Questions: 60 | Time: 01:00 hh:mm | Marks: 60

Q1. From the set {1, 2, 3, 4, 5}, two numbers a and b (a ≠ b) are chosen at random. The probability that $\frac{a}{b}$ is an integer is: **1 Mark**

A $\frac{1}{3}$ B $\frac{1}{4}$ C $\frac{1}{2}$ D $\frac{3}{5}$

Q2. The distance of the point (2, 3, 4) from the plane $\vec{r}.(3\hat{i}-6\hat{j}+2\hat{k})=-11$ **1 Mark**

A 0 units
B 1 units
C 2 units
D $\frac{15}{7}$ units

Q3. The domain of the function $f(x)=\sin^{-1}(2x)$ is **1 Mark**

A $[0,1]$
B $[-1,1]$
C $\left[-\frac{1}{2},\frac{1}{2}\right]$
D $[-2,2]$

Q4. The principal value of $\tan^{-1}\left(\tan\frac{3\pi}{5}\right)$ is: **1 Mark**

A $\frac{2\pi}{5}$ B $\frac{-2\pi}{5}$ C $\frac{3\pi}{5}$ D $\frac{-3\pi}{5}$

Q5. The value of k so that f defined by $f(x)=\begin{cases}x^2\sin\left(\frac{1}{x}\right) & \text{if} \quad x\neq 0\\ k & \text{if} \quad x=0\end{cases}$ is continuous at x = 0 is **1 Mark**

A 0 B $\frac{1}{2}$ C 1 D 2

Q6. The two lines x = ay + b, z = cy + d; and x = a'y + b', z = c'y + d' are perpendicular to each other, if: **1 Mark**

A $\frac{a}{a'}+\frac{c}{c'}=1$
B $\frac{a}{a'}+\frac{c}{c'}=-1$
C $aa'+cc'=1$
D $aa'+cc'=-1$

Q7. If $|\vec{a}|=4$ and $-3\leq\lambda\leq 2$, then, $|\lambda\vec{a}|$ lies in: **1 Mark**

A [0, 12] B [2, 3] C [8, 12] D [–12, 8]

Q8. $\int\frac{e^x(1+x)}{\cos^2(xe^x)}dx$ is equal to **1 Mark**

A $\tan(xe^x)+c$
B $\cos(xe^x)+c$
C $\cot(e^x)+c$
D $\tan[e^x(1+x)]+c$

Q9. The general solution of the differential equation x dy - (1 + x^2) dx = dx is: **1 Mark**

A $y=2x+\frac{x^3}{3}+C$
B $y=2\log x+\frac{x^3}{3}+C$
C $y=\frac{x^2}{2}+C$
D $y=2\log x+\frac{x^2}{2}+C$

Q10. If $\begin{bmatrix}3 & 4\\ 5 & 2\end{bmatrix}$ and 2A + B is a null matrix, then B is equal to: **1 Mark**

A $\begin{bmatrix} 6 & 8 \\ 10 & 4 \end{bmatrix}$

B $\begin{bmatrix} -6 & -8 \\ -10 & -4 \end{bmatrix}$

C $\begin{bmatrix} 5 & 8 \\ 10 & 3 \end{bmatrix}$

D $\begin{bmatrix} -5 & -8 \\ -10 & -3 \end{bmatrix}$

Q11. $\tan^{1} 3 + \tan^{-1} \lambda = \tan^{-1}\left(\frac{3+\lambda}{1-3\lambda}\right)$ is valid for what values of λ? **1 Mark**

A $\lambda \in \left(-\frac{1}{3}, \frac{1}{3}\right)$

B $\lambda > \frac{1}{3}$

C $\lambda < \frac{1}{3}$

D All real values of λ

Q12. $\int \frac{1}{7+5\cos x}\, dx =$ **1 Mark**

A $\frac{1}{\sqrt{6}} \tan^{-1}\left(\frac{1}{\sqrt{6}} \tan \frac{x}{2}\right) + C$

B $\frac{1}{\sqrt{3}} \tan^{-1}\left(\frac{1}{\sqrt{3}} \tan \frac{x}{2}\right) + C$

C $\frac{1}{4} \tan^{-1}\left(\tan \frac{x}{2}\right) + C$

D $\frac{1}{7} \tan^{-1}\left(\tan \frac{x}{2}\right) + C$

Q13. Choose the correct answer from the given four options. **1 Mark**
Total number of possible matrices of order 3 × 3 with each entry 2 or 0 is:

A 9 **B** 27 **C** 81 **D** 512

Q14. The normal to the curve $x^2 = 4y$ passing through (1, 2) is: **1 Mark**

A x + y = 3

B x - y = 3

C x + y = 1

D x - y = 1

Q15. The function $f(x) = 2x^3 - 15x^2 + 36x + 4$ is maximum at x = **1 Mark**

A 3 **B** 0 **C** 4 **D** 2

Q16. If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $J = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then B equals: **1 Mark**

A $I\cos\theta + J\sin\theta$

B $I\sin\theta + J\cos\theta$

C $I\cos\theta - J\sin\theta$

D $-I\cos\theta + J\sin\theta$

Q17. A and B draw two cards each, one after another, from a pack of well-shuffled pack of 52 cards. The probability that all the four cards drawn are of the same suit is **1 Mark**

A $\frac{44}{85\times49}$

B $\frac{11}{85\times49}$

C $\frac{13\times24}{17\times25\times49}$

D None of these.

Q18. if x lies in the interval [0, 1], then the least value of $x^2 + x + 1$ is : **1 Mark**

A 3 **B** $\frac{3}{4}$ **C** 1 **D** none of these.

Q19. The area bounded by the curve $y = 4x - x^2$ and the x-axis is: **1 Mark**

A $\frac{30}{7}$ sq. units

B $\frac{31}{7}$ sq. units

C $\frac{32}{3}$ sq. units

D $\frac{34}{3}$ sq. units

Q20. Choose the correct answer from the given four options. **1 Mark**
The solution of $\frac{dy}{dx} + y = e^{-x}$, y(0) = 0 is:

A $y = e^{-x}(x-1)$

B $y = xe^{x}$

C $y = xe^{-x} + 1$

D $y = xe^{-x}$

Q21. Choose the correct answer in each of the following: **1 Mark**
Suppose that two cards are drawn at random from a deck of cards. Let X be the number of aces obtained. Then the value of E(X) is:

A $\frac{37}{221}$ **B** $\frac{5}{13}$ **C** $\frac{1}{13}$ **D** $\frac{2}{13}$

Q22. The angle between the straight lines $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{4}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{-3}$ is: **1 Mark**

A 45° **B** 30° **C** 60° **D** 90°

Q23. By graphical method, the solution of linear programming problem **1 Mark**
Maximize Z = $3x_1 + 5x_2$
Subject to
$3x_1 + 2x_2 \le 18$
$x_1 \le 4$
$x_2 \le 6$
x1 ≥ 0, x2 ≥ 0, is:

A $x_1 = 2, x_2 = 0, Z = 6$ **B** $x_1 = 2, x_2 = 6, Z = 36$
C $x_1 = 4, x_2 = 3, Z = 27$ **D** $x_1 = 4, x_2 = 6, Z = 42$

Q24. Choose the correct answer from the given four options. **1 Mark**
If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$, then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ is:

A 1 **B** 3 **C** $-\frac{3}{2}$ **D** None of these.

Q25. A function f from the set of natural numbers to integers defined by $f(n) = \begin{cases} \frac{n-1}{2}, & \text{when n is odd} \\ -\frac{n}{2}, & \text{when n is even} \end{cases}$ **1 Mark**

A Neither one-one nor onto. **B** One-one but not onto.
C Onto but not one-one. **D** One-one and onto both.

Q26. If the binary operation ⊙ is defined on the set Q^+ of all positive rational numbers by $a \odot b = \frac{ab}{4}$. **1 Mark**
Then, $3 \odot \left(\frac{1}{5} \odot \frac{1}{2}\right)$ is equal to:

A $\frac{3}{160}$ **B** $\frac{5}{160}$ **C** $\frac{3}{10}$ **D** $\frac{3}{40}$

Q27. The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{-2} = \frac{y-2}{-4} = \frac{z-3}{-6}$ are: **1 Mark**

A Coinicident. **B** Skew. **C** Intersecting. **D** Parallel.

Q28. Choose the correct answer from the given four options. **1 Mark**
The position vector of the point which divides the join of points $2\vec{a} - 3\vec{b}$ and $\vec{a} + \vec{b}$ in the ratio 3 : 1 is:

A $\frac{3\vec{a}-2\vec{b}}{2}$ **B** $\frac{7\vec{a}-8\vec{b}}{4}$
C $\frac{3\vec{a}}{4}$ **D** $\frac{5\vec{a}}{4}$

Q29. If $A = \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix}$, then A^n = **1 Mark**

A $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, if n is an even natural number **B** $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, if n is an odd natural number
C $A = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$, if $n \in N$ **D** None of these.

