

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 :	8643511013
Question Shuffling Allowed :	Yes

Question Number : 61 Question Id : 86435118250 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let an ellipse $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a^2 > b^2$, passes through $\left(\frac{\sqrt{3}}{2}, 1\right)$ and has eccentricity $\frac{1}{\sqrt{3}}$. If

a circle, centered at focus $F(\alpha, 0), \alpha > 0$, of E and radius $\frac{2}{\sqrt{3}}$, intersects E at two points P and

Q , then PQ^2 is equal to :

Options :

86435161331. $\frac{8}{3}$

86435161332. $\frac{4}{3}$

86435161333. $\frac{16}{3}$

86435161334. 3

Question Number : 62 Question Id : 86435118251 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

$$\frac{dy}{dx} = 1 + x e^{y-x}, \quad -\sqrt{2} < x < \sqrt{2}, \quad y(0) = 0$$

then, the minimum value of $y(x)$, $x \in (-\sqrt{2}, \sqrt{2})$ is equal to :

Options :

86435161335. $(1 - \sqrt{3}) - \log_e (\sqrt{3} - 1)$

86435161336. $(1 + \sqrt{3}) - \log_e (\sqrt{3} - 1)$

86435161337. $(2 - \sqrt{3}) - \log_e 2$

86435161338. $(2 + \sqrt{3}) + \log_e 2$

Question Number : 63 Question Id : 86435118252 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The area (in sq. units) of the region, given by the set

$$\{(x, y) \in \mathbf{R} \times \mathbf{R} \mid x \geq 0, 2x^2 \leq y \leq 4 - 2x\}$$
 is :

Options :

86435161339. $\frac{7}{3}$

$$86435161340. \quad \frac{8}{3}$$

$$86435161341. \quad \frac{13}{3}$$

$$86435161342. \quad \frac{17}{3}$$

**Question Number : 64 Question Id : 86435118253 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

Let $f: [0, \infty) \rightarrow [0, \infty)$ be defined as

$$f(x) = \int_0^x [y] dy$$

where $[x]$ is the greatest integer less than or equal to x . Which of the following is true ?

Options :

86435161343. f is differentiable at every point in $[0, \infty)$.

86435161344. f is continuous at every point in $[0, \infty)$ and differentiable except at the integer points.

86435161345. f is continuous everywhere except at the integer points in $[0, \infty)$.

86435161346. f is both continuous and differentiable except at the integer points in $[0, \infty)$.

**Question Number : 65 Question Id : 86435118254 Question Type : MC
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

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

$$f(x) = \begin{cases} \frac{\lambda|x^2 - 5x + 6|}{\mu(5x - x^2 - 6)}, & x < 2 \\ e^{\frac{\tan(x-2)}{x-[x]}} & , x > 2 \\ \mu & , x = 2 \end{cases}$$

where $[x]$ is the greatest integer less than or equal to x . If f is continuous at $x = 2$, then $\lambda + \mu$ is equal to :

Options :

86435161347. 1

86435161348. $2e - 1$

86435161349. $e(e - 2)$

86435161350. $e(-e + 1)$

Question Number : 66 Question Id : 86435118255 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let $g: \mathbb{N} \rightarrow \mathbb{N}$ be defined as

$$g(3n + 1) = 3n + 2,$$

$$g(3n + 2) = 3n + 3,$$

$$g(3n + 3) = 3n + 1, \text{ for all } n \geq 0.$$

Then which of the following statements is true ?

Options :

86435161351. $g \circ g \circ g = g$

86435161352. There exists a one-one function $f: \mathbf{N} \rightarrow \mathbf{N}$ such that $f \circ g = f$

86435161353. There exists an onto function $f: \mathbf{N} \rightarrow \mathbf{N}$ such that $f \circ g = f$

86435161354. There exists a function $f: \mathbf{N} \rightarrow \mathbf{N}$ such that $g \circ f = f$

**Question Number : 67 Question Id : 86435118256 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

Let $f(x) = 3\sin^4x + 10\sin^3x + 6\sin^2x - 3$, $x \in \left[-\frac{\pi}{6}, \frac{\pi}{2}\right]$. Then, f is :

Options :

86435161355. increasing in $\left(-\frac{\pi}{6}, 0\right)$

86435161356. decreasing in $\left(0, \frac{\pi}{2}\right)$

86435161357. increasing in $\left(-\frac{\pi}{6}, \frac{\pi}{2}\right)$

86435161358. decreasing in $\left(-\frac{\pi}{6}, 0\right)$

Question Number : 68 Question Id : 86435118257 Question Type : MC

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let a parabola P be such that its vertex and focus lie on the positive x-axis at a distance 2 and 4 units from the origin, respectively. If tangents are drawn from O(0, 0) to the parabola P which meet P at S and R, then the area (in sq. units) of Δ SOR is equal to :

Options :

86435161359. 16

86435161360. $16\sqrt{2}$

86435161361. $8\sqrt{2}$

86435161362. 32

Question Number : 69 Question Id : 86435118258 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the foot of perpendicular from a point P(1, 2, -1) to the straight line L : $\frac{x}{1} = \frac{y}{0} = \frac{z}{-1}$ be

N. Let a line be drawn from P parallel to the plane $x + y + 2z = 0$ which meets L at point Q. If α is the acute angle between the lines PN and PQ, then $\cos\alpha$ is equal to _____.

