TOP 500

JEE MAIN PYQS

MATHEMATICS

mathongo

Chapter: Quadratic Equation

Q1. JEE Main 2025 (7 April Shift 2)

The number of real roots of the equation $x|x-2|+3|x-3|+1=0$ is :

(1) 4 (2) 2

(3) 1 (4) 3

Q2. JEE Main 2025 (29 Jan Shift 2)

If the set of all $a \in \mathbf{R}$, for which the equation $2x^2+(a-5)x+15=3a$ has no real root, is the interval (α, β), and $X=\{x \in Z : \alpha < x < \beta\}$, then $\sum_{x \in X} x^2$ is equal to :

(1) 2109 (2) 2129

(3) 2119 (4) 2139

Q3. JEE Main 2025 (24 Jan Shift 1)

The product of all the rational roots of the equation $\left(x^2-9x+11\right)^2-(x-4)(x-5)=3$, is equal to

(1) 14 (2) 21

(3) 28 (4) 7

Q4. JEE Main 2025 (23 Jan Shift 1)

If the equation $a(b-c)x^2+b(c-a)x+c(a-b)=0$ has equal roots, where $a+c=15$ and $b=\frac{36}{5}$, then a^2+c^2 is equal to

Q5. JEE Main 2025 (2 April Shift 1)

Let $P_n=\alpha^n+\beta^n, n \in \mathbf{N}$. If $P_{10}=123, P_9=76, P_8=47$ and $P_1=1$, then the quadratic equation having roots $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ is :

(1) $x^2-x+1=0$ (2) $x^2+x-1=0$

(3) $x^2-x-1=0$ (4) $x^2+x+1=0$

Q6. JEE Main 2024 (31 Jan Shift 2)

The number of solutions, of the equation $e^{\sin x}-2e^{-\sin x}=2$ is

(1) 2 (2) more than 2

(3) 1 (4) 0

Q7. JEE Main 2024 (06 Apr Shift 1)

Let α, β be the distinct roots of the equation $x^2-\left(t^2-5t+6\right)x+1=0, t \in \mathbb{R}$ and $a_n=\alpha^n+\beta^n$. Then the minimum value of $\frac{a_{2023}+a_{2025}}{a_{2024}}$ is

(1) $-1/4$ (2) $-1/4$

(3) $-1/2$ (4) $1/4$

Q8. JEE Main 2024 (05 Apr Shift 2)

The number of real solutions of the equation $x|x+5|+2|x+7|-2=0$ is_____

Q9. JEE Main 2023 (31 Jan Shift 2)

The equation $e^{4x}+8e^{3x}+13e^{2x}-8e^{x}+1=0, x \in R$ has :

(1) four solutions two of which are negative

(2) two solutions and both are negative

(3) no solution

(4) two solutions and only one of them is negative

Q10. JEE Main 2023 (31 Jan Shift 1)

The number of real roots of the equation $\sqrt{x^2-4x+3}+\sqrt{x^2-9}=\sqrt{4x^2-14x+6}$, is:

(1) 0 (2) 1

(3) 3 (4) 2

Q11. JEE Main 2023 (29 Jan Shift 1)

Let $\lambda \neq 0$ be a real number. Let α, β be the roots of the equation $14x^2-31x+3\lambda=0$ and α, γ be the roots of the equation $35x^2-53x+4\lambda=0$. Then $\frac{3\alpha}{\beta}$ and $\frac{4\alpha}{\gamma}$ are the roots of the equation :

(1) $7x^2+245x-250=0$

(2) $7x^2-245x+250=0$

(3) $49x^2-245x+250=0$

(4) $49x^2+245x+250=0$

Q12. JEE Main 2022 (28 Jul Shift 1)

The sum of all real values of x for which $\frac{3x^2-9x+17}{x^2+3x+10}=\frac{5x^2-7x+19}{3x^2+5x+12}$ is equal to

Q13. JEE Main 2022 (25 Jul Shift 2)

Let $f(x)$ be a quadratic polynomial with leading coefficient 1 such that $f(0)=p, p \neq 0$, and $f(1)=\frac{1}{3}$. If the equations $f(x)=0$ and $fofofof(x)=0$ have a common real root, then $f(-3)$ is equal to _____.

Q14. JEE Main 2022 (25 Jul Shift 1)

Let a, b be two non-zero real numbers. If p and r are the roots of the equation $x^2-8ax+2a=0$ and q and s are the roots of the equation $x^2+12bx+6b=0$, such that $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}, \frac{1}{s}$ are in A.P., then $a^{-1}-b^{-1}$ is equal to _____ .

Q15. JEE Main 2021 (26 Feb Shift 1)

The sum of 162^{th} power of the roots of the equation $x^3-2x^2+2x-1=0$ is _____.

Q16. JEE Main 2021 (20 Jul Shift 1)

If α and β are the distinct roots of the equation $x^2 + (3)^{\frac{1}{4}}x + 3^{\frac{1}{2}} = 0$, then the value of $\alpha^{96}\left(\alpha^{12} - 1\right) + \beta^{96}\left(\beta^{12} - 1\right)$ is equal to:

(1) 56×3^{25}
(2) 56×3^{24}
(3) 52×3^{24}
(4) 28×3^{25}

Chapter: Complex Number

Q17. JEE Main 2025 (8 April Shift 2)

Let $\mathrm{A} = \left\{\theta \in [0, 2\pi] : 1 + 10\,\mathrm{Re}\left(\frac{2\cos\theta + i\sin\theta}{\cos\theta - 3i\sin\theta}\right) = 0\right\}$.

Then $\sum_{\theta \in A} \theta^2$ is equal to

(1) $\frac{21}{4}\pi^2$
(2) $8\pi^2$
(3) $\frac{27}{4}\pi^2$
(4) $6\pi^2$

Q18. JEE Main 2025 (7 April Shift 2)

If the locus of $z \in \mathrm{C}$, such that
$\mathrm{Re}\left(\frac{z-1}{2z+\mathrm{i}}\right) + \mathrm{Re}\left(\frac{\bar{z}-1}{2\bar{z}-\mathrm{i}}\right) = 2$
is a circle of radius r and center (a, b) then $\frac{15ab}{r^2}$ is equal to :

(1) 24
(2) 12
(3) 18
(4) 16

Q19. JEE Main 2025 (4 April Shift 2)

Let the product of $\omega_1 = (8 + i)\sin\theta + (7 + 4i)\cos\theta$ and $\omega_2 = (1 + 8i)\sin\theta + (4 + 7i)\cos\theta$ be $\alpha + i\beta$, $\mathrm{i} = \sqrt{-1}$.

Let p and q be the maximum and the minimum values of $\alpha + \beta$ respectively.

(1) 140
(2) 130
(3) 160
(4) 150

Q20. JEE Main 2025 (4 April Shift 2)

If α is a root of the equation $x^2 + x + 1 = 0$ and $\sum_{\mathrm{k}=1}^{\mathrm{n}} \left(\alpha^{\mathrm{k}} + \frac{1}{\alpha^{\mathrm{k}}}\right)^2 = 20$, then n is equal to

Q21. JEE Main 2025 (4 April Shift 1)

Let $A = \{z \in C : |z - 2 - i| = 3\}$, $B = \{z \in C : \mathrm{Re}(z - iz) = 2\}$ and $S = A \cap B$. Then $\sum_{z \in S} |z|^2$ is equal to _____ .

Q22. JEE Main 2025 (29 Jan Shift 1)

Let $|z_1 - 8 - 2i| \leq 1$ and $|z_2 - 2 + 6i| \leq 2, z_1, z_2 \in \mathbf{C}$. Then the minimum value of $|z_1 - z_2|$ is :

(1) 13 (2) 10

(3) 3 (4) 7

Q23. JEE Main 2025 (28 Jan Shift 2)

If $\alpha + i\beta$ and $\gamma + i\delta$ are the roots of $x^2 - (3 - 2i)x - (2i - 2) = 0, i = \sqrt{-1}$, then $\alpha\gamma + \beta\delta$ is equal to :

(1) -2 (2) 6

(3) -6 (4) 2

Q24. JEE Main 2025 (28 Jan Shift 1)

Let O be the origin, the point A be $z_1 = \sqrt{3} + 2\sqrt{2}i$, the point $B(z_2)$ be such that $\sqrt{3}|z_2| = |z_1|$ and $\arg(z_2) = \arg(z_1) + \frac{\pi}{6}$. Then

(1) area of triangle ABO is $\frac{11}{\sqrt{3}}$ (2) ABO is an obtuse angled isosceles triangle

(3) area of triangle ABO is $\frac{11}{4}$ (4) ABO is a scalene triangle

Q25. JEE Main 2025 (24 Jan Shift 1)

If α and β are the roots of the equation $2z^2 - 3z - 2\mathrm{i} = 0$, where $\mathrm{i} = \sqrt{-1}$, then $16 \cdot \mathrm{Re}\left(\frac{\alpha^{19}+\beta^{19}+\alpha^{11}+\beta^{11}}{\alpha^{15}+\beta^{15}}\right) \cdot \mathrm{lm}\left(\frac{\alpha^{19}+\beta^{19}+\alpha^{11}+\beta^{11}}{\alpha^{15}+\beta^{15}}\right)$ is equal to

(1) 441 (2) 398

(3) 312 (4) 409

Q26. JEE Main 2025 (22 Jan Shift 1)

Let z_1, z_2 and z_3 be three complex numbers on the circle $|z| = 1$ with $\arg(z_1) = \frac{-\pi}{4}$, $\arg(z_2) = 0$ and $\arg(z_3) = \frac{\pi}{4}$. If $|z_1\bar{z}_2 + z_2\bar{z}_3 + z_3\bar{z}_1|^2 = \alpha + \beta\sqrt{2}, \alpha, \beta \in \mathbf{Z}$, then the value of $\alpha^2 + \beta^2$ is :

(1) 24 (2) 29

(3) 41 (4) 31

Q27. JEE Main 2025 (2 April Shift 1)

Let z be a complex number such that $|z| = 1$. If $\frac{2+\mathrm{k}^2\mathrm{z}}{\mathrm{k}+\mathrm{z}} = \mathrm{kz}, \mathrm{k} \in \mathbf{R}$, then the maximum distance of $\mathrm{k} + \mathrm{ik}^2$ from the circle $|\mathrm{z} - (1 + 2\mathrm{i})| = 1$ is:

(1) $\sqrt{5} + 1$ (2) 2

(3) 3 (4) $\sqrt{3} + 1$

Q28. JEE Main 2024 (29 Jan Shift 2)

Let α, β be the roots of the equation $x^2-\sqrt{6} x+3=0$ such that $\operatorname{Im}(\alpha)>\operatorname{Im}(\beta)$. Let $a,\ b$ be integers not divisible by 3 and n be a natural number such that $\frac{\alpha^{99}}{\beta}+\alpha^{98}=3^n\left(a+i b\right),\ i=\sqrt{-1}$. Then $n+a+b$ is equal to _____.