Q30. If the function $f(x) = \frac{2x-\sin^{-1}x}{2x+\tan^{-1}x}$ is continuous at each point of its domain, then the value of f(0) is: **1 Mark**

A 2 **B** $\frac{1}{3}$ **C** $-\frac{1}{3}$ **D** $\frac{2}{3}$

Q31. Let * be a binary operation on N defined by a * b = a + b + 10 for all a, b ∈ N. The identity element for * in N is: **1 Mark**

A -10 **B** 0 **C** 10 **D** Non-existent.

Q32. Choose the correct answer from the given four options. **1 Mark**
The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20, 40), (60, 20), (60, 0). The objective function is Z = 4x + 3y.

Compare the quantity in Column A and Column B.

Column A	**Column B**
Maximum of Z	325

A The quantity in column A is greater .
B The quantity in column B is greater.
C The two quantities are equal.
D The relationship can not be determined on the basis of the information supplied.

Q33. $\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x+\cos x}$ dx equals to: **1 Mark**

A π **B** $\frac{\pi}{2}$ **C** $\frac{\pi}{3}$ **D** $\frac{\pi}{4}$

Q34. A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement, then the probability that exactly two of the three balls were red, the first ball being red, is: **1 Mark**

A $\frac{1}{3}$ **B** $\frac{4}{7}$ **C** $\frac{15}{28}$ **D** $\frac{5}{28}$

Q35. The radius of a sphere is increasing at the rate of 0.2cm/sec. The rate at which the volume of the sphere increase when radius is 15cm, is: **1 Mark**

A $12\pi\ cm^3/sec.$
B $180\pi\ cm^3/sec.$
C $225\pi\ cm^3/sec.$
D $3\pi\ cm^3/sec.$

Q36. The function f : R → R, f(x) = x^2 is: **1 Mark**

A Injective but not surjective.
B Surjective but not injective.
C Injective as well as surjective.
D Neither injective nor surjective.

Q37. $\int_0^{\frac{\pi}{2}} \frac{1}{1+\cot^3 x}$ dx is equal to: **1 Mark**

A 0 **B** 1 **C** $\frac{\pi}{2}$ **D** $\frac{\pi}{4}$

Q38. The function f : A → B defined by f(x) = $-x^2 + 6x - 8$ is a bijection if, **1 Mark**

A $A = (-\infty, 3]$ and $B = (-\infty, 1]$
B $A = [-3, \infty)$ and $B = (-\infty, 1]$
C $A = (-\infty, 3]$ and $B = [1, \infty)$
D $A = [3, \infty)$ and $B = [1, \infty)$

Q39. The minimum value of $x \log_e x$ is equal to: **1 Mark**

A e **B** $\frac{1}{e}$ **C** $\frac{-1}{e}$ **D** 2e

Q40. If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} equal to: **1 Mark**

A $-(3A^2 + 2A + 5)$ **B** $3A^2 + 2A + 5$ **C** $3A^2 - 2A - 5$ **D** None of these.

Q41. $\int_0^{\frac{\pi}{2}} \frac{1}{2+\cos x}$ dx equals: **1 Mark**

A $\frac{1}{3}\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$
B $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$
C $\sqrt{3}\tan^{-1}\left(\sqrt{3}\right)$
D $2\sqrt{3}\tan^{-1}\sqrt{3}$

Q42. The area included between the parabolas $y^2 = 4x$ and $x^2 = 4y$ is (in square units): **1 Mark**

A $\frac{4}{3}$ **B** $\frac{1}{3}$ **C** $\frac{16}{3}$ **D** $\frac{8}{3}$

Q43. If A is an invertible matrix of order 3, then which of the following is not true: **1 Mark**

A $|adj\ A| = |A|^2$
B $(A^{-1})^{-1} = A$
C If BA = CA, than $B \neq C$, where B and C are square matrices of order 3
D $(AB)^{-1} = B^{-1}A^{-1}$, where $B \neq [b_{ij}]_{3\times3}$ and $|B| \neq 0$

