CBSE Class 12 Mathematics(Set 65/1/2) Question Paper

Time Allowed :3 Hour	**Maximum Marks :**70	**Total Questions :**38

General Instructions

Read the following instructions very carefully and strictly follow them:

(i) This Question paper contains 38 questions. All questions are compulsory.

(ii) Question paper is divided into FIVE Sections – Section A, B, C, D and E.

(iii) In Section A – Question Number 1 to 18 are Multiple Choice Questions (MCQs) and Question Number 19 & 20 are Assertion-Reason based questions of 1 mark each.

(iv) In Section B – Question Number 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.

(v) In Section C – Question Number 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.

(vi) In Section D – Question Number 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.

(vii) In Section E – Question Number 36 to 38 are case study based questions, carrying 4 marks each.

(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.

(ix) Use of calculator is NOT allowed.

1. If $\int \frac{3x+7}{x^2+6x+13}\,dx = A\log\left|x^2+6x+13\right| + K$**, then the value of** A **is:**

(A) $3a$

(B) $\frac{2a}{3b}$

(C) $\frac{3a}{b^2}$

(D) $\frac{3a}{2b}$

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2. The value of $\int \frac{x}{x^2+1}\,dx$ **is**

(A) 0

(B) $\log 2$

(C) $2\log 2$

(D) $\frac{1}{2}\log 2$

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3. The area bounded by the curve $y = x(x-1)$, x-axis and the ordinates $x = 0$ and $x = 1$ is given by

(A) 0
(B) $\frac{1}{3}$
(C) $\frac{2}{3}$
(D) $\frac{4}{3}$

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4. The integrating factor of differential equation $\frac{dy}{dx} + Py = Q$, where P, Q, R are functions of x is

(A) $e^{\int P\,dx}$
(B) $e^{-\int P\,dx}$
(C) $e^{\int Q\,dx}$
(D) $e^{\int R\,dx}$

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5. The order and degree of the differential equation $\frac{d^2y}{dx^2} + (\sin y)^2 = y^3$ respectively are

(A) $1, 1$
(B) $2, 1$
(C) $2, 2$
(D) $1, 2$

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6. The value of p for which vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $2\hat{i} - p\hat{j} + \hat{k}$ are perpendicular to each other is

(A) 0
(B) 1
(C) $\frac{5}{2}$
(D) $-\frac{5}{2}$

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7. The value of a for which the points with position vectors $-\hat{i} - \hat{j} - 2\hat{k}$, $2\hat{i} + a\hat{j} - 5\hat{k}$ and $a\hat{i} + \hat{j} - 5\hat{k}$ are collinear is

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

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8. If $|\vec{a}| = a$, $|\vec{b}| = 3$ and $|\vec{a} \cdot \vec{b}| = 12$, then the value of $|\vec{a}|$ is

(A) $6\sqrt{3}$
(B) $8\sqrt{3}$
(C) $12\sqrt{3}$

(D) $3\sqrt{12}$

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9. The length of perpendicular drawn from the point $(1, 2, 3)$ on the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{6}$ is

(A) 2
(B) 6
(C) $\sqrt{10}$
(D) $\sqrt{14}$

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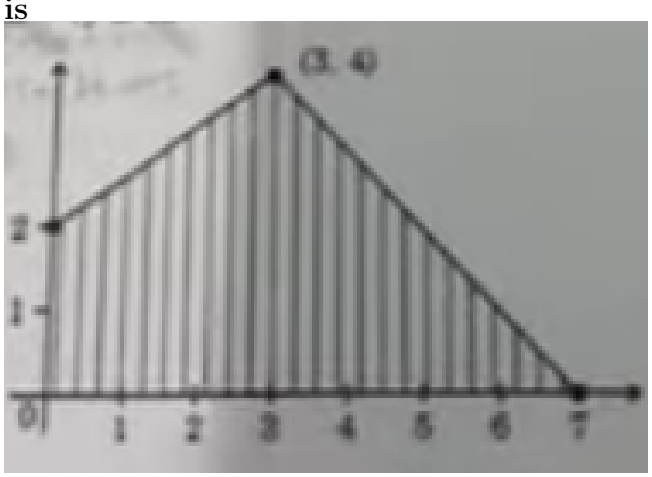
10. The feasible region of a linear programming problem with objective function $Z = 5x + 7y$ is shown below. The maximum value of Z minus minimum value of Z is



(A) 8
(B) 29
(C) 35
(D) 43

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11. The degree of the objective function of a linear programming problem is

(A) 0
(B) 1
(C) 2
(D) Any natural number

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12. If $\vec{a} + \vec{b} = \vec{b}$, then

(A) $\vec{a} + \vec{b} = \vec{b}$
(B) $-\frac{\vec{b}}{2} + \vec{b} = \frac{\vec{b}}{2}$
(C) $-\vec{a} + \vec{b} = \vec{a}$
(D) $\vec{a} + \vec{b} = \vec{a}$

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13. Which of the following cannot be an order of a column matrix?

