

## Mathematics Section A

Section Id :	708191554
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 :	708191834
Question Shuffling Allowed :	Yes

Question Number : 61 Question Id : 70819115214 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

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

Then the composition function  $f(g(x))$  is :

Options :

70819150791. one-one but not onto

70819150792. onto but not one-one

70819150793. neither one-one nor onto

70819150794. both one-one and onto

**Question Number : 62 Question Id : 70819115215 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

Let  $p$  and  $q$  be two positive numbers such that  $p + q = 2$  and  $p^4 + q^4 = 272$ . Then  $p$  and  $q$  are roots of the equation :

**Options :**

70819150795.  $x^2 - 2x + 136 = 0$

70819150796.  $x^2 - 2x + 16 = 0$

70819150797.  $x^2 - 2x + 8 = 0$

70819150798.  $x^2 - 2x + 2 = 0$

**Question Number : 63 Question Id : 70819115216 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

The system of linear equations

$$3x - 2y - kz = 10$$

$$2x - 4y - 2z = 6$$

$$x + 2y - z = 5m$$

is inconsistent if :

**Options :**

70819150799.

$$k \neq 3, m \neq \frac{4}{5}$$

70819150800.  $k = 3, m = \frac{4}{5}$

70819150801.  $k = 3, m \neq \frac{4}{5}$

70819150802.  $k \neq 3, m \in \mathbb{R}$

**Question Number : 64 Question Id : 70819115217 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

The value of

$$-{}^{15}C_1 + 2 \cdot {}^{15}C_2 - 3 \cdot {}^{15}C_3 + \dots - 15 \cdot {}^{15}C_{15} + {}^{14}C_1 + {}^{14}C_3 + {}^{14}C_5 + \dots + {}^{14}C_{11} \text{ is :}$$

**Options :**

70819150803.  $2^{16} - 1$

70819150804.  $2^{13} - 14$

70819150805.  $2^{13} - 13$

70819150806.  $2^{14}$

**Question Number : 65 Question Id : 70819115218 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

If  $e^{(\cos^2 x + \cos^4 x + \cos^6 x + \dots) \log_e 2}$  satisfies the equation  $t^2 - 9t + 8 = 0$ , then the value of

$$\frac{2 \sin x}{\sin x + \sqrt{3} \cos x} \left( 0 < x < \frac{\pi}{2} \right) \text{ is:}$$

**Options :**

70819150807.  $\frac{1}{2}$

70819150808.  $\sqrt{3}$

70819150809.  $\frac{3}{2}$

70819150810.  $2\sqrt{3}$

**Question Number : 66 Question Id : 70819115219 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

$$\lim_{x \rightarrow 0} \frac{\int_0^{x^2} (\sin \sqrt{t}) dt}{x^3} \text{ is equal to :}$$

**Options :**

70819150811.  $\frac{2}{3}$

70819150812.  $\frac{3}{2}$

70819150813.  $\frac{1}{15}$

70819150814.  $0$

Question Number : 67 Question Id : 70819115220 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The function  $f(x) = \frac{4x^3 - 3x^2}{6} - 2 \sin x + (2x - 1) \cos x$  :

Options :

70819150815. increases in  $\left[\frac{1}{2}, \infty\right)$

70819150816. decreases in  $\left[\frac{1}{2}, \infty\right)$

70819150817. increases in  $\left(-\infty, \frac{1}{2}\right]$

70819150818. decreases in  $\left(-\infty, \frac{1}{2}\right]$

Question Number : 68 Question Id : 70819115221 Question Type : MCQ Option Shuffling : Yes

Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A scientific committee is to be formed from 6 Indians and 8 foreigners, which includes at least 2 Indians and double the number of foreigners as Indians. Then the number of ways, the committee can be formed, is :

Options :

70819150819. 1050

70819150820. 1625

70819150821. 560

70819150822. 575

**Question Number : 69 Question Id : 70819115222 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is a function defined by  $f(x) = [x - 1] \cos\left(\frac{2x - 1}{2}\right)\pi$ , where  $[ \cdot ]$  denotes the greatest integer function, then  $f$  is :