Q44. **1 Mark**

If $f(x)=\frac{1}{1-x}$, then the set of points discontinuity of the function f(f(f(x))) is:

A {1} **B** {0,1} **C** {-1, 1} **D** None of these

Q45. The circumference of a circle is measured as 28cm with an error of 0.01cm. The percentage error in the area is: **1 Mark**

A $\frac{1}{14}$ **B** 0.01
C $\frac{1}{7}$ **D** None of these

Q46. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin|x|dx$ is equal to: **1 Mark**

A 1 **B** 2 **C** -1 **D** -2

Q47. If $A=\begin{bmatrix}1&2&x\\0&1&0\\0&0&1\end{bmatrix}$ and $B=\begin{bmatrix}1&-2&y\\0&1&0\\0&0&1\end{bmatrix}$ and AB = I_3, then x + y equals: **1 Mark**

A 0 **B** -1 **C** 2 **D** None of these.

Q48. The value of $\tan\left\{\cos^{-1}\frac{1}{5\sqrt{2}}-\sin^{-1}\frac{4}{\sqrt{17}}\right\}$ is: **1 Mark**

A $\frac{\sqrt{29}}{3}$ **B** $\frac{29}{3}$ **C** $\frac{\sqrt{3}}{29}$ **D** $\frac{3}{29}$

Q49. The solution of the differential equation xdy + ydy = x^2y dy - y^2x dx, is: **1 Mark**

A $x^2 - 1 = C(1 + y^2)$ **B** $x^2 + 1 = C(1 + y^2)$ **C** $x^3 - 1 = C(1 + y^3)$ **D** $x^3 + 1 = C(1 - y^3)$

Q50. If the constraints in a linear programming problem are changed: **1 Mark**

A The problem is to be re-evaluated. **B** Solution is not defined.
C The objective function has to be modified. **D** The change in constraints is ignored.

Q51. The differention equation $\frac{dy}{dx}+Py=Qy^n, n>2$ can be reduced to linear from by substituting: **1 Mark**

A $z=y^{n-1}$ **B** $z=y^n$
C $z=y^{n+1}$ **D** $z=y^{1-n}$

Q52. If $\sin(x+y)=\log(x+y)$, then $\frac{dy}{dx}=$ **1 Mark**

A 2 **B** -2 **C** 1 **D** -1

Q53. If $x=f(t)\cos t-f(t)\sin t$ and $y=f(t)\sin t+f(t)\cos t$, then $\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2=$ **1 Mark**

A $f(t)-f(t)$ **B** $\{f(t)-f(t)\}^2$
C $\{f(t)+f(t)\}^2$ **D** None of these

Q54. Choose the correct answer from the given four options: **1 Mark**
The maximum value of $\sin x \cdot \cos x$ is:

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** $\sqrt{2}$ **D** $2\sqrt{2}$

Q55. The corner points of the feasible region determined by the following system of linear inequalities: **1 Mark**
2x + y ≤ 10, x + 3y ≤ 15, x, y ≥ 0 are (0, 0), (5, 0), (3, 4) and (0, 5).
Let Z = px + qy, where p.q > 0.
Condition on p and q so that the maximum of Z occurs at both (3, 4) and (0, 5) is:

A P = q **B** p = 2q **C** p = 3q **D** q = 3q

Q56. Let f(x) = $2x^3 - 3x^2 - 12x + 5$ on [-2, 4]. The relative maximum occurs at x = **1 Mark**

A -2 **B** -1 **C** 2 **D** 4

Q57. The least and greatest value of f(x) = $x^3 - 6x^2 + 9x$ in [0, 6], are. **1 Mark**

A 3 ,4 **B** 0, 4 **C** 0, 3 **D** 3, 6

Q58. The value of k which makes $f(x) = \begin{cases} \sin\frac{1}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ continuous at x = 0, is: **1 Mark**

A 8 **B** 1 **C** -1 **D** None of these

Q59. The general solution of the dofferential equation $\frac{dy}{dx} = e^{x+y}$ is: **1 Mark**

A $e^x + e^{-y} = C$

B $e^x + e^y = C$

C $e^{-x} + e^y = C$

D $e^{-x} + e^{-y} = C$

Q60. If $V = \frac{4}{3}\pi r^3$, at What rate in cubic units is V increasing when $r = 10\frac{dr}{dt} = 0.01?$ **1 Mark**

A π **B** 4π **C** 40π **D** $4 = \frac{\pi}{3}$