2}}$ (D) $\frac{1}{2}$

24. If $f(x) = \frac{2x+3}{3x-2}$, $x \neq \frac{2}{3}$ then f o f is
(A) a constant function
(B) an even function
(C) an odd function
(D) not defined for all $x \in R$

25. $\int_0^1 \tan^{-1}\left(\frac{2x}{1-x^2}\right)dx =$
(A) $\pi + \log 2$ (B) $\pi - \log 2$
(C) $\frac{\pi}{2} - \log 2$ (D) $\frac{\pi}{2} + \log 2$

26. If $\int x^x(1+\log x)dx = k\,x^x + c$, then k =
(A) $\log_e e$ (B) $\log_e\left(\frac{1}{e}\right)$
(C) $\log_e\left(\frac{1}{e^2}\right)$ (D) $\log_e(e^2)$

27. The p.d.f. of a continuous random variable X is given by
$f(x) = \frac{1}{2}$ if $0 < x < 2$
$= 0$ otherwise
and if $a = P\left(X < \frac{1}{2}\right)$, $b = P\left(X > \frac{3}{2}\right)$, then relation between a and b is
(A) $a - b = 0$ (B) $2a - b = 0$
(C) $3a - b = 0$ (D) $a - 2b = 0$

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

(A) $\dfrac{-1}{3}$ (B) $\dfrac{-1}{4}$
(C) $\dfrac{1}{3}$ (D) $\dfrac{1}{4}$

29. If m_1 and m_2 are slopes of the lines represented by $(\sec^2\theta - \sin^2\theta)\,x^2 - 2\tan\theta\,xy + \sin^2\theta\,y^2 = 0$, then $|m_1 - m_2| =$

(A) 1 (B) 3
(C) 2 (D) 4

30. If $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 3 \\ 0 & 3 & -5 \end{bmatrix}$, where A_{ij} is the cofactor of the element a_{ij} of matrix A, then $a_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23} =$

(A) – 26 (B) 26
(C) – 2 (D) 0

31. A particle moves according to the law $s = t^3 - 6t^2 + 9t + 25$. The displacement of the particle at the time when its acceleration is zero, is

(A) – 27 units (B) 27 units
(C) 9 units (D) 0 units

32. Bacteria increases at the rate proportional to the number of bacteria present. If the original number N doubles in 4 hours, then the number of bacteria will be 4N in

(A) 2 hours (B) 4 hours
(C) 8 hours (D) 6 hours

33. With usual notations in ΔABC, if $C = 90°$, then $\tan^{-1}\left(\dfrac{a}{b+c}\right) + \tan^{-1}\left(\dfrac{b}{c+a}\right) =$

(A) $\dfrac{\pi}{4}$ (B) $\dfrac{\pi}{6}$
(C) π (D) $\dfrac{\pi}{3}$

34. The measure of the acute angle between the lines given by the equation $3x^2 - 4\sqrt{3}\,xy + 3y^2 = 0$ is

(A) 60° (B) 70°
(C) 30° (D) 45°

35. If $y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$, then $\dfrac{dy}{dx} =$

(A) $-\sqrt{\dfrac{1-y^2}{1-x^2}}$ (B) $\sqrt{\dfrac{1-x^2}{1-y^2}}$
(C) $\sqrt{\dfrac{1-x^2}{1-y^2}}$ (D) $\sqrt{\dfrac{1+y^2}{1+x^2}}$

36. The direction cosines of a line which lies in ZOX plane and makes an angle of 30° with Z-axis are

(A) $0, \dfrac{\sqrt{3}}{2}, \pm\dfrac{1}{2}$ (B) $\dfrac{\sqrt{3}}{2}, 0, \pm\dfrac{1}{2}$
(C) $0, \dfrac{1}{2}, \pm\dfrac{\sqrt{3}}{2}$ (D) $\pm\dfrac{1}{2}, 0, \dfrac{\sqrt{3}}{2}$