**Options :**

70819150823. discontinuous only at  $x = 1$

70819150824. discontinuous at all integral values of  $x$  except at  $x = 1$

70819150825. continuous only at  $x = 1$

70819150826. continuous for every real  $x$

**Question Number : 70 Question Id : 70819115223 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

If  $\int \frac{\cos x - \sin x}{\sqrt{8 - \sin 2x}} dx = a \sin^{-1}\left(\frac{\sin x + \cos x}{b}\right) + c$ , where  $c$  is a constant of integration, then the ordered pair  $(a, b)$  is equal to :

**Options :**

70819150827.  $(3, 1)$

70819150828.  $(1, 3)$

70819150829.  $(-1, 3)$

70819150830.  $(1, -3)$

**Question Number : 71 Question Id : 70819115224 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

The area (in sq. units) of the part of the circle  $x^2 + y^2 = 36$ , which is outside the parabola  $y^2 = 9x$ , is :

**Options :**

70819150831.  $24\pi + 3\sqrt{3}$

70819150832.  $24\pi - 3\sqrt{3}$

70819150833.  $12\pi + 3\sqrt{3}$

70819150834.  $12\pi - 3\sqrt{3}$

**Question Number : 72 Question Id : 70819115225 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

The population  $P = P(t)$  at time 't' of a certain species follows the differential equation

$\frac{dP}{dt} = 0.5P - 450$ . If  $P(0) = 850$ , then the time at which population becomes zero is :

**Options :**

70819150835.  $\log_e 9$

70819150836.  $\frac{1}{2} \log_e 18$

70819150837.  $\log_e 18$

70819150838.  $2\log_e 18$

**Question Number : 73 Question Id : 70819115226 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

A man is walking on a straight line. The arithmetic mean of the reciprocals of the intercepts of this line on the coordinate axes is  $\frac{1}{4}$ . Three stones A, B and C are placed at the points (1, 1), (2, 2) and (4, 4) respectively. Then which of these stones is/are on the path of the man ?

**Options :**

70819150839. A only

70819150840. B only

70819150841. C only

70819150842. All the three

**Question Number : 74 Question Id : 70819115227 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

The locus of the mid-point of the line segment joining the focus of the parabola  $y^2 = 4ax$  to a moving point of the parabola, is another parabola whose directrix is :

**Options :**

70819150843.  $x = a$



70819150844.  $x = -\frac{a}{2}$

70819150845.  $x = 0$

70819150846.  $x = \frac{a}{2}$

**Question Number : 75 Question Id : 70819115228 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

If the tangent to the curve  $y = x^3$  at the point  $P(t, t^3)$  meets the curve again at  $Q$ , then the ordinate of the point which divides  $PQ$  internally in the ratio  $1 : 2$  is :

**Options :**

70819150847.  $0$

70819150848.  $2t^3$

70819150849.  $-t^3$

70819150850.  $-2t^3$

**Question Number : 76 Question Id : 70819115229 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

The equation of the plane passing through the point  $(1, 2, -3)$  and perpendicular to the planes  $3x + y - 2z = 5$  and  $2x - 5y - z = 7$ , is :

**Options :**

70819150851.  $6x - 5y + 2z + 10 = 0$

70819150852.  $11x + y + 17z + 38 = 0$

70819150853.  $6x - 5y - 2z - 2 = 0$

70819150854.  $3x - 10y - 2z + 11 = 0$

**Question Number : 77 Question Id : 70819115230 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

The distance of the point (1, 1, 9) from the point of intersection of the line

$\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$  and the plane  $x+y+z=17$  is :

**Options :**

70819150855.  $2\sqrt{19}$

70819150856.  $19\sqrt{2}$

70819150857.  $\sqrt{38}$

70819150858. 38

**Question Number : 78 Question Id : 70819115231 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

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

An ordinary dice is rolled for a certain number of times. If the probability of getting an odd number 2 times is equal to the probability of getting an even number 3 times, then the probability of getting an odd number for odd number of times is :

**Options :**

$$70819150859. \frac{1}{32}$$

$$70819150860. \frac{3}{16}$$

$$70819150861. \frac{5}{16}$$

$$70819150862. \frac{1}{2}$$

**Question Number : 79 Question Id : 70819115232 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

Two vertical poles are 150 m apart and the height of one is three times that of the other. If from the middle point of the line joining their feet, an observer finds the angles of elevation of their tops to be complementary, then the height of the shorter pole (in meters) is :

