JOINT ENTRANCE EXAMINATION (MAIN) JUNE -2022
(CANDIDATE RESPONSE SHEET)

App No 220310128001

Paper/Subject B. Arch (Paper 2A)
Exam Date 23 Jun 2022
Exam Slot 1

Passage: Passage_English
Passage_Hindi

Question ID:100401
Topic Name: Mathematics – Part I-Section A
Question:

The set $\left\{\theta : \frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2},\ \theta \neq \pi,\ \cot^2\theta + 3\,\text{cosec}\theta + 3 < 0\right\}$ is equal to :

A $\left(\frac{\pi}{2}, \frac{4\pi}{3}\right) - \{\pi\}$

B $\left(\frac{7\pi}{6}, \frac{3\pi}{2}\right)$

C $\left(\frac{4\pi}{3}, \frac{3\pi}{2}\right)$

D $\left(\pi, \frac{7\pi}{6}\right)$

Answer Given By Candidate:**Not Attempted**

Question ID:100402
Topic Name: Mathematics – Part I-Section A
Question:

Let $f : \mathbf{R} - \{4\} \to \mathbf{R} - \{1\}$ and $g : \mathbf{R} \to \mathbf{R}$ be defined by $f(x) = \frac{x}{x-4}$ and $g(x) = 4x + 3$.

If $(fog)^{-1}(\alpha) = 0$ for some α, then $\frac{g(\alpha)}{f(\alpha)}$ is equal to :

A 21

B -21

C $\frac{-1}{21}$

D 7

Answer Given By Candidate:**Not Attempted**

Question ID:100403
Topic Name: Mathematics – Part I-Section A

Question:

The sum of the modulus of all the roots of the equation $(x-1)\ (x+1)\ (2x+1)\ (2x-3) = 15$ is :

A $\frac{55}{8}$

B $\frac{9}{2}$

C $\frac{11}{2}$

D $\frac{23}{2}$

Answer Given By Candidate:**Not Attempted**

Question ID:100404
Topic Name: Mathematics – Part I-Section A

Question:

The locus of complex number $z = x + iy,\ z \neq -2i$, satisfying $\left|\frac{z-3i}{z+2i}\right| = \frac{\sqrt{2}}{\sqrt{3}}$ is :

A a straight line parallel to the x-axis

B an ellipse with eccentricity $\sqrt{\frac{2}{3}}$

C a circle with centre $(0, -13)$

D a circle with radius $5\sqrt{6}$

Answer Given By Candidate:**Not Attempted**

Question ID:100405
Topic Name: Mathematics – Part I-Section A

Question:

For two 3×3 matrices A and B, $AB = BA$. Consider the following two statements :

(S1) If A^3 is skew-symmetric and B^2 is symmetric, then $(AB)^6$ is symmetric.

(S2) If A^3 is symmetric and B^2 is skew-symmetric, then $(AB)^6$ is skew-symmetric.

A Both (S1) and (S2) are true

B Only (S1) is true

C Only (S2) is true

D Both (S1) and (S2) are false

Answer Given By Candidate:**Not Attempted**

Question ID:100406
Topic Name: Mathematics – Part I-Section A

Let $\lambda, \mu \in \mathbf{R}$. For which one of the following ordered pairs (λ, μ), the system

$$3x - y + z = 1$$
$$2x - 3y + \lambda z = \mu$$
$$x + y + 3z = -1$$

Question: has no solution ?

A $(-4, 1)$

B $(4, 3)$

C $(-4, 3)$

D $(4, 1)$

Answer Given By Candidate:**Not Attempted**

Question ID:100407
Topic Name: Mathematics – Part I-Section A
Question:

There are 21 terms in a sequence S of which the first 11 terms form an A.P. with common difference 2 and the last 11 terms are in a G.P. with common ratio $\frac{1}{2}$. If the middle terms of both A.P. and G.P. are same, then the 11^{th} term of S is :

A $\frac{320}{31}$

B $\frac{160}{31}$

C $\frac{160}{63}$

D $\frac{64}{33}$

Answer Given By Candidate:**Not Attempted**

Question ID:100408
Topic Name: Mathematics – Part I-Section A

Question: $\lim\limits_{x \to \infty} x \log_e \left(e \left(1 + \frac{1}{x} \right)^{1-x} \right)$ is equal to :

A $\frac{1}{2}$

B $\frac{2}{3}$

C

$\frac{3}{2}$

D 1

Answer Given By Candidate:**Not Attempted**

Question ID:100409
Topic Name: Mathematics – Part I-Section A
Question: If $y\sqrt{x^2+1} = \log_e\left(\sqrt{x^2+1} - x\right)$, then :

A $(x^2+1)y' + xy - 1 = 0$

B $(x^2+1)y'' + 3xy' + y = 0$

C $(x^2+1)y'' + xy' - y = 0$

D $(x^2+1)y' + 2xy + 1 = 0$

Answer Given By Candidate:**Not Attempted**

Question ID:100410
Topic Name: Mathematics – Part I-Section A
Consider the following statements