Options :

86435161363. $\frac{\sqrt{3}}{2}$

86435161364. $\frac{1}{\sqrt{3}}$

86435161365.

$$\frac{1}{\sqrt{5}}$$

86435161366. $\frac{1}{2\sqrt{3}}$

Question Number : 70 Question Id : 86435118259 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If b is very small as compared to the value of a , so that the cube and other higher powers of

$\frac{b}{a}$ can be neglected in the identity

$$\frac{1}{a-b} + \frac{1}{a-2b} + \frac{1}{a-3b} + \dots + \frac{1}{a-nb} = \alpha n + \beta n^2 + \gamma n^3,$$

then the value of γ is :

Options :

86435161367. $\frac{a+b}{3a^2}$

86435161368. $\frac{a+b^2}{3a^3}$

86435161369. $\frac{a^2+b}{3a^3}$

86435161370. $\frac{b^2}{3a^3}$

Question Number : 71 Question Id : 86435118260 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let the vectors

$$(2 + a + b)\hat{i} + (a + 2b + c)\hat{j} - (b + c)\hat{k},$$

$$(1 + b)\hat{i} + 2b\hat{j} - b\hat{k} \text{ and } (2 + b)\hat{i} + 2b\hat{j} + (1 - b)\hat{k}, a, b, c \in \mathbf{R}$$

be co-planar. Then which of the following is true ?

Options :

86435161371. $2b = a + c$

86435161372. $2a = b + c$

86435161373. $3c = a + b$

86435161374. $a = b + 2c$

Question Number : 72 Question Id : 86435118261 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The number of real roots of the equation

$$e^{6x} - e^{4x} - 2e^{3x} - 12e^{2x} + e^x + 1 = 0 \text{ is :}$$

Options :

86435161375. 1

86435161376. 2

86435161377. 4

86435161378. 6

**Question Number : 73 Question Id : 86435118262 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

A spherical gas balloon of radius 16 meter subtends an angle 60° at the eye of the observer A while the angle of elevation of its center from the eye of A is 75° . Then the height (in meter) of the top most point of the balloon from the level of the observer's eye is :

Options :

86435161379. $8(2 + 2\sqrt{3} + \sqrt{2})$

86435161380. $8(\sqrt{6} + \sqrt{2} + 2)$

86435161381. $8(\sqrt{6} - \sqrt{2} + 2)$

86435161382. $8(\sqrt{2} + 2 + \sqrt{3})$

**Question Number : 74 Question Id : 86435118263 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

Let 9 distinct balls be distributed among 4 boxes, B_1, B_2, B_3 and B_4 . If the probability that B_3

contains exactly 3 balls is $k\left(\frac{3}{4}\right)^9$ then k lies in the set :

Options :

86435161383. $\{x \in \mathbf{R} : |x - 1| < 1\}$

86435161384. $\{x \in \mathbf{R} : |x - 2| \leq 1\}$

86435161385. $\{x \in \mathbf{R} : |x - 3| < 1\}$

86435161386. $\{x \in \mathbf{R} : |x - 5| \leq 1\}$

**Question Number : 75 Question Id : 86435118264 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

The locus of the centroid of the triangle formed by any point P on the hyperbola $16x^2 - 9y^2 + 32x + 36y - 164 = 0$, and its foci is :

Options :

86435161387. $9x^2 - 16y^2 + 36x + 32y - 36 = 0$

86435161388. $16x^2 - 9y^2 + 32x + 36y - 144 = 0$

86435161389. $9x^2 - 16y^2 + 36x + 32y - 144 = 0$

86435161390. $16x^2 - 9y^2 + 32x + 36y - 36 = 0$

**Question Number : 76 Question Id : 86435118265 Question Type : MCQ Option Shuffling : Yes
Is Question Mandatory : No**

Correct Marks : 4 Wrong Marks : 1

Let S_n be the sum of the first n terms of an arithmetic progression. If $S_{3n} = 3S_{2n}$, then the

value of $\frac{S_{4n}}{S_{2n}}$ is :

Options :

86435161391. 2

86435161392. 4

86435161393. 6

86435161394. 8

Question Number : 77 Question Id : 86435118266 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The Boolean expression

$(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to :

Options :

