

Mathematics Section A

Section Id :	864351377
Section Number :	5
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	864351377
Question Shuffling Allowed :	Yes

Question Number : 61 Question Id : 8643515641 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

If $15\sin^4\alpha + 10\cos^4\alpha = 6$, for some $\alpha \in \mathbb{R}$, then the value of $27\sec^6\alpha + 8\operatorname{cosec}^6\alpha$ is equal to :

Options :

86435116921. 500

86435116922. 400

86435116923. 350

86435116924. 250

Question Number : 62 Question Id : 8643515642 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If P and Q are two statements, then which of the following compound statement is a tautology ?

Options :

86435116925. $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow P$ 86435116926. $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow Q$ 86435116927. $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow \sim P$ 86435116928. $((P \Rightarrow Q) \wedge \sim Q) \Rightarrow (P \wedge Q)$

Question Number : 63 Question Id : 8643515643 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A pole stands vertically inside a triangular park ABC. Let the angle of elevation of the top of the pole from each corner of the park be $\frac{\pi}{3}$. If the radius of the circumcircle of ΔABC is 2,

then the height of the pole is equal to :

Options :

86435116929. $\frac{2\sqrt{3}}{3}$ 86435116930. $2\sqrt{3}$ 86435116931. $\frac{1}{\sqrt{3}}$ 86435116932. $\sqrt{3}$

Question Number : 64 Question Id : 8643515644 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let in a series of $2n$ observations, half of them are equal to a and remaining half are equal to $-a$. Also by adding a constant b in each of these observations, the mean and standard deviation of new set become 5 and 20, respectively. Then the value of $a^2 + b^2$ is equal to :

Options :

86435116933. $\frac{925}{2}$

86435116934. $\frac{425}{2}$

86435116935. $\frac{650}{2}$

86435116936. $\frac{250}{2}$

Question Number : 65 Question Id : 8643515645 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let in a Binomial distribution, consisting of 5 independent trials, probabilities of exactly 1 and 2 successes be 0.4096 and 0.2048 respectively. Then the probability of getting exactly 3 successes is equal to :

Options :

86435116937. $\frac{40}{243}$

86435116938. $\frac{80}{243}$

86435116939. $\frac{128}{625}$

86435116940. $\frac{32}{625}$

Question Number : 66 Question Id : 8643515646 Question Type : MCQ Option Sh

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

In a triangle ABC, if $|\vec{BC}| = 8$, $|\vec{CA}| = 7$, $|\vec{AB}| = 10$, then the projection of the vector \vec{AB} on \vec{AC} is equal to :

Options :

86435116941. $\frac{115}{16}$

86435116942. $\frac{85}{14}$

86435116943. $\frac{127}{20}$

86435116944. $\frac{25}{4}$

Question Number : 67 Question Id : 8643515647 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the centroid of an equilateral triangle ABC be at the origin. Let one of the sides of the equilateral triangle be along the straight line $x + y = 3$. If R and r be the radius of circumcircle and incircle respectively of ΔABC , then $(R + r)$ is equal to :

Options :

86435116945. $2\sqrt{2}$

86435116946. $\frac{9}{\sqrt{2}}$

86435116947. $7\sqrt{2}$

86435116948. $3\sqrt{2}$

Question Number : 68 Question Id : 8643515648 Question Type : MCQ Option Sh

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let a tangent be drawn to the ellipse $\frac{x^2}{27} + y^2 = 1$ at $(3\sqrt{3}\cos\theta, \sin\theta)$ where $\theta \in \left(0, \frac{\pi}{2}\right)$.

Then the value of θ such that the sum of intercepts on axes made by this tangent is minimum is equal to :

Options :

86435116949. $\frac{\pi}{3}$

86435116950. $\frac{\pi}{6}$

86435116951. $\frac{\pi}{8}$

86435116952. $\frac{\pi}{4}$

Question Number : 69 Question Id : 8643515649 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $y=y(x)$ be the solution of the differential equation $\frac{dy}{dx} = (y+1)((y+1)e^{x^{2/2}} - x)$,

$0 < x < 2.1$, with $y(2)=0$. Then the value of $\frac{dy}{dx}$ at $x=1$ is equal to :

Options :

86435116953. $\frac{e^{5/2}}{(1+e^2)^2}$

86435116954. $-\frac{2e^2}{(1+e^2)^2}$

$$\frac{5e^{1/2}}{(e^2 + 1)^2}$$

86435116955.

$$\frac{-e^{3/2}}{(e^2 + 1)^2}$$

86435116956.

