MATHS

BOOKS - CBSE MODEL PAPER

SAMPLE PAPER 2022

Section A

1. $\sin\left[\frac{\pi}{3}-\sin^{-1}\left(-\frac{1}{2}\right)\right]$ is equal to :

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. -1

D. 1

Answer:

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2. The value of $k(k < 0)$ for which the function is continuous at $x = 0$

$$f(x) = \begin{cases} \frac{1-\cos kx}{x \sin x} & , x \neq 0 \\ \frac{1}{2} & , x = 0 \end{cases}$$

A. ± 1

B. -1

C. $\pm\frac{1}{2}$

D. $\frac{1}{2}$

Answer: A

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3. If $A=[a_{ij}]$ is a square matrix of order 2 such that $a_{ij}=\begin{cases}1 & \text{when } i\neq j\\ 0 & \text{when } i=j\end{cases}$, then A^2 is:

A. $\begin{bmatrix}1 & 0\\ 1 & 0\end{bmatrix}$

B. $\begin{bmatrix}1 & 1\\ 0 & 0\end{bmatrix}$

C. $\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Answer:

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4. Value of k, for which $A = \begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ is a singular matrix is:

A. 4

B. -4

C. ± 4

D. 0

Answer:

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5. Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is strictly increasing:

A. $(-\infty, 2) \cup (2, \infty)$

B. $(2, \infty)$

C. $(-\infty, 2)$

D. $(-\infty, 2] \cup (2, \infty)$

Answer:

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6. Given that A is a square matrix of order 3×3 and $|A| = -4$. Find $|\text{adj } A|$

A. -4

B. 4

C. -16

D. 16

Answer:

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7. A relation R in set A = {1,2,3} is defined as R = {(1, 1), (1, 2), (2, 2), (3, 3)}. Which of the following ordered pair in R shall be removed to make it an equivalence relation in A?

A. (1, 1)

B. (1, 2)

C. (2, 2)

D. (3, 3)

Answer:

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8. If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then value of a + b – c + 2d is:

A. 8

B. 10

C. 4

D. -8

Answer:

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9. The point at which the normal to the curve $y = x + \frac{1}{x}, x > 0$ is perpendicular to the line 3x – 4y – 7 = 0 is:

A. (2, 5/2)

B. $(\pm 2, 5/2)$

C. $(- 1/2, 5/2)$

D. $(1/2, 5/2)$

Answer: B

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10. $\sin\left(\tan^{-1} x\right), \quad \text{where} \quad |x| < 1$, is equal to:

A. $\dfrac{x}{\sqrt{1-x^2}}$

B. $\dfrac{1}{\sqrt{1-x^2}}$

C. $\dfrac{1}{\sqrt{1+x^2}}$

D. $\dfrac{x}{\sqrt{1+x^2}}$

Answer:

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11. Let the relation R in the set $A = \{x \in Z : 0 \leq x \leq 12\}$, given by

$R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$. Then [1], the equivalence class containing 1, is:

A. {1, 5, 9}

B. {0, 1, 2, 5}

C. ϕ

D. A

Answer:

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

A. e^{y-x}

B. e^{x+y}

C. $-e^{y-x}$

D. $2e^{x-y}$

Answer:

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13. Given that matrices A and B are of order 3×n and m×5 respectively, then the order of matrix C = 5A +3B is:

A. 3×5 and $m = n$

B. 3×5

C. 3×3

D. 5×5

Answer:

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14. If $y = 5\cos x - 3\sin x$, then $\frac{d^2y}{dx^2}$ is equal to :

A. $-y$

B. y

C. 25y

D. 9y

Answer:

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15. For matrix $A = \begin{bmatrix} 2 & 5 \\ -11 & 7 \end{bmatrix}$, (adjA)' is equal to:

A. $\begin{bmatrix} -2 & -5 \\ 11 & -7 \end{bmatrix}$

B. $\begin{bmatrix} 7 & 5 \\ 11 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 7 & 11 \\ -5 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 7 & -5 \\ 11 & 2 \end{bmatrix}$

Answer:

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16. The points on the curve $\frac{x^2}{9} + \frac{y^2}{16} = 1$ at which the tangents are parallel to y- axis are:

A. $(0, \pm 4)$

B. $(\pm 4, 0)$

C. $(\pm 3, 0)$

D. $(0, \pm 3)$

Answer: C

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17. Given that $A = [a_{ij}]$ is a square matrix of order 3×3 and $|A| = -7$, then the value of $\Sigma_i = 1^3 a_{12} A_{12}$, where A_{ij} denotes the cofactor of element a_{ij} is:

A. 7

B. -7

C. 0

D. 49

Answer:

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18. If $y = \log(\cos e^x), \quad \text{then } \dfrac{dy}{dx}$ = ______.