Q29. JEE Main 2024 (27 Jan Shift 1)

If $\mathrm{S}=\mathrm{z} \in \mathrm{C}:|\mathrm{z}-\mathrm{i}|=|\mathrm{z}+\mathrm{i}|=|\mathrm{z}-1|$, then, $\mathrm{n}(\mathrm{S})$ is:

(1) 1 (2) 0

(3) 3 (4) 2

Q30. JEE Main 2024 (27 Jan Shift 1)

If α satisfies the equation $x^2+x+1=0$ and $(1+\alpha)^7=\mathrm{A}+\mathrm{B} \alpha+\mathrm{C} \alpha^2,\ \mathrm{A},\ \mathrm{B}, \mathrm{C} \geq 0$, then $5(3\ \mathrm{A}-2\ \mathrm{B}-\mathrm{C})$ is equal to

Q31. JEE Main 2024 (05 Apr Shift 2)

Let $S_1=\{z \in C:|z| \leq 5\}, S_2=\left\{z \in C: \operatorname{Im}\left(\frac{z+1-\sqrt{3} i}{1-\sqrt{3} i}\right) \geq 0\right\}$ and $S_3=\{z \in C: \operatorname{Re}(z) \geq 0\}$. Then the area of the region $S_1 \cap S_2 \cap S_3$ is :

(1) $\frac{125 \pi}{12}$ (2) $\frac{125 \pi}{4}$

(3) $\frac{125 \pi}{24}$ (4) $\frac{125 \pi}{6}$

Q32. JEE Main 2024 (04 Apr Shift 2)

The area (in sq. units) of the region $S=\{z \in \mathbb{C}:|z-1| \leq 2 ;(z+\bar{z})+i(z-\bar{z}) \leq 2, \operatorname{Im}(z) \geq 0\}$ is

(1) $\frac{7 \pi}{3}$ (2) $\frac{7 \pi}{4}$

(3) $\frac{17 \pi}{8}$ (4) $\frac{3 \pi}{2}$

Q33. JEE Main 2024 (01 Feb Shift 1)

Let $S=\{z \in C:|z-1|=1$ and $(\sqrt{2}-1)(z+\bar{z})-i(z-\bar{z})=2 \sqrt{2}\}$. Let $z_1, z_2 \in S$ be such that $\left|z_1\right|=\max _{z \in s}|z|$ and $\left|z_2\right|=\min _{z \in s}|z|$. Then $\left|\sqrt{2} z_1-z_2\right|^2$ equals:

(1) 1 (2) 4

(3) 3 (4) 2

Q34. JEE Main 2024 (01 Feb Shift 1)

Let $P=\{z \in \mathbb{C}:|z+2-3 i| \leq 1\}$ and $Q=\{z \in \mathbb{C}: z(1+i)+\bar{z}(1-i) \leq-8\}$. Let in $P \cap Q,|z-3+2 i|$ be maximum and minimum at z_1 and z_2 respectively. If $\left|z_1\right|^2+2|z|^2=\alpha+\beta \sqrt{2}$, where α, β are integers, then $\alpha+\beta$ equals _____

Q35. JEE Main 2023 (24 Jan Shift 1)

Let $p,\ q \in \mathbb{R}$ and $\left(1-\sqrt{3}i\right)^{200} = 2^{199}\left(p+iq\right)$, $i=\sqrt{-1}$. Then, $p+q+q^2$ and $p-q+q^2$ are roots of the equation.

(1) $x^2+4x-1=0$ (2) $x^2-4x+1=0$

(3) $x^2+4x+1=0$ (4) $x^2-4x-1=0$

Q36. JEE Main 2023 (06 Apr Shift 2)

Let $a \neq b$ be two non-zero real numbers. Then the number of elements in the set $X=\{z \in C : \mathrm{Re}(az^2+bz)=a\}$ and $\mathrm{Re}(bz^2+az)=b$ is equal to

(1) 0 (2) 1

(3) 3 (4) 2

Q37. JEE Main 2023 (01 Feb Shift 2)

Let a, b be two real numbers such that $ab<0$. If the complex number $\frac{1+ai}{b+i}$ is of unit modulus and $a+ib$ lies on the circle $|z-1|=|2z|$, then a possible value of $\frac{1+[a]}{4b}$, where $[t]$ is greatest integer function, is :

(1) 0 (2) -1

(3) 1 (4) $\frac{1}{2}$

Q38. JEE Main 2022 (28 Jul Shift 2)

Let $\mathrm{z}=\mathrm{a}+ib,\ \mathrm{b} \neq 0$ be complex numbers satisfying $\mathrm{z}^2=\bar{\mathrm{z}} \cdot 2^{1-|z|}$. Then the least value of $n \in N$, such that $z^n=(z+1)^n$, is equal to _____ .

Q39. JEE Main 2022 (26 Jun Shift 1)

Let $A=\left\{z \in C : \left|\frac{z+1}{z-1}\right|<1\right\}$ and $B=\left\{z \in C : \arg\left(\frac{z-1}{z+1}\right)=\frac{2\pi}{3}\right\}$. Then $A \cap B$ is

(1) a portion of a circle centred at $\left(0,-\frac{1}{\sqrt{3}}\right)$ that lies in the second and third quadrants only

(2) a portion of a circle centred at $\left(0,-\frac{1}{\sqrt{3}}\right)$ that lies in the second quadrant only

(3) an empty set

(4) a portion of a circle of radius $\frac{2}{\sqrt{3}}$ that lies in the third quadrant only

Q40. JEE Main 2021 (18 Mar Shift 2)

Let a complex number be $w=1-\sqrt{3}i$. Let another complex number z be such that $|zw|=1$ and $\arg(z)-\arg(w)=\frac{\pi}{2}$. Then the area of the triangle (in sq. units) with vertices origin, z and w is equal to

(1) 4 (2) $\frac{1}{2}$

(3) $\frac{1}{4}$ (4) 2

Q41. JEE Main 2021 (16 Mar Shift 1)

Let z and w be two complex numbers such that $w = z\bar{z} - 2z + 2$, $\left|\frac{z+i}{z-3i}\right| = 1$ and Re (w) has minimum value. Then, the minimum value of $n \in N$ for which w^n is real, is equal to _____.

Chapter: Sequences and Series

Q42. JEE Main 2025 (8 April Shift 2)

If $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \ldots\ldots\infty = \frac{\pi^4}{90}$,

$\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \ldots\ldots\infty = \alpha$,

$\frac{1}{2^4} + \frac{1}{4^4} + \frac{1}{6^4} + \ldots\ldots\infty = \beta$,

then $\frac{\alpha}{\beta}$ is equal to

(1) 23 (2) 18 (3) 15 (4) 14

Q43. JEE Main 2025 (7 April Shift 2)

If the sum of the second, fourth and sixth terms of a G.P. of positive terms is 21 and the sum of its eighth, tenth and twelfth terms is 15309 , then the sum of its first nine terms is :

(1) 760 (2) 755 (3) 750 (4) 757

Q44. JEE Main 2025 (7 April Shift 1)

Let x_1, x_2, x_3, x_4 be in a geometric progression. $2, 7, 9, 5$ are subtracted respectively from $x_1, x_2, x_3\ x_4$ then the resulting numbers are in an arithmetic progression. Then the value of $\frac{1}{24}(x_1x_2x_3x_4)$ is :

(1) 72 (2) 18 (3) 36 (4) 216

Q45. JEE Main 2025 (4 April Shift 2)

Consider two sets A and B, each containing three numbers in A.P. Let the sum and the product of the elements of A be 36 and p respectively and the sum and the product of the elements of B be 36 and q respectively. Let d and D be the common differences of AP's in A and B respectively such that $D = d + 3, d > 0$. If $\frac{p+q}{p-q} = \frac{19}{5}$, then $p - q$ is equal to

(1) 600 (2) 450

(3) 630 (4) 540

Q46. JEE Main 2025 (4 April Shift 2)

If the sum of the first 20 terms of the series

$\frac{4.1}{4+3.1^2+1^4} + \frac{4.2}{4+3.2^2+2^4} + \frac{4.3}{4+3.3^2+3^4} + \frac{4.4}{4+3.4^2+4^4} + \ldots$

is $\frac{m}{n}$, where m and n are coprime, then $m + n$ is equal to :-

(1) 423 (2) 420

(3) 421 (4) 422

Q47. JEE Main 2025 (3 April Shift 1)

Let $a_1, a_2, a_3, \ldots$ be a G. P. of increasing positive numbers. If $\mathrm{a}_3\mathrm{a}_5 = 729$ and $\mathrm{a}_2 + \mathrm{a}_4 = \frac{111}{4}$, then $24\left(a_1 + a_2 + a_3\right)$ is equal to

(1) 131 (2) 130

(3) 129 (4) 128

Q48. JEE Main 2025 (29 Jan Shift 2)

Let $a_1, a_2, \ldots, a_{2024}$ be an Arithmetic Progression such that $a_1 + \left(a_5 + a_{10} + a_{15} + \ldots + a_{2020}\right) + a_{2024} = 2233$. Then $a_1 + a_2 + a_3 + \ldots + a_{2024}$ is equal to _____

Q49. JEE Main 2025 (29 Jan Shift 1)

Consider an A. P. of positive integers, whose sum of the first three terms is 54 and the sum of the first twenty terms lies between 1600 and 1800. Then its 11^{th} term is :

(1) 90 (2) 84

(3) 122 (4) 108

Q50. JEE Main 2025 (29 Jan Shift 1)

The value of $\lim_{n\to\infty}\left(\sum_{k=1}^{n}\frac{k^3+6k^2+11k+5}{(k+3)!}\right)$ is:

(1) $4/3$ (2) 2

(3) $7/3$ (4) $5/3$

Q51. JEE Main 2025 (28 Jan Shift 2)

For positive integers n, if $4a_n = \left(n^2 + 5n + 6\right)$ and $S_n = \sum_{k=1}^{n}\left(\frac{1}{a_k}\right)$, then the value of $507S_{2025}$ is :

(1) 540 (2) 675

(3) 1350 (4) 135

Q52. JEE Main 2025 (28 Jan Shift 1)

Let T_r be the r^{th} term of an A.P. If for some m, $\mathrm{T}_\mathrm{m} = \frac{1}{25}$, $\mathrm{T}_{25} = \frac{1}{20}$, and $20\sum_{\mathrm{r}=1}^{25}\mathrm{T}_\mathrm{r} = 13$, then $5\,\mathrm{m}\sum_{\mathrm{r}=\mathrm{m}}^{2\,\mathrm{m}}\mathrm{T}_\mathrm{r}$ is equal to

(1) 98 (2) 126

(3) 142 (4) 112

Q53. JEE Main 2025 (24 Jan Shift 1)

Let $S_n = \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \ldots$ upto n terms. If the sum of the first six terms of an A.P. with first term -p and common difference p is $\sqrt{2026\,\mathrm{S}_{2025}}$, then the absolute difference betwen 20^{th} and 15^{th} terms of the A.P. is

(1) 20 (2) 90 (3) 45 (4) 25

Q54. JEE Main 2025 (23 Jan Shift 2)

The roots of the quadratic equation $3x^2 - \mathrm{p}x + \mathrm{q} = 0$ are 10^{th} and 11^{th} terms of an arithmetic progression with common difference $\frac{3}{2}$. If the sum of the first 11 terms of this arithmetic progression is 88 , then $q - 2p$ is equal to _____ -.

