Mathematics Section A

Section Id :	864351828
Section Number :	5
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Sub-Section Number :	1
Sub-Section Id :	8643511055
Question Shuffling Allowed :	Yes

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let P and Q be two distinct points on a circle which has center at C(2, 3) and which passes through origin O. If OC is perpendicular to both the line segments CP and CQ, then the set{P, Q} is equal to :

Options :

1. $\{(2+2\sqrt{2}, 3+\sqrt{5}), (2-2\sqrt{2}, 3-\sqrt{5})\}$

2. $\{(2+2\sqrt{2}, 3-\sqrt{5}), (2-2\sqrt{2}, 3+\sqrt{5})\}$

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3. $\{(-1, 5), (5, 1)\}$

4. $\{(4, 0), (0, 6)\}$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + 2\hat{j} + 3\hat{k}$. Then the vector product

$\left(\vec{a} + \vec{b}\right) \times \left(\left(\vec{a} \times \left(\left(\vec{a} - \vec{b}\right) \times \vec{b}\right)\right) \times \vec{b}\right)$ is equal to :

Options :

1. $5\left(30\hat{i} - 5\hat{j} + 7\hat{k}\right)$

2. $7\left(30\hat{i} - 5\hat{j} + 7\hat{k}\right)$

3. $5\left(34\hat{i} - 5\hat{j} + 3\hat{k}\right)$

4. $7\left(34\hat{i} - 5\hat{j} + 3\hat{k}\right)$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

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If the coefficients of x^7 in $\left(x^2+\frac{1}{bx}\right)^{11}$ and x^{-7} in $\left(x-\frac{1}{bx^2}\right)^{11}$, $b \neq 0$, are equal, then the value of b is equal to :

Options :

1. -1

2. 2

3. -2

4. 1

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If the area of the bounded region

$$R = \left\{(x, y) : \max\{0, \log_e x\} \leq y \leq 2^x, \frac{1}{2} \leq x \leq 2\right\}$$

is, $\alpha(\log_e 2)^{-1} + \beta(\log_e 2) + \gamma$, then the value of $(\alpha+\beta-2\gamma)^2$ is equal to :

Options :

1. 1

2. 2

3. 4

4. 8

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Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $A=\begin{bmatrix}1 & 2\\ -1 & 4\end{bmatrix}$. If $A^{-1}=\alpha I+\beta A$, $\alpha, \beta \in \mathbf{R}$, I is a 2×2 identity matrix, then $4(\alpha-\beta)$ is equal to :

Options :

1. 2

2. 4

3. 5

4. $\frac{8}{3}$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two tangents are drawn from the point $P(-1, 1)$ to the circle $x^2+y^2-2x-6y+6=0$. If these tangents touch the circle at points A and B, and if D is a point on the circle such that length of the segments AB and AD are equal, then the area of the triangle ABD is equal to :

Options :

1. 2

2. 4

3. $(3\sqrt{2}+2)$

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4. $3(\sqrt{2}-1)$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $\mathbf{C}$ be the set of all complex numbers. Let

$S_1=\{z \in \mathbf{C} : |z-3-2i|^2=8\}$,

$S_2=\{z \in \mathbf{C} : \mathrm{Re}(z) \geq 5\}$ and

$S_3=\{z \in \mathbf{C} : |z-\bar{z}| \geq 8\}$.

Then the number of elements in $S_1 \cap S_2 \cap S_3$ is equal to :

Options :

1. 0

2. 1

3. 2

4. Infinite

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the plane passing through the point $(-1, 0, -2)$ and perpendicular to each of the planes $2x+y-z=2$ and $x-y-z=3$ be $ax+by+cz+8=0$. Then the value of $a+b+c$ is equal to :

Options :

1. 5

2. 3

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3. 4

4. 8

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let α, β be two roots of the equation $x^2 + (20)^{\frac{1}{4}} x + (5)^{\frac{1}{2}} = 0$. Then $\alpha^8 + \beta^8$ is equal to :