A. $\cos e^{x-1}$

B. $e^{-x} \cos e^x$

C. $e^x \sin e^x$

D. $-e^{x}\tan e^{x}$

Answer:

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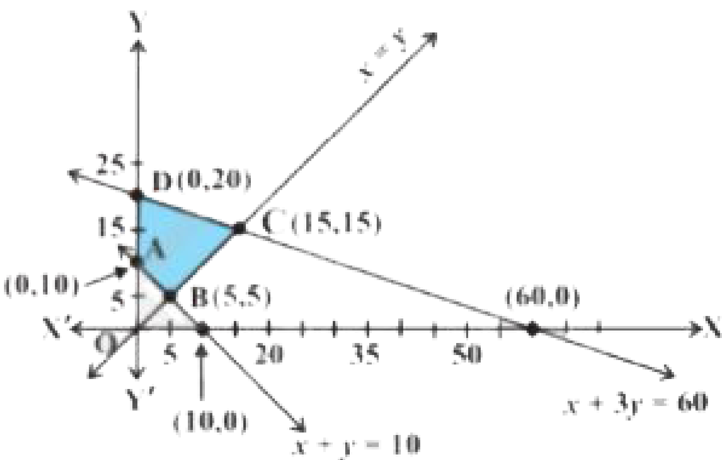
19. Based on the given shaded region as the feasible region in the graph, at which point(s) is the objective function $Z = 3x + 9y$ maximum?



A. Point B

B. Point C

C. Point D

D. every point on the line segment CD

Answer:

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20. The least value of the function $f(x) = 2\cos x + x$ in the closed interval $\left[0, \frac{\pi}{2}\right]$ is:

A. 2

B. $\frac{\pi}{6}+\sqrt{3}$

C. $\frac{\pi}{2}$

D. The least value does not exist.

Answer:

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Section B

1. the function $f: R \to R$ defined as $f(x)=x^3$ is

A. One-on but not onto

B. Not one-one but onto

C. Neither one-one nor onto

D. One-one and onto

Answer:

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2. If $x = a \sec \theta, y = b \tan \theta$ find $\frac{d^2 y}{dx^2}$ at $x = \frac{\pi}{6}$

A. $\frac{-3\sqrt{3}b}{a^2}$

B. $\frac{-2\sqrt{3}b}{a}$

C. $\frac{-3\sqrt{3}b}{a}$

D. $\frac{-b}{3\sqrt{3}a^2}$

Answer:

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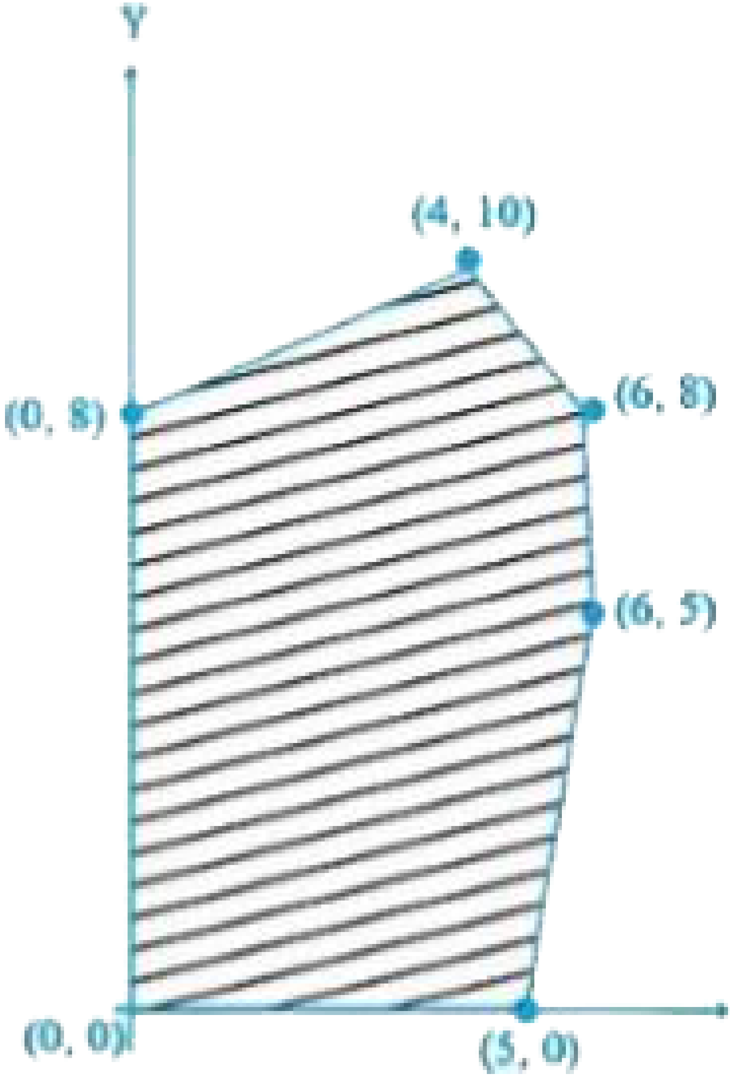
3. In the given graph, the feasible region for a LPP is shaded.

