

Paper:	B.E_B.Tech
Set Name:	Set 04
Exam Date:	29 July 2022
Exam Shift:	2
Language:	English

Topic:	Mathematics-Section A
Item No:	1
Question ID:	15477154601
Question Type:	MCQ
Question:	If $z \neq 0$ be a complex number such that $\left z - \frac{1}{z}\right = 2$, then the maximum value of $ z $ is :
A:	$\sqrt{2}$
B:	1
C:	$\sqrt{2} - 1$
D:	$\sqrt{2} + 1$

Topic:	Mathematics-Section A
Item No:	2
Question ID:	15477154602
Question Type:	MCQ
Question:	Which of the following matrices can NOT be obtained from the matrix $\begin{bmatrix} -1 & 2 \\ 1 & -1 \end{bmatrix}$ by a single elementary row operation ?
A:	$\begin{bmatrix} 0 & 1 \\ 1 & -1 \end{bmatrix}$
B:	$\begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix}$
C:	$\begin{bmatrix} -1 & 2 \\ -2 & 7 \end{bmatrix}$
D:	$\begin{bmatrix} -1 & 2 \\ -1 & 3 \end{bmatrix}$

Topic:	Mathematics-Section A
Item No:	3
Question ID:	15477154603
Question Type:	MCQ

Question:	If the system of equations $\begin{aligned}x + y + z &= 6 \\ 2x + 5y + \alpha z &= \beta \\ x + 2y + 3z &= 14\end{aligned}$ has infinitely many solutions, then $\alpha + \beta$ is equal to
A:	8
B:	36
C:	44
D:	48

Topic:	Mathematics-Section A
Item No:	4
Question ID:	15477154604
Question Type:	MCQ
Question:	Let the function $f(x) = \begin{cases} \frac{\log_e(1+5x) - \log_e(1+\alpha x)}{x} & ; \text{if } x \neq 0 \\ 10 & ; \text{if } x = 0 \end{cases}$ be continuous at $x = 0$. Then α is equal to
A:	10
B:	-10
C:	5
D:	-5

Topic:	Mathematics-Section A
Item No:	5
Question ID:	15477154605
Question Type:	MCQ
Question:	If $[t]$ denotes the greatest integer $\leq t$, then the value of $\int_0^1 [2x - 3x^2 - 5x + 2 + 1] dx$ is :
A:	$\frac{\sqrt{37} + \sqrt{13} - 4}{6}$
B:	$\frac{\sqrt{37} - \sqrt{13} - 4}{6}$
C:	$\frac{-\sqrt{37} - \sqrt{13} + 4}{6}$
D:	$\frac{-\sqrt{37} + \sqrt{13} + 4}{6}$

Topic:	Mathematics-Section A
Item No:	6
Question ID:	15477154606
Question Type:	MCQ
Question:	Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0 = a_1 = 0$ and $a_{n+2} = 3a_{n+1} - 2a_n + 1, \forall n \geq 0$. Then $a_{25}a_{23} - 2a_{25}a_{22} - 2a_{23}a_{24} + 4a_{22}a_{24}$ is equal to
A:	483
B:	528
C:	575
D:	624

Topic:	Mathematics-Section A
Item No:	7
Question ID:	15477154607
Question Type:	MCQ
Question:	$\sum_{r=1}^{20} (r^2 + 1)(r!)$ is equal to
A:	$22! - 21!$
B:	$22! - 2(21!)$
C:	$21! - 2(20!)$
D:	$21! - 20!$

Topic:	Mathematics-Section A
Item No:	8
Question ID:	15477154608
Question Type:	MCQ
Question:	For $I(x) = \int \frac{\sec^2 x - 2022}{\sin^{2022} x} dx$, if $I\left(\frac{\pi}{4}\right) = 2^{1011}$, then
A:	$3^{1010} I\left(\frac{\pi}{3}\right) - I\left(\frac{\pi}{6}\right) = 0$
B:	$3^{1010} I\left(\frac{\pi}{6}\right) - I\left(\frac{\pi}{3}\right) = 0$
C:	$3^{1011} I\left(\frac{\pi}{3}\right) - I\left(\frac{\pi}{6}\right) = 0$

D:	$3^{1011} I\left(\frac{\pi}{6}\right) - I\left(\frac{\pi}{3}\right) = 0$
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Topic:	Mathematics-Section A
Item No:	9
Question ID:	15477154609
Question Type:	MCQ
Question:	If the solution curve of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passes through the points (2, 1) and (k + 1, 2), k > 0, then
A:	$2 \tan^{-1}\left(\frac{1}{k}\right) = \log_e(k^2 + 1)$
B:	$\tan^{-1}\left(\frac{1}{k}\right) = \log_e(k^2 + 1)$
C:	$2 \tan^{-1}\left(\frac{1}{k+1}\right) = \log_e(k^2 + 2k + 2)$
D:	$2 \tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(\frac{k^2 + 1}{k^2}\right)$