86435161395. P

86435161396. Q

86435161397. $\sim p$

86435161398. $\sim q$

Question Number : 78 Question Id : 86435118267 Question Type : MC

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The value of the definite integral

$$\int_{\pi/24}^{5\pi/24} \frac{dx}{1 + \sqrt[3]{\tan 2x}} \text{ is :}$$

Options :

86435161399. $\frac{\pi}{18}$

86435161400. $\frac{\pi}{3}$

86435161401. $\frac{\pi}{12}$

86435161402. $\frac{\pi}{6}$

Question Number : 79 Question Id : 86435118268 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The values of a and b, for which the system of equations

$$2x + 3y + 6z = 8$$

$$x + 2y + az = 5$$

$$3x + 5y + 9z = b$$

has no solution, are :

Options :

86435161403. $a \neq 3, b = 3$

86435161404. $a = 3, b \neq 13$

86435161405. $a = 3, b = 13$

86435161406. $a \neq 3, b \neq 13$

Question Number : 80 Question Id : 86435118269 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The sum of all values of x in $[0, 2\pi]$, for which $\sin x + \sin 2x + \sin 3x + \sin 4x = 0$, is equal to :

Options :

86435161407. 8π

86435161408. 9π

86435161409. 11π

86435161410. 12π

Mathematics Section B

Section Id :	864351787
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 :	8643511014
Question Shuffling Allowed :	Yes

Question Number : 81 Question Id : 86435118270 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The term independent of 'x' in the expansion of $\left(\frac{x+1}{x^{2/3}-x^{1/3}+1} - \frac{x-1}{x-x^{1/2}}\right)^{10}$, where $x \neq 0, 1$ 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 Number : 82 Question Id : 86435118271 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $\vec{p} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{q} = \hat{i} + 2\hat{j} + \hat{k}$ be two vectors. If a vector $\vec{r} = (\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k})$ is perpendicular to each of the vectors $(\vec{p} + \vec{q})$ and $(\vec{p} - \vec{q})$, and $|\vec{r}| = \sqrt{3}$, then $|\alpha| + |\beta| + |\gamma|$ 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 Number : 83 **Question Id :** 86435118272 **Question Type :** SA

Correct Marks : 4 **Wrong Marks :** 0

The ratio of the coefficient of the middle term in the expansion of $(1+x)^{20}$ and the sum of the coefficients of two middle terms in expansion of $(1+x)^{19}$ is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 84 **Question Id :** 86435118273 **Question Type :** SA

Correct Marks : 4 **Wrong Marks :** 0

If the value of $\left(1 + \frac{2}{3} + \frac{6}{3^2} + \frac{10}{3^3} + \dots \text{upto } \infty\right)^{\log_{(0.25)}\left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots \text{upto } \infty\right)}$

is l , then l^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 Number : 85 Question Id : 86435118274 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $y = y(x)$ be solution of the following differential equation

$$e^y \frac{dy}{dx} - 2e^y \sin x + \sin x \cos^2 x = 0, \quad y\left(\frac{\pi}{2}\right) = 0.$$

If $y(0) = \log_e(\alpha + \beta e^{-2})$, then $4(\alpha + \beta)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 86 Question Id : 86435118275 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Consider the following frequency distribution :

Class:	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency:	α	110	54	30	β

If the sum of all frequencies is 584 and median is 45, 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 :

1

Question Number : 87 Question Id : 86435118276 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $S = \left\{ n \in \mathbf{N} \mid \begin{pmatrix} 0 & i \\ 1 & 0 \end{pmatrix}^n \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \forall a, b, c, d \in \mathbf{R} \right\}$, where $i = \sqrt{-1}$. Then the

number of 2-digit numbers in the set S is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 88 Question Id : 86435118277 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $M = \left\{ A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} : a, b, c, d \in \{\pm 3, \pm 2, \pm 1, 0\} \right\}$. Define $f: M \rightarrow \mathbf{Z}$, as $f(A) = \det(A)$, for all

$A \in M$, where \mathbf{Z} is set of all integers. Then the number of $A \in M$ such that $f(A) = 15$ 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 Number : 89 Question Id : 86435118278 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

There are 5 students in class 10, 6 students in class 11 and 8 students in class 12. If the number of ways, in which 10 students can be selected from them so as to include at least 2 students from each class and at most 5 students from the total 11 students of class 10 and 11 is $100k$, then k 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 Number : 90 Question Id : 86435118279 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If α, β are roots of the equation $x^2 + 5(\sqrt{2})x + 10 = 0$, $\alpha > \beta$ and $P_n = \alpha^n - \beta^n$ for each

positive integer n , then the value of $\left(\frac{P_{17}P_{20} + 5\sqrt{2} P_{17}P_{19}}{P_{18}P_{19} + 5\sqrt{2} P_{18}^2} \right)$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1