Question Number : 70 Question Id : 8643515650 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The area bounded by the curve $4y^2 = x^2(4 - x)(x - 2)$ is equal to :

Options :

$$\frac{3\pi}{8}$$

86435116957.

$$\frac{\pi}{16}$$

86435116958.

$$\frac{\pi}{8}$$

86435116959.

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

86435116960.

Question Number : 71 Question Id : 8643515651 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $g(x) = \int_0^x f(t)dt$, where f is continuous function in $[0, 3]$ such that $\frac{1}{3} \leq f(t) \leq 1$ for all

$t \in [0, 1]$ and $0 \leq f(t) \leq \frac{1}{2}$ for all $t \in (1, 3]$. The largest possible interval in which $g(3)$ lies is :

Options :

$$\left[\frac{1}{3}, 2 \right]$$

86435116961.

86435116962. $\left[-1, -\frac{1}{2}\right]$

86435116963. $[1, 3]$

86435116964. $\left[-\frac{3}{2}, -1\right]$

Question Number : 72 Question Id : 8643515652 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as

$$f(x) = \begin{cases} \frac{\sin(a+1)x + \sin 2x}{2x}, & \text{if } x < 0 \\ b, & \text{if } x = 0 \\ \frac{\sqrt{x+bx^3} - \sqrt{x}}{bx^{5/2}}, & \text{if } x > 0 \end{cases}$$

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

Options :

86435116965. $-\frac{5}{2}$

86435116966. -3

86435116967. -2

86435116968. $-\frac{3}{2}$

Question Number : 73 Question Id : 8643515653 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let S_1 be the sum of first $2n$ terms of an arithmetic progression. Let S_2 be the sum of first $4n$ terms of the same arithmetic progression. If $(S_2 - S_1)$ is 1000, then the sum of the first $6n$ terms of the arithmetic progression is equal to :

Options :

86435116969. 7000

86435116970. 5000

86435116971. 3000

86435116972. 1000

Question Number : 74 Question Id : 8643515654 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $S_1 : x^2 + y^2 = 9$ and $S_2 : (x - 2)^2 + y^2 = 1$. Then the locus of center of a variable circle S which touches S_1 internally and S_2 externally always passes through the points :

Options :

86435116973. $\left(2, \pm \frac{3}{2}\right)$

86435116974. $(0, \pm \sqrt{3})$

86435116975. $(1, \pm 2)$

86435116976. $\left(\frac{1}{2}, \pm \frac{\sqrt{5}}{2}\right)$

Question Number : 75 Question Id : 8643515655 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the system of linear equations

$$4x + \lambda y + 2z = 0$$

$$2x - y + z = 0$$

$$\mu x + 2y + 3z = 0, \lambda, \mu \in \mathbb{R}.$$

has a non-trivial solution. Then which of the following is true ?

Options :

86435116977. $\lambda = 3, \mu \in \mathbb{R}$

86435116978. $\mu = -6, \lambda \in \mathbb{R}$

86435116979. $\lambda = 2, \mu \in \mathbb{R}$

86435116980. $\mu = 6, \lambda \in \mathbb{R}$

Question Number : 76 Question Id : 8643515656 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $f: \mathbb{R} - \{3\} \rightarrow \mathbb{R} - \{1\}$ be defined by $f(x) = \frac{x-2}{x-3}$.

Let $g: \mathbb{R} \rightarrow \mathbb{R}$ be given as $g(x) = 2x - 3$. Then, the sum of all the values of x for which

$f^{-1}(x) + g^{-1}(x) = \frac{13}{2}$ is equal to.

Options :

86435116981. 2

86435116982. 5

86435116983. 3

86435116984. 7

Question Number : 77 Question Id : 8643515657 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let a complex number be $w = 1 - \sqrt{3}i$. Let another complex number z be such that $|zw| = 1$ and $\arg(z) - \arg(w) = \frac{\pi}{2}$. Then the area of the triangle with vertices origin, z and w is equal to :

Options :

86435116985. $\frac{1}{2}$

86435116986. 2

86435116987. $\frac{1}{4}$

86435116988. 4

Question Number : 78 Question Id : 8643515658 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Define a relation R over a class of $n \times n$ real matrices A and B as

" ARB iff there exists a non-singular matrix P such that $PAP^{-1} = B$ ".

Then which of the following is true ?