Topic:	Mathematics-Section A
Item No:	10
Question ID:	154771546010
Question Type:	MCQ
Question:	Let $y = y(x)$ be the solution curve of the differential equation $\frac{dy}{dx} + \left(\frac{2x^2 + 11x + 13}{x^3 + 6x^2 + 11x + 6}\right) y = \frac{(x+3)}{x+1}$, $x > -1$, which passes through the point (0, 1). Then $y(1)$ is equal to :
A:	$\frac{1}{2}$
B:	$\frac{3}{2}$
C:	$\frac{5}{2}$
D:	$\frac{7}{2}$

Topic:	Mathematics-Section A
Item No:	11

Question ID:	154771546011
Question Type:	MCQ
Question:	Let m_1, m_2 be the slopes of two adjacent sides of a square of side a such that $a^2 + 11a + 3(m_1^2 + m_2^2) = 220$. If one vertex of the square is $(10(\cos\alpha - \sin\alpha), 10(\sin\alpha + \cos\alpha))$, where $\alpha \in \left(0, \frac{\pi}{2}\right)$ and the equation of one diagonal is $(\cos\alpha - \sin\alpha)x + (\sin\alpha + \cos\alpha)y = 10$, then $72(\sin^4\alpha + \cos^4\alpha) + a^2 - 3a + 13$ is equal to :
A:	119
B:	128
C:	145
D:	155

Topic:	Mathematics-Section A
Item No:	12
Question ID:	154771546012
Question Type:	MCQ
Question:	The number of elements in the set $S = \left\{x \in \mathbb{R} : 2 \cos\left(\frac{x^2 + x}{6}\right) = 4^x + 4^{-x}\right\}$ is :
A:	1
B:	3
C:	0
D:	infinite

Topic:	Mathematics-Section A
Item No:	13
Question ID:	154771546013
Question Type:	MCQ
Question:	Let A $(\alpha, -2)$, B $(\alpha, 6)$ and C $\left(\frac{\alpha}{4}, -2\right)$ be vertices of a ΔABC . If $\left(5, \frac{\alpha}{4}\right)$ is the circumcentre of ΔABC , then which of the following is NOT correct about ΔABC ?
A:	area is 24
B:	perimeter is 25
C:	circumradius is 5
D:	inradius is 2

Topic:	Mathematics-Section A
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Item No:	14
Question ID:	154771546014
Question Type:	MCQ
Question:	Let Q be the foot of perpendicular drawn from the point $P(1, 2, 3)$ to the plane $x + 2y + z = 14$. If R is a point on the plane such that $\angle PRQ = 60^\circ$, then the area of ΔPQR is equal to :
A:	$\frac{\sqrt{3}}{2}$
B:	$\sqrt{3}$
C:	$2\sqrt{3}$
D:	3

Topic:	Mathematics-Section A
Item No:	15
Question ID:	154771546015
Question Type:	MCQ
Question:	If $(2, 3, 9)$, $(5, 2, 1)$, $(1, \lambda, 8)$ and $(\lambda, 2, 3)$ are coplanar, then the product of all possible values of λ is :
A:	$\frac{21}{2}$
B:	$\frac{59}{8}$
C:	$\frac{57}{8}$
D:	$\frac{95}{8}$

Topic:	Mathematics-Section A
Item No:	16
Question ID:	154771546016
Question Type:	MCQ
Question:	Bag I contains 3 red, 4 black and 3 white balls and Bag II contains 2 red, 5 black and 2 white balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be black in colour. Then the probability, that the transferred ball is red, is :
A:	$\frac{4}{9}$
B:	$\frac{5}{18}$

C:	$\frac{1}{6}$
D:	$\frac{3}{10}$

Topic:	Mathematics-Section A
Item No:	17
Question ID:	154771546017
Question Type:	MCQ
Question:	Let $S = \{z = x + iy : z - 1 + i \geq z , z < 2, z + i = z - 1 \}$. Then the set of all values of x , for which $w = 2x + iy \in S$ for some $y \in \mathbb{R}$, is
A:	$\left[-\sqrt{2}, \frac{1}{2\sqrt{2}}\right]$
B:	$\left[-\frac{1}{\sqrt{2}}, \frac{1}{4}\right]$
C:	$\left[-\sqrt{2}, \frac{1}{2}\right]$
D:	$\left[-\frac{1}{\sqrt{2}}, \frac{1}{2\sqrt{2}}\right]$