The objective function $Z = 2x - 3y$, will be minimum at:



A. (4, 10)

B. (6, 8)

C. (0, 8)

D. (6, 5)

Answer:

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4. The derivative of $\sin^{-1}\left(2x\sqrt{1-x^2}\right)$ w.r.t. $\sin^{-1}x, \frac{1}{\sqrt{2}} < x < 1$, is:

A. 2

B. $\frac{\pi}{2} - 2$

C. $\frac{\pi}{2}$

D. -2

Answer:

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5. If

$$A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix},$$

then :

A. $A^{-1} = B$

B. $A^{-1} = 6B$

C. $B^{-1} = B$

D. $B^{-1} = \frac{1}{6}A$

Answer:

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6. The real function $f(x) = 2x^3 - 3x^2 - 36x + 7$ is:

A. Strictly increasing in $(-\infty, -2)$ and strictly decreasing in $(-2, \infty)$

B. Strictly decreasing in (−2,3)

C. Strictly decreasing in $(-\infty, 3)$ and strictly increasing in $(3, \infty)$

D. Strictly decreasing in $(-\infty, -2) \cup (3, \infty)$

Answer:

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7. Simplest form of $\tan^{-1}\left(\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right), \pi < x < \frac{3\pi}{2}$

is:

A. $\frac{\pi}{4}+\frac{x}{2}$

B. $\frac{3\pi}{2}-\frac{x}{2}$

C. $-\frac{x}{2}$

D. $\pi-\frac{x}{2}$

Answer: A

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8. Given that A is a non-singular matrix of order 3 such that $A^2=2A$, then value of |2A| is:

A. 4

B. 8

C. 64

D. 16

Answer:

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9. The function f(x) = x + cos x + b is strictly decreasing over R then:

A. $b < 1$

B. No value of b exists

C. $b \leq 1$

D. $b \geq 1$

Answer:

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10. Let R be a relation on the set N given by $R = \{(a,\ b) : a = b - 2,\ b > 6\}$. Then, $(2,\ 4) \in R$ (b) $(3,\ 8) \in R$ (c) $(6,\ 8) \in R$ (d) $(8,\ 7) \in R$

A. $(2, 4) \in R$

B. $(3, 8) \in R$

C. $(6, 8) \in R$

D. $(8, 7) \in R$

Answer:

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11. The point(s), at which the function f given by

$$f(x) = \begin{cases} \frac{x}{|x|}, & x < 0 \\ -1, & x \geq 0 \end{cases}$$ is continuous, is/are:

A. $x \in R$

B. $x = 0$

C. $x \in R - \{0\}$

D. $x = -1 \text{ and } 1$

Answer:

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12. If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of k, a and b respectively are:

A. $-6, -12, -18$

B. $-6, \ -4, \ -9$

C. $-6, 4, 9$

D. $-6, 12, 18$

Answer:

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13. A linear programming problem is as follows:

Minimize Z= 30x + 50y subject to the constraints,

$3x + 5y \geq 15$

$2x + 3y \leq 18$

$x \geq 0, y \geq 0$ In the feasible region, the minimum value of Z occurs at

A. a unique point

B. no point

C. infinitely many points

D. two points only

Answer:

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14. The area of a trapezium is defined by function ? and given by $f(x) = (10 + x)\sqrt{100 - x^2}$, then the area when it is maximized is:

A. $75cm^2$

B. $7\sqrt{3}cm^2$

C. $75\sqrt{3}cm^2$

D. $5cm^2$

Answer:

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15. If A is square matrix such that $A^2 = A$, then show that $(I + A)^3 = 7A + I$.