(A) 1×2
(B) 2×1
(C) $n \times 1$
(D) 1×1, where $n \in \mathbb{N}$

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14. Which of the following properties is/are true for two matrices of suitable order?
(A) $(A + B)' = A' + B'$
(B) $(A - B)' = B' - A'$
(C) $(AB)' = A'B'$
(D) $(AB)' = B'A'$

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15. If $A_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ **and** $A_2 = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 6 \end{bmatrix}$**, then**
(A) $A_1 = 2A_2$
(B) $A_2 = -2A_1$
(C) $A_1 = A_2$
(D) $A_1 = -A_2$

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16. One of the values of x **for which** $\begin{vmatrix} \cos x & \sin x \\ -\cos x & \sin x \end{vmatrix} = 1$ **is**
(A) 0
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{2}$

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17. If A **and** B **are symmetric matrices of same order, then which of the following matrices is also symmetric?**
(A) $A^T + B^T$
(B) $A^T - B^T$
(C) $AB - BA$
(D) $AB + BA$

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18. The absolute maximum value of $f(x) = x^3 - 3x$ **in** $[-1, 2]$ **is**
(A) 20
(B) 1
(C) 0
(D) 2

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19. Assertion (A): Lines given by $x = py + q$, $x = ry + s$ **and** $x = p'y + q'$, $x = r'y + s'$

are perpendicular to each other when $pp' + rr' = 1$.
Reason (R): Two lines $\vec{r} = \vec{a}_1 + k\vec{b}_1$ and $\vec{r} = \vec{a}_2 + k\vec{b}_2$ are perpendicular to each other if $\vec{b}_1 \cdot \vec{b}_2 = 0$.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true and Reason (R) is false.
(D) Assertion (A) is false and Reason (R) is true.

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20. Assertion (A): In an experiment of throwing an unbiased die, the probability of getting a prime number given that the number appearing on the die being odd is $\frac{2}{3}$.
Reason (R): For any two events A and B, $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true and Reason (R) is false.
(D) Assertion (A) is false and Reason (R) is true.

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21. A vector $\vec{a}$ of magnitude 10 has direction ratios 2, 3, -6. Find the projection of the vector on $\vec{i}$.

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22. Vectors $2\hat{i} - \hat{j} + 4\hat{k}$ and $5\hat{i} + \hat{j} + 2\hat{k}$ represent the two adjacent sides of a parallelogram. Find the diagonals and hence find their lengths.

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23. (a) Simplify : $\tan^{-1}\left(\dfrac{\cos 2x - \sin 2x}{\cos 2x + \sin 2x}\right)$, $0 \le x \le \dfrac{\pi}{2}$.
(b) Evaluate : $\tan\left(\sin^{-1}(-1) - \cos^{-1}\left(\dfrac{1}{2}\right)\right)$.

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24. (a) Check whether the function $f(x)$ defined as

$$f(x) = \begin{cases} \dfrac{x-3}{5x-3}, & x < 3 \\ x - 6, & x \ge 3 \end{cases}$$

is continuous at $x = 3$ or not?
OR
(b) If $\sqrt{5x^2 + y^2} = 4xy$, then find $\dfrac{dy}{dx}$ at $\left(\dfrac{1}{2}, \dfrac{\sqrt{3}}{2}\right)$.

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25. (a) Simplify : $\cot^{-1}\left(\sqrt{\dfrac{1+\cos 2x}{1-\cos 2x}}\right)$, **where** $x \in \left(0, \dfrac{\pi}{2}\right)$.

OR

(b) Evaluate : $\sin\left(\tan^{-1}(\sqrt{3}) - \sec^{-1}(2)\right)$.

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26. If $I_1 = \displaystyle\int_1^2 \frac{x^2}{x^4+x^2+2}\,dx$ **and** $I_2 = \displaystyle\int_1^2 \ln x\,dx$, **then show that** $I_1 = 4I_2$.

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27. (a) Find the general solution of the differential equation

$$y^2\,dx + (y^2 - xy + xy^2)\,dy = 0$$

(b) Find the particular solution of the differential equation

$$\frac{dy}{dx} = y\tan x$$

given that $y = 2$ **if** $x = 0$.