Q55. JEE Main 2025 (22 Jan Shift 2)

Suppose that the number of terms in an A.P. is $2k, k \in N$. If the sum of all odd terms of the A.P. is 40 , the sum of all even terms is 55 and the last term of the A.P. exceeds the first term by 27, then k is equal to :

(1) 6 (2) 5 (3) 8 (4) 4

Q56. JEE Main 2025 (22 Jan Shift 1)

If $\sum_{r=1}^{n} T_r = \frac{(2n-1)(2n+1)(2n+3)(2n+5)}{64}$, then $\lim_{n\to\infty} \sum_{r=1}^{n} \left(\frac{1}{T_r}\right)$ is equal to :

(1) 0 (2) $\frac{2}{3}$ (3) 1 (4) $\frac{1}{3}$

Q57. JEE Main 2025 (2 April Shift 2)

The number of terms of an A.P. is even; the sum of all the odd terms is 24 , the sum of all the even terms is 30 and the last term exceeds the first by $\frac{21}{2}$. Then the number of terms which are integers in the A.P. is :

(1) 4 (2) 10 (3) 6 (4) 8

Q58. JEE Main 2024 (29 Jan Shift 2)

If each term of a geometric progression $\mathrm{a}_1, \mathrm{a}_2, \mathrm{a}_3, \ldots$ with $\mathrm{a}_1 = \frac{1}{8}$ and $\mathrm{a}_2 \neq \mathrm{a}_1$, is the arithmetic mean of the next two terms and $\mathrm{S}_\mathrm{n} = \mathrm{a}_1 + \mathrm{a}_2 + \ldots + \mathrm{a}_\mathrm{n}$, then $\mathrm{S}_{20} - \mathrm{S}_{18}$ is equal to

(1) 2^{15} (2) -2^{18} (3) 2^{18} (4) -2^{15}

Q59. JEE Main 2024 (06 Apr Shift 2)

A software company sets up m number of computer systems to finish an assignment in 17 days. If 4 computer systems crashed on the start of the second day, 4 more computer systems crashed on the start of the third day and so on, then it took 8 more days to finish the assignment. The value of m is equal to:

(1) 150 (2) 180 (3) 160 (4) 125

Q60. JEE Main 2024 (06 Apr Shift 2)

Let ABC be an equilateral triangle. A new triangle is formed by joining the middle points of all sides of the triangle ABC and the same process is repeated infinitely many times. If P is the sum of perimeters and Q is be the sum of areas of all the triangles formed in this process, then:

(1) $\mathrm{P}^2 = 6\sqrt{3}\mathrm{Q}$ (2) $\mathrm{P}^2 = 36\sqrt{3}\mathrm{Q}$

(3) $\mathrm{P} = 36\sqrt{3}\mathrm{Q}^2$ (4) $\mathrm{P}^2 = 72\sqrt{3}\mathrm{Q}$

Q61. JEE Main 2024 (01 Feb Shift 2)

If three successive terms of a G.P. with common ratio $r(r > 1)$ are the length of the sides of a triangle and $[r]$ denotes the greatest integer less than or equal to r, then $3[r] + [-r]$ is equal to:

Q62. JEE Main 2022 (28 Jul Shift 1)

If the minimum value of $f(x) = \frac{5x^2}{2} + \frac{\alpha}{x^5}, x > 0$, is 14, then the value of α is equal to

(1) 32 (2) 64 (3) 128 (4) 256

Q63. JEE Main 2022 (26 Jul Shift 1)

Consider two G.Ps. $2, 2^2, 2^3, \ldots$ and $4, 4^2, 4^3, \ldots$ of 60 and n terms respectively. If the geometric mean of all the $60 + n$ terms is $(2)^{\frac{225}{8}}$, then $\sum_{k=1}^{n} k(n-k)$ is equal to:

(1) 560 (2) 1540 (3) 1330 (4) 2600

Q64. JEE Main 2022 (24 Jun Shift 2)

Let $x, y > 0$. If $x^3y^2 = 2^{15}$, then the least value of $3x + 2y$ is

(1) 30 (2) 32 (3) 36 (4) 40

Q65. JEE Main 2020 (07 Jan Shift 2)

Let $a_1, a_2, a_3, \ldots$, be a G. P. such that $a_1 < 0, a_1 + a_2 = 4$ and $a_3 + a_4 = 16$. If $\sum_{i=1}^{9} a_i = 4\lambda$, then λ, is equal to.

(1) -513 (2) -171 (3) 171 (4) $\frac{511}{3}$

Q66. JEE Main 2020 (02 Sep Shift 1)

If $|x| < 1$, $|y| < 1$ and $x \neq 1$, then the sum to infinity of the following series $(x + y) + (x^2 + xy + y^2) + (x^3 + x^2y + xy^2 + y^3) + \ldots\ldots$ is

(1) $\frac{x+y-xy}{(1+x)(1+y)}$ (2) $\frac{x+y+xy}{(1+x)(1+y)}$

(3) $\frac{x+y-xy}{(1-x)(1-y)}$ (4) $\frac{x+y+xy}{(1-x)(1-y)}$

Chapter: Permutation Combination

Q67. JEE Main 2025 (7 April Shift 2)

Let p be the number of all triangles that can be formed by joining the vertices of a regular polygon P of n sides and q be the number of all quadrilaterals that can be formed by joining the vertices of P. If $p + q = 126$, then the eccentricity of the ellipse $\frac{x^2}{16} + \frac{y^2}{n} = 1$ is :

(1) $\frac{3}{4}$ (2) $\frac{1}{2}$ (3) $\frac{\sqrt{7}}{4}$ (4) $\frac{1}{\sqrt{2}}$

Q68. JEE Main 2025 (7 April Shift 1)

For n ≥ 2, let S_n denote the set of all subsets of $\{1, 2 \ldots \ldots, n\}$ with no two consecutive numbers. For example $\{1, 3, 5\} \in \mathrm{S}_6$, but $\{1, 2, 4\} \notin \mathrm{S}_6$. Then $n(\mathrm{S}_5)$ is equal to _____

Q69. JEE Main 2025 (3 April Shift 1)

If the number of seven-digit numbers, such that the sum of their digits is even, is $m \cdot n \cdot 10^{\mathrm{n}}$; $m, n \in \{1, 2, 3, \ldots, 9\}$, then $m + n$ is equal to _____

Q70. JEE Main 2025 (29 Jan Shift 1)

The number of 6-letter words, with or without meaning, that can be formed using the letters of the word MATHS such that any letter that appears in the word must appear at least twice, is _____.

Q71. JEE Main 2025 (28 Jan Shift 1)

The number of different 5 digit numbers greater than 50000 that can be formed using the digits 0 , 1, 2, 3, 4, 5, 6, 7, such that the sum of their first and last digits should not be more than 8 , is

(1) 4608 (2) 5720

(3) 5719 (4) 4607

Q72. JEE Main 2025 (23 Jan Shift 2)

The number of ways, 5 boys and 4 girls can sit in a row so that either all the boys sit together or no two boys sit together, is _____ -

Q73. JEE Main 2025 (23 Jan Shift 1)

The number of words, which can be formed using all the letters of the word "DAUGHTER", so that all the vowels never come together, is

(1) 36000 (2) 37000

(3) 34000 (4) 35000

Q74. JEE Main 2025 (22 Jan Shift 2)

In a group of 3 girls and 4 boys, there are two boys B_1 and B_2. The number of ways, in which these girls and boys can stand in a queue such that all the girls stand together, all the boys stand together, but B_1 and B_2 are not adjacent to each other, is :

(1) 96 (2) 144 (3) 120 (4) 72

Q75. JEE Main 2025 (22 Jan Shift 1)

From all the English alphabets, five letters are chosen and are arranged in alphabetical order. The total number of ways, in which the middle letter is ' M ', is :

(1) 5148 (2) 6084

(3) 4356 (4) 14950

Q76. JEE Main 2025 (2 April Shift 1)

The largest $n \in N$ such that 3^n divides 50 ! is:

(1) 21 (2) 22 (3) 20 (4) 23

Q77. JEE Main 2024 (30 Jan Shift 2)

In an examination of Mathematics paper, there are 20 questions of equal marks and the question paper is divided into three sections : A, B and C. A student is required to attempt total 15 questions taking at least 4 questions from each section. If section A has 8 questions, section B has 6 questions and section C has 6 questions, then the total number of ways a student can select 15 questions is _____.