Options :

86435116989. R is reflexive, symmetric but not transitive

86435116990. R is reflexive, transitive but not symmetric

86435116991. R is symmetric, transitive but not reflexive,

86435116992. R is an equivalence relation

Question Number : 79 Question Id : 8643515659 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Consider a hyperbola $H : x^2 - 2y^2 = 4$. Let the tangent at a point $P (4, \sqrt{6})$ meet the x -axis at Q and latus rectum at $R (x_1, y_1)$, $x_1 > 0$. If F is a focus of H which is nearer to the point P , then the area of ΔQFR is equal to .

Options :

86435116993. $\sqrt{6} - 1$

86435116994. $\frac{7}{\sqrt{6}} - 2$

86435116995. $4\sqrt{6} - 1$

86435116996. $4\sqrt{6}$

Question Number : 80 Question Id : 8643515660 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let \vec{a} and \vec{b} be two non-zero vectors perpendicular to each other and $|\vec{a}| = |\vec{b}|$. If

$|\vec{a} \times \vec{b}| = |\vec{a}|$, then the angle between the vectors $(\vec{a} + \vec{b} + (\vec{a} \times \vec{b}))$ and \vec{a} is equal to :

Options :

86435116997. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

86435116998. $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

86435116999. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

86435117000. $\sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$

Mathematics Section B

Section Id :	864351378
Section Number :	6
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	5
Section Marks :	20
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	864351378
Question Shuffling Allowed :	Yes

Question Number : 81 Question Id : 8643515661 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If $f(x)$ and $g(x)$ are two polynomials such that the polynomial $P(x) = f(x^3) + x g(x^3)$ is divisible by $x^2 + x + 1$, then $P(1)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 82 Question Id : 8643515662 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let I be an identity matrix of order 2×2 and $P = \begin{bmatrix} 2 & -1 \\ 5 & -3 \end{bmatrix}$. Then the value of $n \in \mathbb{N}$ for which

$P^n = 5I - 8P$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 83 Question Id : 8643515663 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The term independent of x in the expansion of $\left[\frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}} \right]^{10}$, $x \neq 1$, is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 84 Question Id : 8643515664 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If $\sum_{r=1}^{10} r! (r^3 + 6r^2 + 2r + 5) = \alpha (11!)$,

then the value of α is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 85 Question Id : 8643515665 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $P(x)$ be a real polynomial of degree 3 which vanishes at $x = -3$. Let $P(x)$ have local minima at $x = 1$, local maxima at $x = -1$ and $\int_{-1}^1 P(x) dx = 18$, then the sum of all the coefficients of the polynomial $P(x)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 86 Question Id : 8643515666 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $y = y(x)$ be the solution of the differential equation $x dy - y dx = \sqrt{(x^2 - y^2)} dx$, $x \geq 1$, with $y(1) = 0$. If the area bounded by the line $x = 1$, $x = e^\pi$, $y = 0$ and $y = y(x)$ is $\alpha e^{2\pi} + \beta$, then the value of $10(\alpha + \beta)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 87 Question Id : 8643515667 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let P be a plane containing the line $\frac{x-1}{3} = \frac{y+6}{4} = \frac{z+5}{2}$ and parallel to the line $\frac{x-3}{4} = \frac{y-2}{-3} = \frac{z+5}{7}$. If the point $(1, -1, \alpha)$ lies on the plane P, then the value of $|5\alpha|$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 88 Question Id : 8643515668 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let the mirror image of the point $(1, 3, a)$ with respect to the plane $\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) - b = 0$ be $(-3, 5, 2)$. Then, the value of $|a + b|$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

Question Number : 89 Question Id : 8643515669 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let nC_r denote the binomial coefficient of x^r in the expansion of $(1+x)^n$.

If $\sum_{k=0}^{10} (2^2 + 3k) {}^nC_k = \alpha \cdot 3^{10} + \beta \cdot 2^{10}$, $\alpha, \beta \in \mathbb{R}$, 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 :

100

Question Number : 90 Question Id : 8643515670 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $f: \mathbb{R} \rightarrow \mathbb{R}$ satisfy the equation $f(x+y) = f(x) \cdot f(y)$ for all $x, y \in \mathbb{R}$ and $f(x) \neq 0$ for any $x \in \mathbb{R}$.

If the function f is differentiable at $x=0$ and $f'(0)=3$, then $\lim_{h \rightarrow 0} \frac{1}{h} (f(h) - 1)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100