37. The maximum value of $Z = 3x + 5y$, subject to $x + 4y \le 24$, $y \le 4$, $x \ge 0$, $y \ge 0$ is

(A) 44 (B) 72
(C) 120 (D) 20

38. If the line $\bar{r} = (\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ is parallel to the plane $\bar{r}\cdot(3\hat{i} - 2\hat{j} - m\hat{k}) = 5$, then value of m is

(A) 2 (B) –3
(C) 3 (D) –2

39. If A(–1, 2, 3), B(3, –2, 1), C(2, 1, 3) and D(–1, –2, 4) are the vertices of a tetrahedron, then its volume is

(A) $\dfrac{31}{6}$ cu. units (B) $\dfrac{16}{31}$ cu. units
(C) $\dfrac{16}{3}$ cu. units (D) $\dfrac{13}{6}$ cu. units

40. If the vectors $(2\hat{i} - q\,\hat{j} + 3\hat{k})$ and $(4\hat{i} - 5\hat{j} + 6\hat{k})$ are collinear, then the value of q is

(A) $\dfrac{-5}{2}$ (B) $\dfrac{5}{2}$
(C) $\dfrac{-2}{5}$ (D) $\dfrac{2}{5}$

41. If $\operatorname{cosec}\theta + \cot\theta = 5$, then $\sin\theta =$

(A) $\dfrac{5}{13}$ (B) $\dfrac{5}{26}$
(C) $\dfrac{1}{13}$ (D) $\dfrac{1}{5}$

42. For a sequence (t_n) if $S_n = 7(3^n - 1)$, then $t_n =$

(A) $(14)\,3^{n-1}$ (B) $(7)\,3^{n-1}$
(C) $(7)\,3^{n+1}$ (D) $(14)\,3^{n+1}$

43. $\sin^{-1}\left(\dfrac{1}{2}\right) + \cos^{-1}\left(\dfrac{\sqrt{3}}{2}\right) + \cot^{-1}\left(-\dfrac{1}{\sqrt{3}}\right) =$

(A) $\dfrac{2\pi}{3}$ (B) π
(C) $\dfrac{\pi}{6}$ (D) $\dfrac{\pi}{3}$

44. The general solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is
(A) $y + \sin^{-1} x = c$
(B) $x^2 + 2\sin^2 y = c$
(C) $y^2 + 2\sin^{-1} x = c$
(D) $x + \sin^{-1} y = c$

45. If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ interect, then k =
(A) $\frac{2}{9}$ (B) $\frac{-2}{9}$
(C) $\frac{9}{2}$ (D) $\frac{-9}{2}$

46. If the radius of a circle increases at the rate of 7 cm/sec, then the rate of increase of its area after 10 minutes is
(A) 1,68,400 cm^2/sec
(B) 1,88,400 cm^2/sec
(C) 1,64,800 cm^2/sec
(D) 1,84,800 cm^2/sec

47. If the planes $2x - 5y + z = 8$ and $2\lambda x - 15y + \lambda z + 6 = 0$ are parallel to each other, then value of λ is
(A) 2 (B) $\frac{1}{3}$
(C) 3 (D) -3

48. $\cos\left(\frac{3\pi}{4}+x\right)-\sin\left(\frac{\pi}{4}-x\right) =$
(A) $-\sqrt{2}\sin x$ (B) $\sqrt{2}\cos x$
(C) $-\sqrt{2}\cos x$ (D) $\sqrt{2}\sin x$

49. The logical expression
$[p \wedge (q \vee r)] \vee [\sim r \wedge \sim q \wedge p]$ is equivalent to
(A) p (B) $\sim p$
(C) $\sim q$ (D) q

50. $\int_{-\pi}^{\pi} \frac{2x}{1+\cos^2 x}\, dx =$
(A) π (B) $-\pi$
(C) 1 (D) 0