**Options :**

$$70819150863. 25$$

$$70819150864. 30$$

$$70819150865. 20\sqrt{3}$$

$$70819150866. 25\sqrt{3}$$

**Question Number : 80 Question Id : 70819115233 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

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

The statement among the following that is a tautology is :

**Options :**

70819150867.  $A \wedge (A \vee B)$

70819150868.  $A \vee (A \wedge B)$

70819150869.  $[ A \wedge (A \rightarrow B) ] \rightarrow B$

70819150870.  $B \rightarrow [ A \wedge (A \rightarrow B) ]$

## Mathematics Section B

<b>Section Id :</b>	708191555
<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>	708191835
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 81 Question Id : 70819115234 Question Type : SA**

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

If the least and the largest real values of  $\alpha$ , for which the equation  $z + \alpha|z - 1| + 2i = 0$  ( $z \in \mathbb{C}$  and  $i = \sqrt{-1}$ ) has a solution, are  $p$  and  $q$  respectively; then  $4(p^2 + q^2)$  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 : 82 Question Id : 70819115235 Question Type : SA**

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

Let  $B_i$  ( $i=1, 2, 3$ ) be three independent events in a sample space. The probability that only  $B_1$  occur is  $\alpha$ , only  $B_2$  occurs is  $\beta$  and only  $B_3$  occurs is  $\gamma$ . Let  $p$  be the probability that none of the events  $B_i$  occurs and these 4 probabilities satisfy the equations  $(\alpha - 2\beta) p = \alpha\beta$  and  $(\beta - 3\gamma) p = 2\beta\gamma$  (All the probabilities are assumed to lie in the interval  $(0, 1)$ ). Then  $\frac{P(B_1)}{P(B_3)}$  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 : 70819115236 Question Type : SA**

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

Let  $P = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$ , where  $\alpha \in \mathbb{R}$ . Suppose  $Q = [q_{ij}]$  is a matrix satisfying  $PQ = kI_3$  for

some non-zero  $k \in \mathbb{R}$ . If  $q_{23} = -\frac{k}{8}$  and  $|Q| = \frac{k^2}{2}$ , then  $\alpha^2 + k^2$  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 : 84 Question Id : 70819115237 Question Type : SA**

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

Let  $M$  be any  $3 \times 3$  matrix with entries from the set  $\{0, 1, 2\}$ . The maximum number of such matrices, for which the sum of diagonal elements of  $M^T M$  is seven, 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 : 70819115238 Question Type : SA**

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

Let  $A = \{n \in \mathbb{N} : n \text{ is a 3-digit number}\}$

$B = \{9k + 2 : k \in \mathbb{N}\}$

and  $C = \{9k + l : k \in \mathbb{N}\}$  for some  $l$  ( $0 < l < 9$ )

If the sum of all the elements of the set  $A \cap (B \cup C)$  is  $274 \times 400$ , then  $l$  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 : 70819115239 Question Type : SA**

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

The minimum value of  $\alpha$  for which the equation  $\frac{4}{\sin x} + \frac{1}{1 - \sin x} = \alpha$  has at least one solution in  $\left(0, \frac{\pi}{2}\right)$  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 : 70819115240 Question Type : SA**

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

If  $\int_{-a}^a (|x| + |x - 2|) dx = 22$ , ( $a > 2$ ) and  $[x]$  denotes the greatest integer  $\leq x$ ,

then  $\int_a^{-a} (x + [x]) dx$  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 : 88 Question Id : 70819115241 Question Type : SA**

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

If one of the diameters of the circle  $x^2 + y^2 - 2x - 6y + 6 = 0$  is a chord of another circle 'C', whose center is at (2, 1), then its radius 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 : 89 Question Id : 70819115242 Question Type : SA**

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

Let three vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be such that  $\vec{c}$  is coplanar with  $\vec{a}$  and  $\vec{b}$ ,  $\vec{a} \cdot \vec{c} = 7$  and  $\vec{b}$  is perpendicular to  $\vec{c}$ , where  $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$  and  $\vec{b} = 2\hat{i} + \hat{k}$ , then the value of  $2|\vec{a} + \vec{b} + \vec{c}|^2$  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 : 90 Question Id : 70819115243 Question Type : SA**



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

$$\lim_{n \rightarrow \infty} \tan \left\{ \sum_{r=1}^n \tan^{-1} \left( \frac{1}{1+r+r^2} \right) \right\} \text{ is equal to } \underline{\hspace{2cm}}.$$

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001