Topic:	Mathematics-Section A
Item No:	18
Question ID:	154771546018
Question Type:	MCQ
Question:	Let $\vec{a}, \vec{b}, \vec{c}$ be three coplanar concurrent vectors such that angles between any two of them is same. If the product of their magnitudes is 14 and $(\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c}) + (\vec{b} \times \vec{c}) \cdot (\vec{c} \times \vec{a}) + (\vec{c} \times \vec{a}) \cdot (\vec{a} \times \vec{b}) = 168$, then $ \vec{a} + \vec{b} + \vec{c} $ is equal to :
A:	10
B:	14
C:	16
D:	18

Topic:	Mathematics-Section A
Item No:	19
Question ID:	154771546019
Question Type:	MCQ
Question:	The domain of the function $f(x) = \sin^{-1}\left(\frac{x^2 - 3x + 2}{x^2 + 2x + 7}\right)$ is :
A:	$[1, \infty)$

B:	$[-1, 2]$
C:	$[-1, \infty)$
D:	$(-\infty, 2]$

Topic:	Mathematics-Section A
Item No:	20
Question ID:	154771546020
Question Type:	MCQ
Question:	The statement $(p \Rightarrow q) \vee (p \Rightarrow r)$ is NOT equivalent to
A:	$(p \wedge (\sim r)) \Rightarrow q$
B:	$(\sim q) \Rightarrow ((\sim r) \vee p)$
C:	$p \Rightarrow (q \vee r)$
D:	$(p \wedge (\sim q)) \Rightarrow r$

Topic:	Mathematics-Section B
Item No:	21
Question ID:	154771546021
Question Type:	Numeric Answer
Question:	The sum and product of the mean and variance of a binomial distribution are 82.5 and 1350 respectively. Then the number of trials in the binomial distribution is _____.

Topic:	Mathematics-Section B
Item No:	22
Question ID:	154771546022
Question Type:	Numeric Answer
Question:	Let α, β ($\alpha > \beta$) be the roots of the quadratic equation $x^2 - x - 4 = 0$. If $P_n = \alpha^n - \beta^n$, $n \in \mathbb{N}$, then $\frac{P_{15}P_{16} - P_{14}P_{16} - P_{15}^2 + P_{14}P_{15}}{P_{13}P_{14}}$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	23
Question ID:	154771546023
Question Type:	Numeric Answer

Question:	Let $X = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 1 & 6 \\ 0 & 0 & -1 \end{bmatrix}$. For $k \in \mathbb{N}$, if $X^T A^k X = 33$, then k is equal to _____.
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Topic:	Mathematics-Section B
Item No:	24
Question ID:	154771546024
Question Type:	Numeric Answer
Question:	The number of natural numbers lying between 1012 and 23421 that can be formed using the digits 2, 3, 4, 5, 6 (repetition of digits is not allowed) and divisible by 55 is _____.

Topic:	Mathematics-Section B
Item No:	25
Question ID:	154771546025
Question Type:	Numeric Answer
Question:	If $\sum_{k=1}^{10} K^2 \left({}^{10}C_K \right)^2 = 22000L$, then L is equal to _____.

Topic:	Mathematics-Section B
Item No:	26
Question ID:	154771546026
Question Type:	Numeric Answer
Question:	If $[t]$ denotes the greatest integer $\leq t$, then the number of points, at which the function $f(x) = 4 2x+3 + 9\left[x + \frac{1}{2}\right] - 12[x+20]$ is not differentiable in the open interval $(-20, 20)$, is _____.

Topic:	Mathematics-Section B
Item No:	27
Question ID:	154771546027
Question Type:	Numeric Answer
Question:	If the tangent to the curve $y = x^3 - x^2 + x$ at the point (a, b) is also tangent to the curve $y = 5x^2 + 2x - 25$ at the point $(2, -1)$, then $ 2a + 9b $ is equal to _____

Topic:	Mathematics-Section B
Item No:	28
Question ID:	154771546028
Question Type:	Numeric Answer

Question:	Let AB be a chord of length 12 of the circle $(x-2)^2 + (y+1)^2 = \frac{169}{4}$. If tangents drawn to the circle at points A and B intersect at the point P, then five times the distance of point P from chord AB is equal to _____.
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Topic:	Mathematics-Section B
Item No:	29
Question ID:	154771546029
Question Type:	Numeric Answer
Question:	Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\vec{a} + \vec{b} ^2 = \vec{a} ^2 + 2 \vec{b} ^2$, $\vec{a} \cdot \vec{b} = 3$ and $\vec{a} \times \vec{b} ^2 = 75$. Then $\vec{a} ^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	30
Question ID:	154771546030
Question Type:	Numeric Answer
Question:	Let $S = \{(x, y) \in \mathbb{N} \times \mathbb{N} : 9(x-3)^2 + 16(y-4)^2 \leq 144\}$ and $T = \{(x, y) \in \mathbb{R} \times \mathbb{R} : (x-7)^2 + (y-4)^2 \leq 36\}$. Then $n(S \cap T)$ is equal to _____