Options :

1. 100

2. 10

3. 50

4. 160

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

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Let $f:\left(-\frac{\pi}{4},\frac{\pi}{4}\right)\to \mathbf{R}$ be defined as

$$f(x)=\begin{cases}(1+|\sin x|)^{\frac{3a}{|\sin x|}}, & -\frac{\pi}{4}<x<0\\ b, & x=0\\ e^{\cot 4x/\cot 2x}, & 0<x<\frac{\pi}{4}\end{cases}$$

If f is continuous at $x=0$, then the value of $6a+b^2$ is equal to :

Options :

1. $1+e$

2. $1-e$

3. e

4. $e-1$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let

$A=\{(x,y)\in \mathbf{R}\times\mathbf{R} \mid 2x^2+2y^2-2x-2y=1\}$,

$B=\{(x,y)\in \mathbf{R}\times\mathbf{R} \mid 4x^2+4y^2-16y+7=0\}$ and

$C=\{(x,y)\in \mathbf{R}\times\mathbf{R} \mid x^2+y^2-4x-2y+5\le r^2\}$.

Then the minimum value of $|r|$ such that $A\cup B\subseteq C$ is equal to :

Options :

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1. $\frac{3+\sqrt{10}}{2}$

2. $1+\sqrt{5}$

3. $\frac{2+\sqrt{10}}{2}$

4. $\frac{3+2\sqrt{5}}{2}$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If the mean and variance of the following data :

6, 10, 7, 13, a, 12, b, 12

are 9 and $\frac{37}{4}$ respectively, then $(a-b)^2$ is equal to :

Options :

1. 16

2. 12

3. 24

4. 32

Question Type : MCQ Is Question Mandatory : No

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Correct Marks : 4 Wrong Marks : 1

Let $y=y(x)$ be solution of the differential equation $\log_e\left(\frac{dy}{dx}\right)=3x+4y$, with $y(0)=0$.

If $y\left(-\frac{2}{3}\log_e 2\right)=\alpha\log_e 2$, then the value of α is equal to :

Options :

1. $-\frac{1}{4}$

2. $\frac{1}{4}$

3. 2

4. $-\frac{1}{2}$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If $\sin\theta+\cos\theta=\frac{1}{2}$, then $16(\sin(2\theta)+\cos(4\theta)+\sin(6\theta))$ is equal to :

Options :

1. 23

2. -23

3. 27

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4. -27

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The probability that a randomly selected 2-digit number belongs to the set $\{n \in \mathbf{N} : (2^n - 2)$ is a multiple of $3\}$ is equal to :

Options :

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

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

3. $\frac{2}{3}$

4. $\frac{1}{6}$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

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A ray of light through $(2, 1)$ is reflected at a point P on the y-axis and then passes through the point $(5, 3)$. If this reflected ray is the directrix of an ellipse with eccentricity $\frac{1}{3}$ and the distance of the nearer focus from this directrix is $\frac{8}{\sqrt{53}}$, then the equation of the other directrix can be :

Options :

1. $2x-7y-39=0$ or $2x-7y-7=0$

2. $11x+7y+8=0$ or $11x+7y-15=0$

3. $2x-7y+29=0$ or $2x-7y-7=0$

4. $11x-7y-8=0$ or $11x+7y+15=0$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The compound statement $(P \vee Q) \wedge (\sim P) \Rightarrow Q$ is equivalent to :

Options :

1. $\sim(P \Rightarrow Q)$

2. $P \wedge \sim Q$

3. $\sim(P \Rightarrow Q) \Leftrightarrow P \wedge \sim Q$

4. $P \vee Q$

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Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $f : \mathbf{R} \to \mathbf{R}$ be a function such that $f(2)=4$ and $f'(2)=1$. Then, the value of

$\lim\limits_{x\to 2} \dfrac{x^2 f(2) - 4f(x)}{x-2}$ is equal to :

Options :

