

<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	20
<b>Number of Questions to be attempted :</b>	20
<b>Section Marks :</b>	80
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	7081911074
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 61 Question Id : 70819118814 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If for the matrix,  $A = \begin{bmatrix} 1 & -\alpha \\ \alpha & \beta \end{bmatrix}$ ,  $AA^T = I_2$ , then the value of  $\alpha^4 + \beta^4$  is :

**Options :**

70819161591. <sup>4</sup>

70819161592. <sup>1</sup>

70819161593. <sup>2</sup>

70819161594. <sup>3</sup>

**Question Number : 62 Question Id : 70819118815 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let A be a  $3 \times 3$  matrix with  $\det(A) = 4$ . Let  $R_i$  denote the  $i^{\text{th}}$  row of A. If a matrix B is obtained by performing the operation  $R_2 \rightarrow 2R_2 + 5R_3$  on 2A, then  $\det(B)$  is equal to :

**Options :**

70819161595. <sup>16</sup>

70819161596. 80

70819161597. 64

70819161598. 128

**Question Number : 63 Question Id : 70819118816 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The following system of linear equations

$$2x + 3y + 2z = 9$$

$$3x + 2y + 2z = 9$$

$$x - y + 4z = 8$$

**Options :**

70819161599. does not have any solution

70819161600. has a unique solution

70819161601. has infinitely many solutions

70819161602. has a solution  $(\alpha, \beta, \gamma)$  satisfying  $\alpha + \beta^2 + \gamma^3 = 12$

**Question Number : 64 Question Id : 70819118817 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If  $I_n = \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cot^n x \, dx$ , then :

**Options :**

70819161603.  $\frac{1}{I_2 + I_4}, \frac{1}{I_3 + I_5}, \frac{1}{I_4 + I_6}$  are in A.P.

70819161604.  $I_2 + I_4, I_3 + I_5, I_4 + I_6$  are in A.P.

70819161605.  $\frac{1}{I_2 + I_4}, \frac{1}{I_3 + I_5}, \frac{1}{I_4 + I_6}$  are in G.P.

70819161606.  $I_2 + I_4, (I_3 + I_5)^2, I_4 + I_6$  are in G.P.

**Question Number : 65 Question Id : 70819118818 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A function  $f(x)$  is given by  $f(x) = \frac{5^x}{5^x + 5}$ , then the sum of the series

$$f\left(\frac{1}{20}\right) + f\left(\frac{2}{20}\right) + f\left(\frac{3}{20}\right) + \dots + f\left(\frac{39}{20}\right)$$

is equal to :

**Options :**

70819161607.  $\frac{29}{2}$

70819161608.  $\frac{49}{2}$

70819161609.  $\frac{39}{2}$

70819161610.  $\frac{19}{2}$

Question Number : 66 Question Id : 70819118819 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let  $\alpha$  and  $\beta$  be the roots of  $x^2 - 6x - 2 = 0$ . If  $a_n = \alpha^n - \beta^n$  for  $n \geq 1$ , then the value of  $\frac{a_{10} - 2a_8}{3a_9}$

is :

Options :

70819161611. 4

70819161612. 3

70819161613. 2

70819161614. 1

Question Number : 67 Question Id : 70819118820 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The minimum value of  $f(x) = a^{a^x} + a^{1-a^x}$ , where  $a, x \in \mathbb{R}$  and  $a > 0$ , is equal to :

Options :

70819161615.  $a + 1$

70819161616.  $a + \frac{1}{a}$

70819161617.  $2\sqrt{a}$

70819161618. 2a

**Question Number : 68 Question Id : 70819118821 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The integral  $\int \frac{e^{3\log_e 2x} + 5e^{2\log_e 2x}}{e^{4\log_e x} + 5e^{3\log_e x} - 7e^{2\log_e x}} dx, x > 0$ , is equal to :

(where c is a constant of integration)

**Options :**

70819161619.  $\log_e |x^2 + 5x - 7| + c$

70819161620.  $4\log_e |x^2 + 5x - 7| + c$

70819161621.  $\frac{1}{4}\log_e |x^2 + 5x - 7| + c$

70819161622.  $\log_e \sqrt{x^2 + 5x - 7} + c$

**Question Number : 69 Question Id : 70819118822 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If  $\alpha, \beta \in \mathbb{R}$  are such that  $1 - 2i$  (here  $i^2 = -1$ ) is a root of  $z^2 + \alpha z + \beta = 0$ , then  $(\alpha - \beta)$  is equal to :