A. A

B. $I + A$

C. $I - A$

D. I

Answer:

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16. If $\tan^{-1} x = y$, then:

A. $-1 < y < 1$

B. $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$

C. $\frac{-\pi}{2} < y < \frac{\pi}{2}$

D. $y \in \left\{\frac{-\pi}{2}, \frac{\pi}{2}\right\}$

Answer:

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17. Let $A = \{1, 2, 3\}$, $B = \{4, 5, 6, 7\}$and let $f = \{(1, 4), (2, 5), (3, 6)\}$be a function from A to B. Show that f is one-one.

A. Surjective function

B. Injective function

C. Bijective function

D. function

Answer:

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18. For $A\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then $14A^{-1}$ is given by:

A. $14\begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$

B. $\begin{bmatrix} 4 & -2 \\ 2 & 6 \end{bmatrix}$

C. $2\begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$

D. $2\begin{bmatrix} -3 & -1 \\ 1 & -2 \end{bmatrix}$

Answer:

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19. Find the point on the curve $y = x^3 - 11x + 5$ at which the tangent is $y = x - 11$.

A. $(-2, 19)$

B. $(2, -9)$

C. $(\pm 2, 19)$

D. $(-2, 19)$ and $(2, -9)$

Answer:

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20. Given that $A = \begin{bmatrix} \alpha & \beta \\ \gamma & \alpha \end{bmatrix}$ and $A^2 = 3I$, then :

A. $1 + \alpha^2 + \beta\gamma = 0$

B. $1 - \alpha^2 - \beta\gamma = 0$

C. $3 - \alpha^2 - \beta\gamma = 0$

D. $3+\alpha^2+\beta\gamma=0$

Answer:

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Section C

1. For an objective function $Z = ax + by$, where $a, b > 0$, the corner points of the feasible region determined by a set of constraints (linear inequalities) are (0, 20), (10, 10), (30, 30) and (0, 40). The condition on a and b such that the maximum Z occurs at both the points (30, 30) and (0, 40) is:

A. $b - 3a = 0$

B. $a = 3b$

C. $a + 2b = 0$

D. $2a - b = 0$

Answer:

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2. The line $y = mx + 1$ is a tangent to the curve $y^2 = 4x$, if the value of m is (a) 1 (b) 2 (c) 3 (d) 1/2

A. $\frac{1}{2}$

B. 1

C. 2

D. 3

Answer:

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3. The maximum value of $[x(x-1)+1]^{\frac{1}{3}}, 0 \leq x \leq 1$ is:

A. 0

B. $\frac{1}{2}$

C. 1

D. $\sqrt[3]{\frac{1}{3}}$

Answer:

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4. In a linear programming problem, the constraints on the decision variables x and y are $x - 3y \geq 0, y \geq 0, 0 \leq x \leq 3.$ The feasible region

A. is not in the first quadrant

B. is bounded in the first quadrant

C. is unbounded in the first quadrant

D. does not exist

Answer:

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5. Let

$$A\begin{bmatrix} 1 & \sin\alpha & 1 \\ -\sin\alpha & 1 & \sin\alpha \\ -1 & -\sin\alpha & 1 \end{bmatrix}, \quad \text{where} \quad 0 \leq \alpha \leq 2\pi,$$

then:

A. $|A| = 0$

B. $|A| \in (2, \infty)$

C. $|A| \in (2, 4)$

D. $|A| \in [2, 4]$

Answer:

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6. The fuel cost per hour for running a train is proportional to the square of the speed it generates in km per hour. If the fuel costs ₹ 48 per hour at speed 16 km per hour and the fixed charges to run the train amount to ₹ 1200 per hour Assume the speed of the train as v km/h. Given that the fuel cost per hour is k times the square of the speed the train generates in km/h, the value of k is:

A. $\frac{16}{3}$

B. $\frac{1}{3}$

C. 3

D. $\frac{3}{16}$

Answer:

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7. The fuel cost per hour for running a train are proportional to the square of the speed generated in km/h. if the fuel cost is Rs . 48 at 16 km/h . It the fixed charges amount to Rs. 1200/h. If the train has travelled a distance of 500km, then the total cost of running the train is given by function:

A. $\frac{15}{16}v + \frac{600000}{v}$

B. $\frac{375}{4}v + \frac{600000}{v}$

C. $\frac{5}{16}v^2 + \frac{150000}{v}$

D. $\frac{3}{16}v + \frac{6000}{v}$

Answer:

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8. The fuel cost per hour for running a train is proportional to the square of the speed generated in km/h. if the fuel cost is Rs.48/h at 16 km/h . It the fixed charges amount to Rs.1200/h