Q78. JEE Main 2024 (29 Jan Shift 2)

Number of ways of arranging 8 identical books into 4 identical shelves where any number of shelves may remain empty is equal to

(1) 18 (2) 16 (3) 12 (4) 15

Q79. JEE Main 2024 (08 Apr Shift 2)

The number of ways five alphabets can be chosen from the alphabets of the word MATHEMATICS, where the chosen alphabets are not necessarily distinct, is equal to :

(1) 179 (2) 177 (3) 181 (4) 175

Q80. JEE Main 2024 (06 Apr Shift 2)

If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315^{th} position in this arrangement is :

(1) NRAGUP (2) NRAPUG

(3) NRAPGU (4) NRAGPU

Q81. JEE Main 2024 (01 Feb Shift 1)

If n is the number of ways five different employees can sit into four indistinguishable offices where any office may have any number of persons including zero, then n is equal to:

(1) 47 (2) 53 (3) 51 (4) 43

Q82. JEE Main 2023 (30 Jan Shift 2)

The number of ways of selecting two numbers a and b, $a \in \{2, 4, 6, \ldots\ldots, 100\}$ and $b \in \{1, 3, 5, \ldots\ldots, 99\}$ such that 2 is the remainder when $a + b$ is divided by 23 is

(1) 186 (2) 54

(3) 108 (4) 268

Q83. JEE Main 2023 (30 Jan Shift 1)

Number of 4-digit numbers (the repetition of digits is allowed) which are made using the digits $1,\ 2,\ 3$ and 5 , and are divisible by 15 , is equal to

Q84. JEE Main 2023 (25 Jan Shift 2)

Let $f(x) = 2x^n + \lambda, \lambda \in \mathbb{R}, \mathrm{n} \in \mathbb{N}$, and $f(4) = 133$, $f(5) = 255$. Then the sum of all the positive integer divisors of $(f(3) - f(2))$ is

(1) 61 (2) 60 (3) 58 (4) 59

Q85. JEE Main 2023 (11 Apr Shift 1)

The number of triplets $(x,\ y,\ z)$ where $x,\ y,\ z$ are distinct non negative integers satisfying $x + y + z = 15$, is

(1) 80 (2) 136 (3) 114 (4) 92

Q86. JEE Main 2022 (24 Jun Shift 1)

In an examination, there are 5 multiple choice questions with 3 choices, out of which exactly one is correct. There are 3 marks for each correct answer, -2 marks for each wrong answer and 0 mark if the question is not attempted. Then, the number of ways a student appearing in the examination gets 5 marks is _____

Q87. JEE Main 2021 (25 Feb Shift 2)

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

Q88. JEE Main 2020 (02 Sep Shift 2)

Let $n > 2$ be an integer. Suppose that there are n Metro stations in a city located around a circular path. Each pair of the nearest stations is connected by a straight track only. Further, each pair of the nearest station is connected by blue line, whereas all remaining pairs of stations are connected by red line. If number of red lines is 99 times the number of blue lines, then the value of n is

(1) 201 (2) 200

(3) 101 (4) 199

Chapter: Binomial Theorem

Q89. JEE Main 2025 (8 April Shift 2)

The product of the last two digits of $(1919)^{1919}$ is

Q90. JEE Main 2025 (8 April Shift 2)

The number of integral terms in the expansion of $\left(5^{\frac{1}{2}}+7^{\frac{1}{8}}\right)^{1016}$ is

(1) 127 (2) 130

(3) 129 (4) 128

Chapter: Binomial theorem

Q91. JEE Main 2025 (4 April Shift 2)

If $1^2 \cdot \left({}^{15}C_1\right)+2^2 \cdot \left({}^{15}C_2\right)+3^2 \cdot \left({}^{15}C_3\right)+\ldots+15^2 \cdot \left({}^{15}C_{15}\right)=2^m \cdot 3^n \cdot 5^k$, where $m, n, k \in \mathbf{N}$, then $\mathrm{m}+\mathrm{n}+\mathrm{k}$ is equal to :

(1) 19 (2) 21 (3) 18 (4) 20

Chapter: Binomial Theorem

Q92. JEE Main 2025 (4 April Shift 1)

For an integer $\mathrm{n} \geq 2$, if the arithmetic mean of all coefficients in the binomial expansion of $(x+y)^{2n-3}$ is 16 , then the distance of the point $P\left(2n-1, n^2-4n\right)$ from the line $x+y=8$ is:

(1) $\sqrt{2}$ (2) $2\sqrt{2}$

(3) $5\sqrt{2}$ (4) $3\sqrt{2}$

Q93. JEE Main 2025 (4 April Shift 1)

In the expansion of $\left(\sqrt[3]{2}+\frac{1}{\sqrt[3]{3}}\right)^n, \mathrm{n} \in \mathrm{N}$, if the ratio of 15^{at} term from the beginning to the 15^{th} term from the end is $\frac{1}{6}$, then the value of ${}^nC_3$ is:

(1) 4060 (2) 1040

(3) 2300 (4) 4960

Q94. JEE Main 2025 (3 April Shift 1)

If $\sum_{\mathrm{r}=1}^{9}\left(\frac{\mathrm{r}+3}{2^{\mathrm{r}}}\right) \cdot {}^{9}\mathrm{C}_{\mathrm{r}}=\alpha\left(\frac{3}{2}\right)^9-\beta, \quad \alpha, \beta \in \mathrm{N}, \quad$ then $(\alpha+\beta)^2$ is equal to

(1) 27 (2) 9 (3) 81 (4) 18

Q95. JEE Main 2025 (29 Jan Shift 2)

The remainder, when 7^{103} is divided by 23 , is equal to :

(1) 6 (2) 17 (3) 9 (4) 14

Q96. JEE Main 2025 (29 Jan Shift 1)

The least value of n for which the number of integral terms in the Binomial expansion of $(\sqrt[3]{7}+\sqrt[12]{11})^{n}$ is 183, is :

(1) 2184 (2) 2196

(3) 2148 (4) 2172

Q97. JEE Main 2025 (28 Jan Shift 2)

Let the coefficients of three consecutive terms T_r, T_{r+1} and T_{r+2} in the binomial expansion of $(a+b)^{12}$ be in a G.P. and let p be the number of all possible values of r. Let q be the sum of all rational terms in the binomial expansion of $(\sqrt[4]{3}+\sqrt[3]{4})^{12}$. Then p + q is equal to :

(1) 283 (2) 287 (3) 295 (4) 299

Q98. JEE Main 2025 (28 Jan Shift 1)

If $\alpha = 1+\sum_{r=1}^{6}(-3)^{r-1}\ {}^{12}C_{2r-1}$, then the distance of the point $(12, \sqrt{3})$ from the line $\alpha x - \sqrt{3}y + 1 = 0$ is _____.

Q99. JEE Main 2025 (22 Jan Shift 2)

Let α, β, γ and δ be the coefficients of x^7, x^5, x^3 and x respectively in the expansion of $\left(x+\sqrt{x^3-1}\right)^5+\left(x-\sqrt{x^3-1}\right)^5, x>1$. If u and v satisfy the equations $\alpha u+\beta v=18$, $\gamma u+\delta v=20$ then $u+v$ equals :

(1) 5 (2) 3

(3) 4 (4) 8

Q100. JEE Main 2025 (22 Jan Shift 1)

If $\sum_{r=0}^{5}\frac{{}^{11}C_{2r+1}}{2r+2}=\frac{m}{n}, \gcd(m,n)=1$, then m − n is equal to _____

Q101. JEE Main 2025 (2 April Shift 2)

If $\sum_{r=0}^{10}\left(\frac{10^{r+1}-1}{10^{r}}\right)\cdot{}^{11}C_{r+1}=\frac{\alpha^{11}-11^{11}}{10^{10}}$, then α is equal to :

(1) 15 (2) 11 (3) 24 (4) 20

Q102. JEE Main 2025 (2 April Shift 1)

The term independent of x in the expansion of $\left(\frac{(x+1)}{(x^{2/3}+1-x^{1/3})}-\frac{(x+1)}{(x-x^{1/2})}\right)^{10}, x>1$ is:

(1) 210 (2) 150

(3) 240 (4) 120

Q103. JEE Main 2024 (31 Jan Shift 1)

In the expansion of $(1+x)\left(1-x^2\right)\left(1+\frac{3}{x}+\frac{3}{x^2}+\frac{1}{x^3}\right)^5,\ x \neq 0$, the sum of the coefficient of x^3 and x^{-13} is equal to _____

Q104. JEE Main 2024 (30 Jan Shift 1)

Number of integral terms in the expansion of $\left\{7^{\left(\frac{1}{2}\right)}+11^{\left(\frac{1}{6}\right)}\right\}^{824}$ is equal to _____.

Q105. JEE Main 2024 (29 Jan Shift 2)

Remainder when $64^{32^{32}}$ is divided by 9 is equal to _____.

Q106. JEE Main 2024 (09 Apr Shift 1)

The remainder when 428^{2024} is divided by 21 is_____

Q107. JEE Main 2024 (01 Feb Shift 2)

Let m and n be the coefficients of seventh and thirteenth terms respectively in the expansion of $\left(\frac{1}{3}x^{\frac{1}{3}}+\frac{1}{2x^{\frac{2}{3}}}\right)^{18}$.

Then $\left(\frac{n}{m}\right)^{\frac{1}{3}}$ is:

(1) $\frac{4}{9}$ (2) $\frac{1}{9}$

(3) $\frac{1}{4}$ (4) $\frac{9}{4}$

Q108. JEE Main 2023 (31 Jan Shift 1)

The remainder on dividing 5^{99} by 11 is _____ .

Q109. JEE Main 2022 (28 Jun Shift 2)

The term independent of x in the expression of $\left(1-x^2+3x^3\right)\left(\frac{5}{2}x^3-\frac{1}{5x^2}\right)^{11}, x \neq 0$ is

(1) $\frac{7}{40}$ (2) $\frac{33}{200}$

(3) $\frac{39}{200}$ (4) $\frac{11}{50}$

Q110. JEE Main 2022 (25 Jul Shift 2)

The remainder when $(11)^{1011}+(1011)^{11}$ is divided by 9 is _____ .

(1) 1 (2) 8 (3) 6 (4) 4

Q111. JEE Main 2020 (06 Sep Shift 1)

If $\{p\}$ denotes the fractional part of the number p, then $\left\{\frac{3^{200}}{8}\right\}$ is equal to

(1) $\frac{5}{8}$ (2) $\frac{7}{8}$

(3) $\frac{3}{8}$ (4) $\frac{1}{8}$

Q112. JEE Main 2020 (02 Sep Shift 1)

Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $\left(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}}\right)^{10}$ is $10k$, then k is equal to

(1) 336
(2) 352
(3) 84
(4) 176

Chapter: Statistics

Q113. JEE Main 2025 (4 April Shift 2)

Let the mean and the standard deviation of the observation 2, 3, 3, 4, 5, 7, a, b be 4 and $\sqrt{2}$ respectively. Then the mean deviation about the mode of these observations is :

(1) 1
(2) $\frac{3}{4}$
(3) 2
(4) $\frac{1}{2}$

Q114. JEE Main 2025 (3 April Shift 2)

Let the Mean and Variance of five observations $x_1 = 1, x_2 = 3, x_3 = a, x_4 = 7$ and $x_5 = b, a > b$, be 5 and 10 respectively. Then the Variance of the observations $n + x_n, n = 1, 2, \ldots\ldots\ldots 5$ is

(1) 17
(2) 16.4
(3) 17.4
(4) 16

Q115. JEE Main 2025 (24 Jan Shift 1)

For a statistical data $x_1, x_2, \ldots, x_{10}$ of 10 values, a student obtained the mean as 5.5 and $\sum_{i=1}^{10} x_i^2 = 371$. He later found that he had noted two values in the data incorrectly as 4 and 5 , instead of the correct values 6 and 8 , respectively. The variance of the corrected data is