1. 4

2. 8

3. 12

4. 16

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The value of $\lim\limits_{n\to\infty} \dfrac{1}{n} \sum\limits_{j=1}^{n} \dfrac{(2j-1)+8n}{(2j-1)+4n}$ is equal to :

Options :

1. $5 + \log_e\left(\dfrac{3}{2}\right)$

2. $1 + 2\log_e\left(\dfrac{3}{2}\right)$

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3. $2 - \log_e\left(\frac{2}{3}\right)$

4. $3 + 2\log_e\left(\frac{2}{3}\right)$

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The value of the definite integral

$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{dx}{(1+e^{x\cos x})(\sin^4 x + \cos^4 x)}$$

is equal to :

Options :

1. $\frac{\pi}{2\sqrt{2}}$

2. $-\frac{\pi}{4}$

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

4. $\frac{\pi}{\sqrt{2}}$

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Mathematics Section B

Section Id :	864351829
Section Number :	6
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	5
Section Marks :	20
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Sub-Section Number :	1
Sub-Section Id :	8643511056
Question Shuffling Allowed :	Yes

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let a plane P pass through the point $(3, 7, -7)$ and contain the line,

$\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$. If distance of the plane P from the origin is d, then d^2 is equal to

_____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

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Question Type : SA

Correct Marks : 4 Wrong Marks : 0

$$\text{Let } f(x) = \begin{vmatrix} \sin^2 x & -2 + \cos^2 x & \cos 2x \\ 2 + \sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & 1 + \cos 2x \end{vmatrix}, \ x \in [0, \pi].$$

Then the maximum value of $f(x)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $F : [3, 5] \to \mathbf{R}$ be a twice differentiable function on $(3, 5)$ such that

$$F(x) = e^{-x} \int_3^x (3t^2 + 2t + 4F'(t))dt.$$

If $F'(4) = \dfrac{\alpha e^{\beta} - 224}{(e^{\beta} - 4)^2}$, then $\alpha + \beta$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

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1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b}$ and $\vec{c} = \hat{j} - \hat{k}$ be three vectors such that $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \cdot \vec{b} = 1$. If the length of projection vector of the vector $\vec{b}$ on the vector $\vec{a} \times \vec{c}$ is l, then the value of $3l^2$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let the domain of the function

$$f(x) = \log_4\left(\log_5\left(\log_3\left(18x - x^2 - 77\right)\right)\right)$$ be (a, b).

Then the value of the integral

$$\int_a^b \frac{\sin^3 x}{(\sin^3 x + \sin^3(a + b - x))}dx$$

is equal to _____.

Response Type : Numeric

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Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If $\log_3 2, \log_3(2^x-5), \log_3\left(2^x-\frac{7}{2}\right)$ are in an arithmetic progression, then the value of x is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

For real numbers α and β, consider the following system of linear equations :

$x+y-z=2,\ x+2y+\alpha z=1,\ 2x-y+z=\beta.$

If the system has infinite solutions, then $\alpha+\beta$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

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Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $S=\{1, 2, 3, 4, 5, 6, 7\}$. Then the number of possible functions $f: S \to S$ such that $f(m \cdot n)=f(m) \cdot f(n)$ for every $m, n \in S$ and $m \cdot n \in S$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If $y=y(x), \quad y \in \left[0, \frac{\pi}{2}\right)$ is the solution of the differential equation

$$\sec y \frac{dy}{dx} - \sin(x+y) - \sin(x-y) = 0, \text{ with } y(0)=0, \text{ then } 5y'\left(\frac{\pi}{2}\right) \text{ is equal to } \_\_\_\_\_.$$

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

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Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $f : [0, 3] \to \mathbf{R}$ be defined by

$f(x) = \min\{x - [x], 1 + [x] - x\}$

where $[x]$ is the greatest integer less than or equal to x.

Let P denote the set containing all $x \in [0, 3]$ where f is discontinuous, and Q denote the set containing all $x \in (0, 3)$ where f is not differentiable. Then the sum of number of elements in P and Q is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

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