(S1) $1\cdot2+2\cdot3+3\cdot4+.....+n\cdot(n+1)\le\frac{n(n^2+40)}{10}$

(S2) $1\cdot3+3\cdot5+5\cdot7+.....+(2n-1)\cdot(2n+1)\le\frac{4n^2(2n+3)}{5}$

Question: Then, for any $n\in N$,

A both (S1) and (S2) are true

B both (S1) and (S2) are false

C only (S1) is true

D only (S2) is true

Answer Given By Candidate:**Not Attempted**

Question ID:100411
Topic Name: Mathematics – Part I-Section A
Question: The value of the integral $\int_0^1 \tan^{-1}(1-x+x^2)\,dx$ is :

A $\frac{\pi}{4} - \frac{1}{2}\log_e 2$

B $\frac{\pi}{2} - \log_e 2$

C $\log_e 2$

D $\pi + \log_e 2$

Answer Given By Candidate:**Not Attempted**

Question ID:100412
Topic Name: Mathematics – Part I-Section A
Question:

Let $\vec{a} = x\hat{i} + \hat{j} + \hat{k}$, $\vec{b} = y\hat{i} + 2\hat{k}$ and $\vec{c} = 2\hat{j} + y\hat{k}$ be three vectors such that projection of $\vec{a}$ on $\vec{b}$ is $\frac{4}{\sqrt{5}}$ and projection of $\vec{a}$ on $\vec{c}$ is $\frac{3}{\sqrt{5}}$. If $|\vec{c}| < 3$ and $|\vec{a}| < 6$, then $\vec{a} \cdot (\vec{b} \times \vec{c})$ is equal to :

A -7

B -5

C 9

D 16

Answer Given By Candidate:**A**

Question ID:100413
Topic Name: Mathematics – Part I-Section A
Question:

A rod of length 11 units moves in such a way that its ends A and B are on the lines $2x - 3y = 0$ and $3x + 2y = 0$, respectively. The mid-point of the rod lies on a :

A circle of radius 11 units

B circle of radius $\frac{11}{2}$ units

C parabola whose latus rectum is of length 11 units

D parabola whose latus rectum is of length $\frac{11}{2}$ units

Answer Given By Candidate:**Not Attempted**

Question ID:100414
Topic Name: Mathematics – Part I-Section A
Question:

Consider the following differential equation

$$\frac{dy}{dx} = \frac{e^{2y} + x^2}{x^3}, \; x > 0.$$

If $y(e) = 1$, then $y(1)$ is equal to :

A $-\frac{3}{2}$

B $\log_e(\sqrt{3})$

C $\log_e\left(\frac{1}{\sqrt{5}}\right)$

D $\log_e\left(\frac{1}{\sqrt{3}}\right)$

Answer Given By Candidate:**Not Attempted**

Question ID:100415
Topic Name: Mathematics – Part I-Section A
Question:

A light ray is thrown from the point (2, 0). After reflecting from y-axis at (0, 2), if this ray divides the line segment of the line $x+y=3$ in the first quadrant in the ratio m : n (m < n), then $\frac{2n-m}{2n+m}$ is equal to :

A $\frac{9}{11}$

B $\frac{11}{13}$

C $\frac{5}{7}$

D $\frac{2}{3}$

Answer Given By Candidate:**Not Attempted**

Question ID:100416
Topic Name: Mathematics – Part I-Section A
Question:

The distance between the two points on the hyperbola $x^2-y^2=60$, where the tangents are parallel to the line $y=2x$, is :

A $6\sqrt{10}$

B 20

C 10

D $10\sqrt{2}$

Answer Given By Candidate:**Not Attempted**

Question ID:100417
Topic Name: Mathematics – Part I-Section A
Question:

Let Q be the mirror image of the point (2, 3, 4) with respect to the plane $2x-y+z+4=0$. Then Q lies on :

A $x-y+3z+5=0$

B

$x+2y+3z-10=0$

C $\frac{x-6}{5}=y-8=\frac{z-5}{2}$

D $\frac{x+6}{5}=y+8=\frac{z+5}{3}$

Answer Given By Candidate:**Not Attempted**

Question ID:100418
Topic Name: Mathematics – Part I-Section A
Question:

For some $p \in \mathbf{R}$, let the line (L_1) $\frac{x-1}{2}=\frac{y-1}{p}=\frac{z-2}{2}$ intersect the line L_2 passing through the point A(1, 2, 0) and parallel to the plane $x+y+z=1$. If L_1 lies on the plane $2x+3y-4z=3$, then the line L_2 is :