(1) 9
(2) 5
(3) 7
(4) 4

Q116. JEE Main 2025 (23 Jan Shift 1)

Marks obtains by all the students of class 12 are presented in a freqency distribution with classes of equal width. Let the median of this grouped data be 14 with median class interval 12-18 and median class frequency 12 . If the number of students whose marks are less than 12 is 18 , then the total number of students is

(1) 52
(2) 48
(3) 44
(4) 40

Q117. JEE Main 2025 (2 April Shift 2)

If the mean and the variance of $6, 4, a, 8, b, 12, 10, 13$ are 9 and 9.25 respectively, then $a + b + ab$ is equal to :

(1) 105
(2) 103
(3) 100
(4) 106

Q118. JEE Main 2024 (08 Apr Shift 2)

Let $a, b, c \in N$ and $a < b < c$. Let the mean, the mean deviation about the mean and the variance of the 5 observations $9, 25, a, b, c$ be 18,4 and $\frac{136}{5}$, respectively. Then $2a + b - c$ is equal to_____

Q119. JEE Main 2024 (04 Apr Shift 2)

If the mean of the following probability distribution of a random variable X :

X	0	2	4	6	8
P(X)	a	$2a$	$a+b$	$2b$	$3b$

is $\frac{46}{9}$, then the variance of the distribution is

(1) $\frac{173}{27}$ (2) $\frac{566}{81}$

(3) $\frac{151}{27}$ (4) $\frac{581}{81}$

Q120. JEE Main 2024 (01 Feb Shift 1)

Let the median and the mean deviation about the median of 7 observation $170, 125, 230, 190, 210, a, b$ be 170 and $\frac{205}{7}$ respectively. Then the mean deviation about the mean of these 7 observations is:

(1) 31 (2) 28 (3) 30 (4) 32

Q121. JEE Main 2023 (30 Jan Shift 1)

The mean and variance of 7 observations are 8 and 16 respectively. If one observation 14 is omitted, a and b are respectively mean and variance of remaining 6 observation, then $a + 3\,b - 5$ is equal to _____

Q122. JEE Main 2022 (26 Jul Shift 2)

The mean and standard deviation of 40 observations are 30 and 5 respectively. It was noticed that two of these observations 12 and 10 were wrongly recorded. If σ is the standard deviation of the data after omitting the two wrong observations from the data, then $38\sigma^2$ is equal to _____.

Q123. JEE Main 2021 (27 Jul Shift 2)

Let the mean and variance of the frequency distribution

x :	$x_1 = 2$	$x_2 = 6$	$x_3 = 8$	$x_4 = 9$
f :	4	4	α	β

be 6 and 6.8 respectively. If x_3 is changed from 8 to 7, then the mean for the new dala will be:

(1) 4 (2) 5

(3) $\frac{17}{3}$ (4) $\frac{16}{3}$

Q124. JEE Main 2021 (25 Jul Shift 2)

The first of the two samples in a group has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15. 6 and standard deviation $\sqrt{13.44}$, then the standard deviation of the second sample is:

(1) 8 (2) 6 (3) 4 (4) 5

Q125. JEE Main 2021 (22 Jul Shift 1)

Consider the following frequency distribution:

Class:	$0-6$	$6-12$	$12-18$
Frequency:	a	b	12

Class:	$18-24$	$24-30$
Frequency:	9	5

If mean $=\frac{309}{22}$ and median $=14$, then the value $(a-b)^2$ is equal to

Chapter: Matrices

Q126. JEE Main 2025 (8 April Shift 2)

Let α be a solution of $x^2+x+1=0$, and for some a and b in $\mathbb{R}$, $\begin{bmatrix}4 & a & b\end{bmatrix}\begin{bmatrix}1 & 16 & 13\\ -1 & -1 & 2\\ -2 & -14 & -8\end{bmatrix}=\begin{bmatrix}0 & 0 & 0\end{bmatrix}$. If $\frac{4}{\alpha^4}+\frac{m}{\alpha^a}+\frac{n}{\alpha^b}=3$, then $m+n$ is equal to

(1) 3 (2) 11

(3) 7 (4) 8

Q127. JEE Main 2025 (7 April Shift 1)

Let A be a 3×3 matrix such that $|\operatorname{adj}(\operatorname{adj}(\operatorname{adj} A))|=81$. If $S=\left\{n\in\mathbb{Z}:(|\operatorname{adj}(\operatorname{adj} A)|)^{\frac{(n-1)^2}{2}}=|A|^{(3n^2-5n-4)}\right\}$, then $\sum_{n\in S}\left|A^{(n^2+n)}\right|$ is equal to

(1) 866 (2) 750

(3) 820 (4) 732

Q128. JEE Main 2025 (4 April Shift 2)

Let the matrix $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$ satisfy $A^n=A^{n-2}+A^2-I$ for $n\geq 3$. Then the sum of all the elements of A^{50} is :-

(1) 53 (2) 52

(3) 39 (4) 44

Q129. JEE Main 2025 (4 April Shift 1)

Let $A=\begin{bmatrix}\cos\theta & 0 & -\sin\theta\\ 0 & 1 & 0\\ \sin\theta & 0 & \cos\theta\end{bmatrix}$. If for some $\theta\in(0,\pi)$, $A^2=A^T$, then the sum of the diagonal elements of the matrix $(A+I)^3+(A-I)^3-6A$ is equal to _____ .

Q130. JEE Main 2025 (3 April Shift 1)

Let A be a matrix of order 3×3 and $|A| = 5$. If $|2\,\mathrm{adj}(3\,A\,\mathrm{adj}(2\,A))| = 2^{\alpha} \cdot 3^{\beta} \cdot 5^{\gamma} \alpha, \beta, \gamma \in \mathrm{N}$ then $\alpha + \beta + \gamma$ is equal to

(1) 25 (2) 26

(3) 27 (4) 28

Q131. JEE Main 2025 (29 Jan Shift 1)

Let $\mathrm{A} = [\mathrm{a}_{ij}] = \begin{bmatrix} \log_5 128 & \log_4 5 \\ \log_5 8 & \log_4 25 \end{bmatrix}$.

If A_{ij} is the cofactor of a_{ij}, $\mathrm{C}_{ij} = \sum_{\mathrm{k}=1}^{2} \mathrm{a}_{i\mathrm{k}} \mathrm{A}_{j\mathrm{k}}, 1 \leq i, j \leq 2$, and $\mathrm{C} = [\mathrm{C}_{ij}]$, then $8|\mathrm{C}|$ is equal to :

(1) 288 (2) 222

(3) 242 (4) 262

Q132. JEE Main 2025 (28 Jan Shift 2)

Let $A = \begin{bmatrix} \frac{1}{\sqrt{2}} & -2 \\ 0 & 1 \end{bmatrix}$ and $P = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}, \theta > 0$. If $\mathrm{B} = \mathrm{PAP}^{\mathrm{T}}, \mathrm{C} = \mathrm{P}^{\mathrm{T}}\mathrm{B}^{10}\mathrm{P}$ and the sum of the diagonal elements of C is $\frac{\mathrm{m}}{\mathrm{n}}$, where $\gcd(\mathrm{m}, \mathrm{n}) = 1$, then $\mathrm{m} + \mathrm{n}$ is :

(1) 127 (2) 258

(3) 65 (4) 2049

Q133. JEE Main 2025 (28 Jan Shift 1)

Let M denote the set of all real matrices of order 3×3 and let $\mathrm{S} = \{-3, -2, -1, 1, 2\}$. Let

$\mathrm{S}_1 = \{\mathrm{A} = [a_{\mathrm{ij}}] \in \mathrm{M} : \mathrm{A} = \mathrm{A}^{\mathrm{T}}$ and $a_{\mathrm{ij}} \in \mathrm{S}, \forall \mathrm{i}, \mathrm{j}\}$ $\mathrm{S}_2 = \{\mathrm{A} = [a_{\mathrm{ij}}] \in \mathrm{M} : \mathrm{A} = -\mathrm{A}^{\mathrm{T}}$ and $a_{\mathrm{ij}} \in \mathrm{S}, \forall \mathrm{i}, \mathrm{j}\}$

$\mathrm{S}_3 = \{\mathrm{A} = [a_{\mathrm{ij}}] \in \mathrm{M} : a_{11} + a_{22} + a_{33} = 0$ and $a_{\mathrm{ij}} \in \mathrm{S}, \forall \mathrm{i}, \mathrm{j}\}$ If $n(S_1 \cup S_2 \cup S_3) = 125\alpha$, then α equals _____

Q134. JEE Main 2025 (22 Jan Shift 2)

For a 3×3 matrix M, let trace (M) denote the sum of all the diagonal elements of M. Let A be a 3×3 matrix such that $|A| = \frac{1}{2}$ and trace $(A) = 3$. If $B = \mathrm{adj}(\mathrm{adj}(2A))$, then the value of $|B|+$ trace (B) equals :

(1) 56 (2) 132

(3) 174 (4) 280

Q135. JEE Main 2025 (22 Jan Shift 1)

Let A be a square matrix of order 3 such that $\det(A) = -2$ and $\det(3\,\mathrm{adj}(-6\,\mathrm{adj}(3A))) = 2^{\mathrm{m}+\mathrm{n}} \cdot 3^{\mathrm{mn}}, \mathrm{m} > \mathrm{n}$.

Then $4\,\mathrm{m} + 2\mathrm{n}$ is equal to _____

Q136. JEE Main 2025 (2 April Shift 1)

Let a $\in \mathbf{R}$ and A be a matrix of order 3×3 such that $\det(A) = -4$ and $A + I = \begin{bmatrix} 1 & a & 1 \\ 2 & 1 & 0 \\ a & 1 & 2 \end{bmatrix}$, where I is the identity matrix of order 3×3.

If $\det((a+1)\,\text{adj}((a-1)A))$ is $2^m 3^n, m, n \in \{0, 1, 2, \ldots .20\}$, then m + n is equal to :

(1) 14 (2) 17 (3) 15 (4) 16

Q137. JEE Main 2024 (27 Jan Shift 2)

Let A be a 2×2 real matrix and I be the identity matrix of order 2. If the roots of the equation $|\mathrm{A} - \mathrm{xI}| = 0$ be -1 and 3, then the sum of the diagonal elements of the matrix A^2 is _____.