The most economical speed to run the train is:

A. 18km/h

B. 5km/h

C. 80km/h

D. 40km/h

Answer:

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9. The fuel cost per hour for running a train are proportional to the square of the speed generated in km/h. if the fuel cost is Rs . 48 at 16 km/h . It the fixed charges amount to Rs. 1200/h. The fuel cost for the train to travel 500km at the most economical speed is:

A. ₹ 3750

B. ₹ 750

C. ₹ 7500

D. ₹ 75000

Answer:

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10. The fuel cost per hour for running a train is proportional to the square of the speed it generates in km per hour. If the fuel costs ₹ 48 per hour at speed 16 km per hour and the fixed charges to run the train amount to ₹ 1200 per hour. Assume the speed of the train as v km/h. The total cost of the train to travel 500km at the most economical speed is:

A. ₹ 3750

B. ₹ 75000

C. ₹ 7500

D. ₹ 15000

Answer:

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Section A

1. Find $\int \frac{\log x}{(1+\log x)^2}$ dx

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2. Find $\int \frac{\sin 2x}{9 - \cos^4 x}$ dx

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3. Write the sum of the order and the degree of the following differential equation:

$$\frac{d}{dx}\left(\frac{dy}{dx}\right) = 5$$

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4. If $\widehat{a}$ and $\hat{b}$ are unit vectors, then prove that $\left|\widehat{a} + \hat{b}\right| = 2\cos\left(\frac{\theta}{2}\right)$, where θ is the angle

between them.

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5. Find the direction cosines of the following line:

$$\frac{3-x}{-1}=\frac{2y-1}{2}=\frac{z}{4}$$

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6. A bag contains 1 red and 3 white balls. Find the probability distribution of the number of red balls if 2 balls are drawn at random from the bag one-byone without replacement.

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7. Two cards are drawn at random from a pack of 52 cards one-by-one without replacement. What is the probability of getting first card red and second card Jack ?

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Section B

1. Find: $\int \frac{x+1}{(x^2+1)x}$dx

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2. Find the general solution of the following differential equation:

$$x\frac{dy}{dx} = y - x\sin\left(\frac{y}{x}\right)$$

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3. Find the particular solution of the following differential equation, given that y = 0 when $x = \frac{\pi}{4}$

$$\frac{dy}{dx} + y\cot x = \frac{2}{1+\sin x}$$

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4. If $\vec{a} \neq \vec{0}, \vec{b} = \vec{a}.\vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}$, then show that $\vec{b} = \vec{c}$

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5. Find the shortest distance between the following lines:

$$\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + s\left(2\hat{i} + \hat{j} + \hat{k}\right)$$

$$\vec{r} = \left(\hat{i} + \hat{j} + 2\hat{k}\right) + t\left(4\hat{i} + 2\hat{j} + 2\hat{k}\right)$$

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6. Find the vector and the cartesian equations of the plane containing the point $\hat{i}+2\hat{j}-\hat{k}$ and parallel to the lines $\overrightarrow{r}=\left(\hat{i}+2\hat{j}+2\hat{k}\right)+s\left(2\hat{i}-3\hat{j}+2\hat{k}\right)=0$ and $\overrightarrow{r}=\left(3\hat{i}+\hat{j}-2\hat{k}\right)+t\left(\hat{i}-3\hat{j}+\hat{k}\right)=0$

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Section C

1. Evaluate: $\int_{-1}^{2}\left|x^3-3x^2+2x\right|dx$

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2. Using integration, find the area of the region in the first quadrant enclosed by the line x + y = 2, the parabola $y^2 = x$ and the x-axis.

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3. Using integration, find the area of the region.

$\{(x, y) : 0 \leq y \leq \sqrt{3}x, x^2 + y^2 \leq 4\}$

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4. Find the foot of the perpendicular from the point (1, 2, 0) upon the plane $x - 3y + 2z = 9$, Hence, find the distance of the point (1, 2, 0) from the given plane.

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5. 

An insurance company believes that people can be divided into two classes: those who are accident prone and those who are not. The company's statistics show that an accident-prone person will have an accident at sometime within a fixed one-year period with probability 0.6, whereas this probability is 0.2 for a person who is not accident prone. The company knows that 20 percent of the population is accident prone.

Based on the given information, answer the following questions.

(i)what is the probability that a new policyholder will have an accident within a year of purchasing a policy ?

(ii) Suppose that a new policyholder has an accident within a year of purchasing a policy.

What is the probability that he or she is accident prone?

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