A $\frac{8x-5}{-3}=\frac{4y-3}{-5}=\frac{8z-13}{13}$

B $\frac{4x-5}{1}=\frac{2y-3}{-1}=\frac{4z-13}{13}$

C $\frac{8x-5}{3}=\frac{4y-3}{5}=\frac{4z-13}{-13}$

D $\frac{8x+5}{-13}=\frac{4y+3}{-11}=\frac{8z-13}{13}$

Answer Given By Candidate:**C**

Question ID:100419
Topic Name: Mathematics – Part I-Section A
Question:

Let the mean of the data 2, 6, 12, 8, k, 20 be 12. If m and σ^2 are the mean deviation about the median and the variance of the data respectively, then $\frac{\sigma^2}{m}$ is equal to :

A 9

B 10

C 12

D 18

Answer Given By Candidate:**Not Attempted**

Question ID:100420
Topic Name: Mathematics – Part I-Section A
Question: The negation of $(p \rightarrow \sim p) \wedge ((\sim q) \rightarrow q)$ is equivalent to :

A

$(\sim p) \rightarrow q$

B $p \rightarrow q$

C $(\sim p) \rightarrow (\sim q)$

D $p \rightarrow \sim q$

Answer Given By Candidate:**Not Attempted**

Question ID:100421
Topic Name: Mathematics – Part I-Section B
Question:

Let $\binom{n}{k}$ denote the number of ways of choosing k objects out of n distinct objects.

If $\sum_{k=1}^{20}\binom{20}{k}\binom{20}{k-1}(-1)^k+\sum_{k=0}^{20}\binom{20}{k}^2(-1)^k+\sum_{k=0}^{21}\binom{21}{k}^2(-1)^k = p\binom{19}{10}$, then p^2-p is equal to

_____.

Answer Given By Candidate:**Not Attempted**

Question ID:100422
Topic Name: Mathematics – Part I-Section B
Question:

If the largest area of a rectangle inscribed in an equilateral triangle, such that a side of the rectangle is on a side of the triangle, is $\frac{25}{2}\sqrt{3}$ unit^2, then the perimeter (in units) of the triangle is _____.

Answer Given By Candidate:**Not Attempted**

Question ID:100423
Topic Name: Mathematics – Part I-Section B
Question:

Let [t] denote the greatest integer less than or equal to t. The number of points where the function. $f(x)=\begin{cases} x^2+2x+2 & \text{if} \quad x \le -1 \\ \left[x^2+\frac{1}{4}x+\frac{5}{3}\right] & \text{if} \quad -1<x<1 \\ x^2-2x+4 & \text{if} \quad x \ge 1 \end{cases}$ is not continuous, is _____.

Answer Given By Candidate:**Not Attempted**

Question ID:100424
Topic Name: Mathematics – Part I-Section B
Question:

The number of 6-digit numbers formed by using all the digits 1, 3, 4, 5, 6, 8 and divisible by 11, is _____.

Answer Given By Candidate:**Not Attempted**

Question ID:100425
Topic Name: Mathematics – Part I-Section B
Question:

Let two elements (a, b), (c, d) be selected randomly from the Set

$S=\{(m, n) : m, n \in \{1, 2, ..., 10\}, m \neq n\}$.

If the probability that $a+b=c+d$ is p, then $(45)^2$ p is equal to :

Answer Given By Candidate:**Not Attempted**

Question ID:100426
Topic Name: Mathematics – Part I-Section B
Question:

If the length of a common tangent to $x^2+y^2=16$ and $9x^2+25y^2=225$, between the points of contact is L, then $32L^2$ is equal to _____.

Answer Given By Candidate:**Not Attempted**

Question ID:100427
Topic Name: Mathematics – Part I-Section B
Question:

Let $f_n(x)=\sum_{j=1}^{n}\cot^{-1}\left(1-(x+j)+(x+j)^2\right)$ for all $x\geq 0$. Then $\sum_{j=1}^{10}(j^2+1)\sin^2(f_j(0))$ is equal to

_____.

Answer Given By Candidate:**Not Attempted**

Question ID:100428
Topic Name: Mathematics – Part I-Section B
Question:

If the area enclosed by the curves $y=2x^2-1$ and $|x|=3-2y$ is A, then 12 A is equal to

_____.

Answer Given By Candidate:**Not Attempted**

Question ID:100429
Topic Name: Mathematics – Part I-Section B
Question:

If the roots of the equation $x^2+(\sqrt{3}-\sqrt{2}-1)x+(\sqrt{3}-2-\sqrt{6}+2\sqrt{2})=0$ are

$\tan\frac{A}{2}$ and $\tan\frac{B}{2}$, $0 < A, B < \pi$, then the value of $12\sec^2 4(A+B)$ is equal to _____.

Answer Given By Candidate:**Not Attempted**

Question ID:100430
Topic Name: Mathematics – Part I-Section B
Question:

The value of $2\int_{-1}^{4}(|x-3|+[x])\,dx$, where $[x]$ denotes the greatest integer less than or equal to

x, is _____.

Answer Given By Candidate:**Not Attempted**