Q138. JEE Main 2024 (05 Apr Shift 1)

Let A and B be two square matrices of order 3 such that $|A| = 3$ and $|B| = 2$. Then $\left|\mathrm{A}^{\mathrm{T}}\mathrm{A}(\text{adj}(2\,\mathrm{A}))^{-1}(\text{adj}(4\,\mathrm{B}))(\text{adj}(\mathrm{AB}))^{-1}\mathrm{AA}^{\mathrm{T}}\right|$ is equal to :

(1) 108 (2) 32 (3) 81 (4) 64

Q139. JEE Main 2024 (01 Feb Shift 2)

Let $A = I_2 - 2MM^T$, where M is real matrix of order 2×1 such that the relation $M^T M = I_1$ holds. If λ is a real number such that the relation $AX = \lambda X$ holds for some non-zero real matrix X of order 2×1, then the sum of squares of all possible values of λ is equal to:

Q140. JEE Main 2023 (30 Jan Shift 1)

Let $A = \begin{bmatrix} m & n \\ p & q \end{bmatrix}$, $d = |A| \neq 0$ and $|A - \mathrm{d}(\text{Adj } A)| = 0$. Then

(1) $(1+d)^2 = (m+q)^2$ (2) $1 + d^2 = (m+q)^2$ (3) $(1+d)^2 = m^2 + q^2$ (4) $1 + d^2 = m^2 + q^2$

Q141. JEE Main 2023 (29 Jan Shift 2)

The set of all values of $t \in \mathbb{R}$, for which the matrix $\begin{bmatrix} \mathrm{e}^t & \mathrm{e}^{-t}(\sin t - 2\cos t) & \mathrm{e}^{-t}(-2\sin t - \cos t) \\ \mathrm{e}^t & \mathrm{e}^{-t}(2\sin t + \cos t) & \mathrm{e}^{-t}(\sin t - 2\cos t) \\ \mathrm{e}^t & \mathrm{e}^{-t}\cos t & \mathrm{e}^{-t}\sin t \end{bmatrix}$ is invertible, is

(1) $\left\{(2k+1)\frac{\pi}{2}, k \in \mathbb{Z}\right\}$ (2) $\left\{k\pi + \frac{\pi}{4}, k \in \mathbb{Z}\right\}$

(3) $\{k\pi, k \in \mathbb{Z}\}$ (4) $\mathbb{R}$

Q142. JEE Main 2023 (25 Jan Shift 2)

Let A, B, C be 3×3 matrices such that A is symmetric and B and C are skew-symmetric.

Consider the statements

$(S1)$ $A^{13}\ B^{26} - B^{26}\ A^{13}$ is symmetric

(S2) $A^{26}C^{13} - C^{13}\ A^{26}$ is symmetric

Then,

(1) Only $S2$ is true

(2) Only S1 is true

(3) Both $S1$ and $S2$ are false

(4) Both $S1$ and $S2$ are true

Q143. JEE Main 2023 (08 Apr Shift 1)

Let $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$. If $P^T Q^{2007}\ P = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then $2a + b - 3c - 4d$ is equal to

(1) 2004 (2) 2005

(3) 2007 (4) 2006

Q144. JEE Main 2023 (06 Apr Shift 2)

Let P be a square matrix such that $P^2 = I - P$. For $\alpha, \beta, \gamma, \delta \in \mathbb{N}$, if $P^\alpha + P^\beta = \gamma l - 29P$ and $P^\alpha - P^\beta = \delta l - 13P$, then $\alpha + \beta + \gamma - \delta$ is equal to

(1) 18 (2) 40 (3) 22 (4) 24

Q145. JEE Main 2022 (29 Jun Shift 1)

The probability that a randomly chosen 2×2 matrix with all the entries from the set of first 10 primes, is singular, is equal to

(1) $\frac{133}{10^4}$ (2) $\frac{19}{10^3}$

(3) $\frac{18}{10^3}$ (4) $\frac{271}{10^4}$

Q146. JEE Main 2022 (28 Jul Shift 1)

Let the matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and the matrix $B_0 = A^{49} + 2A^{98}$. If $B_n = \text{Adj}(B_{n-1})$ for all $n \geq 1$, then $\det\ (B_4)$ is equal to

(1) 3^{28} (2) 3^{30}

(3) 3^{32} (4) 3^{36}

Q147. JEE Main 2022 (26 Jul Shift 2)

The number of matrices $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, where $a, b, c, \text{d} \in \{-1, 0, 1, 2, 3, \ldots\ldots, 10\}$, such that $A = A^{-1}$, is _____.

Q148. JEE Main 2022 (25 Jul Shift 2)

Let $A=\begin{bmatrix}1 & a & a\\ 0 & 1 & b\\ 0 & 0 & 1\end{bmatrix}, a, b \in \mathbb{R}$. If for some $n \in N, A^n=\begin{bmatrix}1 & 48 & 2160\\ 0 & 1 & 96\\ 0 & 0 & 1\end{bmatrix}$ then $n+a+b$ is equal to _____.

Q149. JEE Main 2021 (20 Jul Shift 2)

Let $A=\{a_{ij}\}$ be a 3×3 matrix, where $a_{ij}=\begin{cases}(-1)^{j-i} & \text{if } i<j\\ 2 & \text{if } i=j\\ (-1)^{i+j} & \text{if } i>j\end{cases}$ then $\det\left(3 \text{ Adj } \left(2A^{-1}\right)\right)$ is equal to _____.

Chapter: Determinants

Q150. JEE Main 2025 (7 April Shift 2)

Let the system of equations

$x+5y-z=1$

$4x+3y-3z=7$

$24x+y+\lambda z=\mu$

$\lambda, \mu \in$ R, have infinitely many solutions. Then the number of the solutions of this system, If x, y, z are integers and satisfy $7 \leq x+y+z \leq 77$, is

(1) 3 (2) 6

(3) 5 (4) 4

Q151. JEE Main 2025 (7 April Shift 1)

Let the system of equations :

$2x+3y+5z=9$

$7x+3y-2z=8$

$12x+3y-(4+\lambda)z=16-\mu$

have infinitely many solutions. Then the radius of the circle centred at (λ, μ) and touching the line $4x=3y$ is

(1) $\frac{17}{5}$ (2) $\frac{7}{5}$

(3) 7 (4) $\frac{21}{5}$

Q152. JEE Main 2025 (3 April Shift 1)

If $y(x)=\begin{vmatrix}\sin x & \cos x & \sin x+\cos x+1\\ 27 & 28 & 27\\ 1 & 1 & 1\end{vmatrix}, x \in \mathbb{R}$, then $\frac{d^2y}{dx^2}+y$ is equal to

(1) -1 (2) 28

(3) 27 (4) 1

Q153. JEE Main 2025 (24 Jan Shift 2)

For some a, b, let $f(x)=\begin{vmatrix} a+\frac{\sin x}{x} & 1 & b \\ a & 1+\frac{\sin x}{x} & b \\ a & 1 & b+\frac{\sin x}{x} \end{vmatrix}, x \neq 0, \lim_{x\to 0} f(x)=\lambda+\mu a+\nu b$. Then $(\lambda+\mu+\nu)^2$ is equal to :

(1) 16 (2) 25

(3) 9 (4) 36

Q154. JEE Main 2025 (24 Jan Shift 2)

If the system of equations

$x+2y-3z=2$

$2x+\lambda y+5z=5$

$14x+3y+\mu z=33$

has infinitely many solutions, then $\lambda+\mu$ is equal to :

(1) 13 (2) 10 (3) 12 (4) 11

Q155. JEE Main 2025 (23 Jan Shift 1)

If the system of equations

$(\lambda-1)x+(\lambda-4)y+\lambda z=5$

$\lambda x+(\lambda-1)y+(\lambda-4)z=7$

$(\lambda+1)x+(\lambda+2)y-(\lambda+2)z=9$

has infinitely many solutions, then $\lambda^2+\lambda$ is equal to

(1) 6 (2) 10

(3) 20 (4) 12

Q156. JEE Main 2025 (2 April Shift 2)

If the system of equation

$2x+\lambda y+3z=5$

$3x+2y-z=7$

$4x+5y+\mu z=9$

has infinitely many solutions, then $\left(\lambda^2+\mu^2\right)$ is equal to :

(1) 22 (2) 18

(3) 26 (4) 30

Q157. JEE Main 2024 (31 Jan Shift 2)

Let A be a 3×3 real matrix such that $A\begin{pmatrix}1\\0\\1\end{pmatrix} = 2\begin{pmatrix}1\\0\\1\end{pmatrix}$, $A\begin{pmatrix}-1\\0\\1\end{pmatrix} = 4\begin{pmatrix}-1\\0\\1\end{pmatrix}$, $A\begin{pmatrix}0\\1\\0\end{pmatrix} = 2\begin{pmatrix}0\\1\\0\end{pmatrix}$. Then, the system $(A-3I)\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}1\\2\\3\end{pmatrix}$ has

(1) unique solution

(2) exactly two solutions

(3) no solution

(4) infinitely many solutions

Q158. JEE Main 2024 (30 Jan Shift 1)

If $f(x) = \begin{vmatrix} 2\cos^4 x & 2\sin^4 x & 3+\sin^2 2x \\ 3+2\cos^4 x & 2\sin^4 x & \sin^2 2x \\ 2\cos^4 x & 3+2\sin^4 x & \sin^2 2x \end{vmatrix}$ then $\frac{1}{5}f'(0)$ is equal to _____.

(1) 0

(2) 1

(3) 2

(4) 6

Q159. JEE Main 2024 (09 Apr Shift 2)

Consider the matrices : $A = \begin{bmatrix}2 & -5\\3 & m\end{bmatrix}, B = \begin{bmatrix}20\\m\end{bmatrix}$ and $X = \begin{bmatrix}x\\y\end{bmatrix}$. Let the set of all m, for which the system of equations $AX = B$ has a negative solution (i.e., $x < 0$ and $y < 0$), be the interval (a, b). Then $8\int_a^b |A| dm$ is equal to_____

Q160. JEE Main 2024 (01 Feb Shift 1)

If the system of equations

$2x + 3y - z = 5$

$x + \alpha y + 3z = -4$

$3x - y + \beta z = 7$

has infinitely many solutions, then $13\alpha\beta$ is equal to

(1) 1110

(2) 1120

(3) 1210

(4) 1220

Q161. JEE Main 2023 (12 Apr Shift 1)

Let $D_k = \begin{vmatrix} 1 & 2k & 2k-1 \\ n & n^2+n+2 & n^2 \\ n & n^2+n & n^2+n+2 \end{vmatrix}$. If $\sum_{k=1}^{n} D_k = 96$, then n is equal to _____.