**Options :**

70819161623. 3

70819161624. -3

70819161625. 7

70819161626. -7

**Question Number : 70 Question Id : 70819118823 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the curve  $x^2 + 2y^2 = 2$  intersects the line  $x + y = 1$  at two points P and Q, then the angle subtended by the line segment PQ at the origin is :

**Options :**

70819161627.  $\frac{\pi}{2} + \tan^{-1}\left(\frac{1}{4}\right)$

70819161628.  $\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{4}\right)$

70819161629.  $\frac{\pi}{2} + \tan^{-1}\left(\frac{1}{3}\right)$

70819161630.  $\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{3}\right)$

**Question Number : 71 Question Id : 70819118824 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The shortest distance between the line  $x - y = 1$  and the curve  $x^2 = 2y$  is :

**Options :**

70819161631.

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

70819161632.  $\frac{1}{2\sqrt{2}}$

70819161633. 0

70819161634.  $\frac{1}{2}$

**Question Number : 72 Question Id : 70819118825 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A hyperbola passes through the foci of the ellipse  $\frac{x^2}{25} + \frac{y^2}{16} = 1$  and its transverse and conjugate axes coincide with major and minor axes of the ellipse, respectively. If the product of their eccentricities is one, then the equation of the hyperbola is :

**Options :**

70819161635.  $\frac{x^2}{9} - \frac{y^2}{16} = 1$

70819161636.  $\frac{x^2}{9} - \frac{y^2}{4} = 1$

70819161637.  $\frac{x^2}{9} - \frac{y^2}{25} = 1$

70819161638.  $x^2 - y^2 = 9$

Question Number : 73 Question Id : 70819118826 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A plane passes through the points A(1, 2, 3), B(2, 3, 1) and C(2, 4, 2). If O is the origin and P is (2, -1, 1), then the projection of  $\vec{OP}$  on this plane is of length :

Options :

70819161639.  $\sqrt{\frac{2}{3}}$

70819161640.  $\sqrt{\frac{2}{11}}$

70819161641.  $\sqrt{\frac{2}{7}}$

70819161642.  $\sqrt{\frac{2}{5}}$

Question Number : 74 Question Id : 70819118827 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

$\lim_{n \rightarrow \infty} \left[ \frac{1}{n} + \frac{n}{(n+1)^2} + \frac{n}{(n+2)^2} + \dots + \frac{n}{(2n-1)^2} \right]$  is equal to :

Options :

70819161643. 1

70819161644.  $\frac{1}{2}$



70819161645.  $\frac{1}{3}$

70819161646.  $\frac{1}{4}$

**Question Number : 75 Question Id : 70819118828 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In a group of 400 people, 160 are smokers and non-vegetarian; 100 are smokers and vegetarian and the remaining 140 are non-smokers and vegetarian. Their chances of getting a particular chest disorder are 35%, 20% and 10% respectively. A person is chosen from the group at random and is found to be suffering from the chest disorder. The probability that the selected person is a smoker and non-vegetarian is :

**Options :**

70819161647.  $\frac{7}{45}$

70819161648.  $\frac{8}{45}$

70819161649.  $\frac{28}{45}$

70819161650.  $\frac{14}{45}$

**Question Number : 76 Question Id : 70819118829 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let A be a set of all 4-digit natural numbers whose exactly one digit is 7. Then the probability that a randomly chosen element of A leaves remainder 2 when divided by 5 is :

Options :

70819161651.  $\frac{1}{5}$

70819161652.  $\frac{2}{9}$

70819161653.  $\frac{97}{297}$

70819161654.  $\frac{122}{297}$

Question Number : 77 Question Id : 70819118830 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

If  $0 < x, y < \pi$  and  $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$ , then  $\sin x + \cos y$  is equal to :

Options :

70819161655.  $\frac{1}{2}$

70819161656.  $\frac{\sqrt{3}}{2}$

70819161657.  $\frac{1 - \sqrt{3}}{2}$

70819161658.  $\frac{1 + \sqrt{3}}{2}$

Question Number : 78 Question Id : 70819118831 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let  $x$  denote the total number of one-one functions from a set A with 3 elements to a set B with 5 elements and  $y$  denote the total number of one-one functions from the set A to the set  $A \times B$ . Then :

Options :

70819161659.  $2y = 91x$

70819161660.  $2y = 273x$

70819161661.  $y = 91x$

70819161662.  $y = 273x$

Question Number : 79 Question Id : 70819118832 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

$\operatorname{cosec} \left[ 2 \cot^{-1}(5) + \cos^{-1} \left( \frac{4}{5} \right) \right]$  is equal to :

Options :

70819161663.  $\frac{56}{33}$

70819161664.  $\frac{65}{33}$

70819161665.  $\frac{65}{56}$

70819161666.