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28. Solve the following linear programming problem graphically :
Minimize $Z = 13x - 6y$
Subject to constraints

$$\begin{aligned} x + 5y &\le 5, \\ 2x - 5y + 6 &\ge 0, \\ x \ge 0,\ y &\ge 0. \end{aligned}$$

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29. (a) Out of two bags, bag I contains 3 red and 4 white balls and bag II contains 8 red and 6 white balls. A die is thrown. If it shows a number less than 3 then a ball is drawn at random from bag I, otherwise a ball is drawn at random from bag II. Find the probability that the ball drawn from one of the bags is a red ball.

OR

(b) The probability of simultaneous occurrence of at least one of the two events X **and** Y **is** a. **If the probability that exactly one of the events** X, Y **occurs is** b, **prove that**

$$P(X) + P(Y) = 2 - a + b.$$

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30. Evaluate : $\displaystyle\int_0^{\frac{\pi}{2}} x\cos x\,dx$

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31. (a) Find $\displaystyle\int \sqrt{\frac{x+1}{x-1}}\,dx$

OR

(b) Find $\displaystyle\int \frac{x+4}{x^2-3x+10}\,dx$

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32. If $x = 3\sin t$ **and** $y = 3\cos t$, $0 \le t \le 2\pi$, **find** $\dfrac{dy}{dx}$ **and prove that**

$$\left(\frac{dy}{dx}\right)^2 + 1 = \frac{1}{\cos^2 t}.$$

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33. Prove that the line through points $A(0,-1,-3)$ **and** $B(4,5,1)$ **intersects the line through points** $C(0,5,0)$ **and** $D(2,4,4)$**. Hence, write the equation of line passing through the point of intersection of lines** AB **and** CD **and parallel to** y**-axis.**

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34. (a) A relation R **is defined on** Z**, the set of integers, as**

$$R = \{(x,y) : |x-y| \text{ is divisible by a prime number } p,\ x, y \in Z\}.$$

Check whether R **is an equivalence relation or not.**
OR
(b) A function $f : R - \left\{\frac{3}{5}\right\} \to R - \left\{\frac{1}{5}\right\}$ **is defined as**

$$f(x) = \frac{3x+2}{5x-3}.$$

Show that f **is one-one and onto.**

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35. (a) If $A = \begin{bmatrix} 0 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ **and** A^{-1} **exists, find** x **to solve the following system of equations:**

$$x + y + z = 8, \quad x - y + z = 4, \quad -3y = 10.$$

OR
(b) If $V = \begin{bmatrix} 3 & -1 & \sin 2x \\ 2 & 1 & \cos 2x \\ -11 & 7 & 2 \end{bmatrix}$ **is a singular matrix, then find the value of** x**, where** $x \in \left[0, \frac{\pi}{2}\right]$**.**

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36. In an online jackpot, there is one first prize of 3,00,000, two second prizes of 2,00,000 each and three third prizes of 50,000 each.

A total of 1,00,000 jackpot tickets each costing 100 were sold thereby raising a fund of 1,00,00,000. Rohan bought one ticket.
Based on the given information, answer the following questions:
(i) What are the possible amounts that the person can win?
(ii) (a) What is the probability that the person wins at least 2,00,000?
OR
(b) When a person participates in the online jackpot, Rohan also bought a lottery ticket of 50,000. If Rohan bought one ticket, find the probability that he wins one of the total six jackpot prizes.

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37. Roundabout XYZ offers rides to tour buses to view the parks and sights. One such roundabout is made such that the equation representing its boundary is given by $C_1 : x^2 + y^2 = 9$.
There is a circular pond with a fountain in the middle of the roundabout whose equation is given by $C_2 : x^2 + y^2 = 4$.
Based on the given information, answer the following questions:
(i) Represent the given equations C_1 and C_2 graphically with the help of a diagram.
(ii) Express y as a function of x from both C_1 and C_2.
(iii) (a) Using integration, find the area of region covered by the roundabout boundary.
OR
(b) Using integration, find the area of region covered by the circular pond.

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38. An online platform charges a monthly subscription fee of 500. The management decides to increase the subscription fee. It is predicted that for every increase of 1 in fee, 10 subscribers will discontinue the subscription.

Based on the given information, answer the following questions:
(i) How many subscribers will discontinue after an increase of x in annual fee?
(ii) If $R(x)$ denotes the total revenue collected after the increase of x in subscription fee, express $R(x)$ as a function of x.
(iii) (a) Find the value of x for which $R(x)$ is maximum.
OR
(b) Find the sub-intervals of $(0, 5000)$ in which $R(x)$ is increasing and decreasing.