Q162. JEE Main 2021 (31 Aug Shift 2)

If $\alpha+\beta+\gamma=2\pi$, then the system of equations

$x+(\cos\gamma)y+(\cos\beta)z=0$

$(\cos\gamma)x+y+(\cos\alpha)z=0$

$(\cos\beta)x+(\cos\alpha)y+z=0$

has :

(1) infinitely many solutions

(2) a unique solution

(3) no solution

(4) exactly two solutions

Q163. JEE Main 2021 (27 Aug Shift 2)

Let $A=\begin{bmatrix}[x+1] & [x+2] & [x+3]\\ [x] & [x+3] & [x+3]\\ [x] & [x+2] & [x+4]\end{bmatrix}$, where $[x]$ denotes the greatest integer less than or equal to x. If $\det(A)=192$, then the set of values of x is in the interval:

(1) $[62,63)$

(2) $[65,66)$

(3) $[60,61)$

(4) $[68,69)$

Q164. JEE Main 2021 (20 Jul Shift 1)

Let a,b,c,d be in arithmetic progression with common difference λ. If $\begin{vmatrix}x+a-c & x+b & x+a\\ x-1 & x+c & x+b\\ x-b+d & x+d & x+c\end{vmatrix}=2$, then value of λ^2 is equal to_____.

Q165. JEE Main 2020 (05 Sep Shift 1)

If the minimum and the maximum values of the function $f:\left[\frac{\pi}{4},\frac{\pi}{2}\right]\to R$, defined by $f(\theta)=\begin{vmatrix}-\sin^2\theta & -1-\sin^2\theta & 1\\ -\cos^2\theta & -1-\cos^2\theta & 1\\ 12 & 10 & -2\end{vmatrix}$ are m and Mrespectively, then the ordered pair $(\mathrm{m},\ \mathrm{M})$ is equal to :

(1) $\left(0,2\sqrt{2}\right)$

(2) $(-4,0)$

(3) $(-4,\ 4)$

(4) $(0,4)$

Q166. JEE Main 2020 (03 Sep Shift 1)

If $\Delta=\begin{vmatrix}x-2 & 2x-3 & 3x-4\\ 2x-3 & 3x-4 & 4x-5\\ 3x-5 & 5x-8 & 10x-17\end{vmatrix}=Ax^3+Bx^2+Cx+D$, then $B+C$ is equal to :

(1) -1

(2) 1

(3) -3

(4) 9

Chapter: Probability

Q167. JEE Main 2025 (7 April Shift 2)

Let a random variable X take values $0, 1, 2, 3$ with $\mathrm{P(X=0)=P(X=1)=p, P(X=2)=P(X=3)}$ and $\mathrm{E\left(X^2\right)=2E(X)}$. Then the value of $8\mathrm{p}-1$ is :

(1) 0 (2) 2

(3) 1 (4) 3

Q168. JEE Main 2025 (4 April Shift 1)

The probability, of forming a 12 persons committee from 4 engineers, 2 doctors and 10 professors containing at least 3 engineers and at least 1 doctor, is:

(1) $\frac{129}{182}$ (2) $\frac{103}{182}$

(3) $\frac{17}{26}$ (4) $\frac{19}{26}$

Q169. JEE Main 2025 (3 April Shift 2)

If the probability that the random variable X takes the value x is given by $P(X=x)=k(x+1)3^{-x}$, $\mathrm{x}=0,1,2,3\ldots\ldots$, where k is a constant, then $\mathrm{P(X\geq 3)}$ is equal to

(1) $\frac{7}{27}$ (2) $\frac{4}{9}$

(3) $\frac{8}{27}$ (4) $\frac{1}{9}$

Q170. JEE Main 2025 (3 April Shift 1)

All five letter words are made using all the letters $\mathrm{A, B, C, D, E}$ and arranged as in an English dictionary with serial numbers. Let the word at serial number n be denoted by W_n. Let the probability $\mathrm{P\left(W_n\right)}$ of choosing the word $\mathrm{W_n}$ satisfy $\mathrm{P\left(W_n\right)=2P\left(W_{n-1}\right), n>1}$.

If $\mathrm{P(CDBEA)}=\frac{2^\alpha}{2^\beta-1}, \alpha, \beta \in \mathbb{N}$, then $\alpha+\beta$ is equal to : _____

Q171. JEE Main 2025 (29 Jan Shift 2)

Bag 1 contains 4 white balls and 5 black balls, and Bag 2 contains n white balls and 3 black balls. One ball is drawn randomly from Bag 1 and transferred to Bag 2. A ball is then drawn randomly from Bag 2. If the probability, that the ball drawn is white, is $29/45$, then n is equal to :

(1) 6 (2) 3 (3) 5 (4) 4

Q172. JEE Main 2025 (28 Jan Shift 2)

Bag B_1 contains 6 white and 4 blue balls, Bag B_2 contains 4 white and 6 blue balls, and Bag B_3 contains 5 white and 5 blue balls. One of the bags is selected at random and a ball is drawn from it. If the ball is white, then the probability, that the ball is drawn from Bag B_2, is :

(1) $\frac{4}{15}$ (2) $\frac{1}{3}$ (3) $\frac{2}{5}$ (4) $\frac{2}{3}$

Q173. JEE Main 2025 (28 Jan Shift 1)

Three defective oranges are accidently mixed with seven good ones and on looking at them, it is not possible to differentiate between them. Two oranges are drawn at random from the lot. If x denote the number of defective oranges, then the variance of x is

(1) 28/75 (2) 18/25

(3) $26/75$ (4) $14/25$

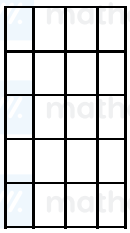
Q174. JEE Main 2025 (24 Jan Shift 1)

A and B alternately throw a pair of dice. A wins if he throws a sum of 5 before B throws a sum of 8 , and B wins if he throws a sum of 8 before A throws a sum of 5 . The probability, that A wins if A makes the first throw, is

(1) $\frac{8}{17}$ (2) $\frac{9}{19}$ (3) $\frac{9}{17}$ (4) $\frac{8}{19}$

Q175. JEE Main 2025 (23 Jan Shift 2)

A board has 16 squares as shown in the figure:



Out of these 16 squares, two squares are chosen at random. The probability that they have no side in common is :

(1) 7/10 (2) 4/5 (3) 23/30 (4) 3/5

Q176. JEE Main 2025 (22 Jan Shift 1)

Two balls are selected at random one by one without replacement from a bag containing 4 white and 6 black balls. If the probability that the first selected ball is black, given that the second selected ball is also black, is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $m + n$ is equal to :

(1) 4 (2) 14 (3) 13 (4) 11

Q177. JEE Main 2025 (2 April Shift 2)

Given three indentical bags each containing 10 balls, whose colours are as follows :

	Red	Blue	Green
Bag I	3	2	5
Bag II	4	3	3
Bag III	5	1	4

A person chooses a bag at random and takes out a ball. If the ball is Red, the probability that it is from bag I is p and if the balls is Green, the probability that it is from bag III is q , then the value of $\left(\frac{1}{\mathrm{p}}+\frac{1}{\mathrm{q}}\right)$ is :

(1) 6 (2) 9 (3) 7 (4) 8

Q178. JEE Main 2025 (2 April Shift 1)

Three distinct numbers are selected randomly from the set $\{1, 2, 3, \ldots\ldots, 40\}$. If the probability, that the selected numbers are in an increasing G.P. is $\frac{m}{n}$, $\gcd(m, n) = 1$, then $m + n$ is equal to _____.

Q179. JEE Main 2024 (31 Jan Shift 2)

A coin is biased so that a head is twice as likely to occur as a tail. If the coin is tossed 3 times, then the probability of getting two tails and one head is-

(1) $\frac{2}{9}$ (2) $\frac{1}{9}$ (3) $\frac{2}{27}$ (4) $\frac{1}{27}$

Q180. JEE Main 2024 (30 Jan Shift 1)

Two integers x and y are chosen with replacement from the set $\{0, 1, 2, 3, \ldots\ldots, 10\}$. Then the probability that $|x - y| > 5$ is :

(1) $\frac{30}{121}$ (2) $\frac{62}{121}$ (3) $\frac{60}{121}$ (4) $\frac{31}{121}$

Q181. JEE Main 2024 (27 Jan Shift 1)

A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required and let $\mathrm{a} = \mathrm{P}(\mathrm{X} = 3), \mathrm{b} = \mathrm{P}(\mathrm{X} \geq 3)$ and $\mathrm{c} = \mathrm{P}(\mathrm{X} \geq 6 \mid \mathrm{X} > 3)$. Then $\frac{\mathrm{b}+\mathrm{c}}{\mathrm{a}}$ is equal to

Q182. JEE Main 2024 (09 Apr Shift 1)

Let a, b and c denote the outcome of three independent rolls of a fair tetrahedral die, whose four faces are marked $1, 2, 3, 4$. If the probability that $ax^2 + bx + c = 0$ has all real roots is $\frac{m}{n}$, $\gcd(\mathrm{m}, \mathrm{n}) = 1$, then $\mathrm{m} + \mathrm{n}$ is equal to _____

Q183. JEE Main 2024 (06 Apr Shift 2)

If three letters can be posted to any one of the 5 different addresses, then the probability that the three letters are posted to exactly two addresses is:

(1) $\frac{18}{25}$ (2) $\frac{12}{25}$ (3) $\frac{6}{25}$ (4) $\frac{4}{25}$

Q184. JEE Main 2024 (06 Apr Shift 1)

A company has two plants A and B to manufacture motorcycles. 60% motorcycles are manufactured at plant A and the remaining are manufactured at plant B.80% of the motorcycles manufactured at plant A are rated of the standard quality, while 90% of the motorcycles manufactured at plant B are rated of the standard quality. A motorcycle picked up randomly from the total production is found to be of the standard quality. If p is the probability that it was manufactured at plant B, then $126p$ is

(1) 54 (2) 66 (3) 64 (4) 56

Q185. JEE Main 2023 (12 Apr Shift 1)

Two dice A and B are rolled. Let the numbers obtained on A and B be α and β respectively. If the variance of $\alpha - \beta$ is $\frac{p}{q}$, where p and q are co-prime, then the sum of the positive divisors of p is equal to

(1) 72 (2) 36 (3) 48 (4) 31

Q186. JEE Main 2023 (11 Apr Shift 1)

Let $S = \{M = [a_{ij}],\ a_{ij} \in \{0, 1, 2\},\ \{1 \leq i, j \leq 2\}\}$ be a sample space and $A\ \{M \in S : M$ is invertible$\}$ be an even. Then $P(A)$ is equal to

(1) $\frac{16}{27}$ (2) $\frac{47}{81}$ (3) $\frac{49}{81}$ (4) $\frac{50}{81}$

Q187. JEE Main 2022 (25 Jun Shift 2)

A biased die is marked with numbers $2, 4, 8, 16, 32, 32$ on its faces and the probability of getting a face with mark n is $\frac{1}{n}$. If the die is thrown thrice, then the probability, that the sum of the numbers obtained is 48, is

(1) $\frac{7}{2^{11}}$ (2) $\frac{7}{2^{12}}$ (3) $\frac{3}{2^{10}}$ (4) $\frac{13}{2^{12}}$

Q188. JEE Main 2022 (24 Jun Shift 1)

Bag A contains 2 white, 1 black and 3 red balls and bag B contains 3 black, 2 red and n white balls. One bag is chosen at random and 2 balls drawn from it at random are found to be 1 red and 1 black. If the probability that both balls come from Bag A is $\frac{6}{11}$, then n is equal to _____

(1) 13 (2) 6 (3) 4 (4) 3

Q189. JEE Main 2021 (27 Aug Shift 1)

When a certain biased die is rolled, a particular face occurs with probability $\frac{1}{6} - x$ and its opposite face occurs with probability $\frac{1}{6} + x$. All other faces occur with probability $\frac{1}{6}$.