**Question Number : 80 Question Id : 70819118833 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The contrapositive of the statement "If you will work, you will earn money" is :

**Options :**

70819161667. To earn money, you need to work

70819161668. You will earn money, if you will not work

70819161669. If you will not earn money, you will not work

70819161670. If you will earn money, you will work

## Mathematics Section B

<b>Section Id :</b>	708191795
<b>Section Number :</b>	6
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	10
<b>Number of Questions to be attempted :</b>	5
<b>Section Marks :</b>	20
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	7081911075

Question Shuffling Allowed :

Yes

Question Number : 81 Question Id : 70819118834 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A function  $f$  is defined on  $[-3, 3]$  as

$$f(x) = \begin{cases} \min\{|x|, 2 - x^2\}, & -2 \leq x \leq 2 \\ [x] & , 2 < |x| \leq 3 \end{cases}$$

where  $[x]$  denotes the greatest integer  $\leq x$ . The number of points, where  $f$  is not differentiable in  $(-3, 3)$  is \_\_\_\_\_.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 82 Question Id : 70819118835 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If the curve,  $y=y(x)$  represented by the solution of the differential equation  $(2xy^2 - y)dx + xdy = 0$ , passes through the intersection of the lines,  $2x - 3y = 1$  and  $3x + 2y = 8$ , then  $|y(1)|$  is equal to \_\_\_\_\_.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5 to 5.001

Question Number : 83 Question Id : 70819118836 Question Type : SA

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

The total number of two digit numbers 'n', such that  $3^n + 7^n$  is a multiple of 10, is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 84 Question Id : 70819118837 Question Type : SA**

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

If  $\lim_{x \rightarrow 0} \frac{ax - (e^{4x} - 1)}{ax(e^{4x} - 1)}$  exists and is equal to b, then the value of  $a - 2b$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 85 Question Id : 70819118838 Question Type : SA**

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

If the curves  $x = y^4$  and  $xy = k$  cut at right angles, then  $(4k)^6$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 86 Question Id : 70819118839 Question Type : SA**

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

The value of  $\int_{-2}^2 |3x^2 - 3x - 6| dx$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 87 Question Id : 70819118840 Question Type : SA**

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

If the remainder when  $x$  is divided by 4 is 3, then the remainder when  $(2020 + x)^{2022}$  is divided by 8 is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 88 Question Id : 70819118841 Question Type : SA**

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

A line 'l' passing through origin is perpendicular to the lines

$$l_1 : \vec{r} = (3 + t)\hat{i} + (-1 + 2t)\hat{j} + (4 + 2t)\hat{k}$$

$$l_2 : \vec{r} = (3 + 2s)\hat{i} + (3 + 2s)\hat{j} + (2 + s)\hat{k}$$

If the co-ordinates of the point in the first octant on 'l<sub>2</sub>' at a distance of  $\sqrt{17}$  from the point of intersection of 'l' and 'l<sub>1</sub>' are (a, b, c), then 18(a + b + c) is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 89 **Question Id :** 70819118842 **Question Type :** SA

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

A line is a common tangent to the circle  $(x - 3)^2 + y^2 = 9$  and the parabola  $y^2 = 4x$ . If the two points of contact (a, b) and (c, d) are distinct and lie in the first quadrant, then 2(a + c) is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 90 **Question Id :** 70819118843 **Question Type :** SA

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



Let  $\vec{a} = \hat{i} + \alpha\hat{j} + 3\hat{k}$  and  $\vec{b} = 3\hat{i} - \alpha\hat{j} + \hat{k}$ . If the area of the parallelogram whose adjacent sides are represented by the vectors  $\vec{a}$  and  $\vec{b}$  is  $8\sqrt{3}$  square units, then  $\vec{a} \cdot \vec{b}$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001