Note that opposite faces sum to 7 in any die. If $0 < x < \frac{1}{6}$, and the probability of obtaining total sum $= 7$, when such a die is rolled twice, is $\frac{13}{96}$, then the value of x is

(1) $\frac{1}{16}$ (2) $\frac{1}{12}$ (3) $\frac{1}{8}$ (4) $\frac{1}{9}$

Q190. JEE Main 2021 (25 Feb Shift 2)

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:

(1) $\frac{1}{5}$ (2) $\frac{122}{297}$
(3) $\frac{97}{297}$ (4) $\frac{2}{9}$

Q191. JEE Main 2020 (02 Sep Shift 2)

Let E^C denote the complement of an event E. Let E_1, E_2 and E_3 be any pairwise independent events with $P(E_1) > 0$ and $P(E_1 \cap E_2 \cap E_3) = 0$ then $P\left(\left(E_2^C \cap E_3^C\right)/E_1\right)$ is equal to

(1) $P\left(E_2^C\right) + P(E_3)$
(2) $P\left(E_3^C\right) - P\left(E_2^C\right)$
(3) $P(E_3) - P\left(E_2^C\right)$
(4) $P\left(E_3^C\right) - P(E_2)$

Chapter: Sets and Relations

Q192. JEE Main 2025 (3 April Shift 1)

Let $A = \{-3, -2, -1, 0, 1, 2, 3,\}$. $LetR$ be a relation on A defined by xRy if and only if $0 \leq x^2 + 2y \leq 4$.

Let l be the number of elements in R and m be the minimum number of elements required to be added in R to make it a reflexive relation. then $l + m$ is equal to

(1) 19
(2) 20
(3) 17
(4) 18

Q193. JEE Main 2025 (28 Jan Shift 1)

The relation $R = \{(x, y) : x, y \in \mathbb{Z}$ and $x + y$ is even $\}$ is:

(1) reflexive and symmetric but not transitive
(2) an equivalence relation
(3) symmetric and transitive but not reflexive
(4) reflexive and transitive but not symmetric

Q194. JEE Main 2025 (24 Jan Shift 2)

Let $\mathrm{A} = \left\{x \in (0, \pi) - \left\{\frac{\pi}{2}\right\} : \log_{(2/\pi)} |\sin x| + \log_{(2/\pi)} |\cos x| = 2\right\}$ and

$\mathrm{B} = \{x \geqslant 0 : \sqrt{x}(\sqrt{x} - 4) - 3|\sqrt{x} - 2| + 6 = 0\}$. Then $\mathrm{n}(\mathrm{A} \cup \mathrm{B})$ is equal to :

(1) 4
(2) 8
(3) 6
(4) 2

Q195. JEE Main 2025 (23 Jan Shift 2)

Let $\mathrm{A} = \{(x, y) \in \mathbf{R} \times \mathbf{R} : |x + y| \geqslant 3\}$ and $\mathrm{B} = \{(x, y) \in \mathbf{R} \times \mathbf{R} : |x| + |y| \leq 3\}$.

If $\mathrm{C} = \{(x, y) \in \mathrm{A} \cap \mathrm{B} : x = 0$ or $y = 0\}$, then $\sum_{(x,y) \in \mathrm{C}} |x + y|$ is :

(1) 15
(2) 24
(3) 18
(4) 12

Q196. JEE Main 2025 (23 Jan Shift 1)

Let $\mathrm{R} = \{(1, 2), (2, 3), (3, 3)\}$ be a relation defined on the set $\{1, 2, 3, 4\}$. Then the minimum number of elements, needed to be added in R so that R becomes an equivalence relation, is:

(1) 10
(2) 7
(3) 8
(4) 9

Q197. JEE Main 2025 (22 Jan Shift 2)

Let $A = \{1, 2, 3\}$. The number of relations on A, containing $(1, 2)$ and $(2, 3)$, which are reflexive and transitive but not symmetric, is _____ .

Q198. JEE Main 2025 (22 Jan Shift 1)

Let $A = \{1, 2, 3, \ldots, 10\}$ and $B = \left\{\frac{m}{n} : m, n \in A, m < n \text{ and } \gcd(m, n) = 1\right\}$. Then $n(B)$ is equal to :

(1) 36 (2) 31

(3) 37 (4) 29

Q199. JEE Main 2024 (06 Apr Shift 1)

Let the relations R_1 and R_2 on the set $X = \{1, 2, 3, \ldots, 20\}$ be given by $R_1 = \{(x, y) : 2x - 3y = 2\}$ and $R_2 = \{(x, y) : -5x + 4y = 0\}$. If M and N be the minimum number of elements required to be added in R_1 and R_2, respectively, in order to make the relations symmetric, then $M + N$ equals

(1) 12 (2) 16

(3) 8 (4) 10

Q200. JEE Main 2024 (04 Apr Shift 2)

Let a relation R on N $\times$ N be defined as: $(x_1, y_1)\mathrm{R}\,(x_2, y_2)$ if and only if $x_1 \leq x_2$ or $y_1 \leq y_2$. Consider the two statements:

(I) R is reflexive but not symmetric.

(II) R is transitive Then which one of the following is true?

(1) Both (I) and (II) are correct.

(2) Only (II) is correct.

(3) Neither (I) nor (II) is correct.

(4) Only (I) is correct.

Q201. JEE Main 2024 (01 Feb Shift 1)

The number of elements in the set $S = \{(x, y, z) : x, y, z \in Z, x + 2y + 3z = 42, x, y, z \geq 0\}$ equals _____

Q202. JEE Main 2023 (06 Apr Shift 2)

In a group of 100 persons 75 speak English and 40 speak Hindi. Each person speaks at least one of the two languages. If the number of persons who speak only English is α and the number of persons who speaks only Hindi is β, then the eccentricity of the ellipse $25\left(\beta^2 x^2 + \alpha^2 y^2\right) = \alpha^2\beta^2$ is

(1) $\frac{\sqrt{119}}{12}$ (2) $\frac{\sqrt{117}}{12}$

(3) $\frac{3\sqrt{15}}{12}$ (4) $\frac{\sqrt{129}}{12}$

Q203. JEE Main 2023 (01 Feb Shift 2)

Let $P(S)$ denote the power set of $S=\{1,2,3,\ldots,10\}$. Define the relations R_1 and R_2 on $P(S)$ as AR_1B if $(A\cap B^c)\cup(B\cap A^c)=\phi$ and $AR_2\ B$ if $A\cup B^c=B\cup A^c, \forall A,B\in P(S)$. Then :

(1) both R_1 and R_2 are equivalence relations

(2) only R_1 is an equivalence relation

(3) only R_2 is an equivalence relation

(4) both R_1 and R_2 are not equivalence relations

Q204. JEE Main 2021 (27 Aug Shift 2)

Let Z be the set of all integers,

$A=\left\{(x,y)\in Z\times Z:(x-2)^2+y^2\leq 4\right\}$

$B=\left\{(x,y)\in Z\times Z:x^2+y^2\leq 4\right\}$ and

$C=\left\{(x,y)\in Z\times Z:(x-2)^2+(y-2)^2\leq 4\right\}$

If the total number of relations from $A\cap B$ to $A\cap C$ is 2^p, then the value of p is:

(1) 25 (2) 9

(3) 16 (4) 49

Q205. JEE Main 2020 (07 Jan Shift 2)

Let $X=\{n\in N:1\leq n\leq 50\}$. If $A=\{n\in X:$ n is a multiple of $2\}$ and $B=\{n\in X:$ n is a multiple of $7\}$, then the number of elements in the smallest subset of X, containing both A and B, is.

Chapter: Functions

Q206. JEE Main 2025 (8 April Shift 2)

Let the domain of the function

$f(x)=\cos^{-1}\left(\frac{4x+5}{3x-7}\right)$ be $[\alpha,\beta]$ and the domain of $g(x)=\log_2\left(2-6\log_{27}(2x+5)\right)$ be (γ,δ).

Then $|7(\alpha+\beta)+4(\gamma+\delta)|$ is equal to _____

Q207. JEE Main 2025 (7 April Shift 2)

If the range of the function $f(x)=\frac{5-x}{x^2-3x+2}$, $x\neq 1,2$, is $(-\infty,\alpha]\cup[\beta,\infty)$, then $\alpha^2+\beta^2$ is equal to :

(1) 190 (2) 192

(3) 188 (4) 194

Q208. JEE Main 2025 (4 April Shift 2)

Let $f(x)+2f\left(\frac{1}{x}\right)=x^2+5$ and $2g(x)-3g\left(\frac{1}{2}\right)=x, x>0$. If $\alpha=\int_1^2 f(x)dx$, and $\beta=\int_1^2 g(x)dx$, then the value of $9\alpha+\beta$ is:

(1) 1 (2) 0

(3) 10 (4) 11

Q209. JEE Main 2025 (4 April Shift 1)

Let $f,\ \mathrm{g}:(1,\infty)\to\mathbb{R}$ be defined as $f(\mathrm{x})=\frac{2x+3}{5x+2}$ and $g(x)=\frac{2-3x}{1-x}$. If the range of the function $f\circ g:[2,4]\to\mathbb{R}$ is $[\alpha,\beta]$, then $\frac{1}{\beta-\alpha}$ is equal to

(1) 68
(2) 29
(3) 2
(4) 56

Q210. JEE Main 2025 (4 April Shift 1)

Consider the sets $\mathrm{A}=\left\{(\mathrm{x},\mathrm{y})\in\mathbb{R}\times\mathbb{R}:\mathrm{x}^2+\mathrm{y}^2=25\right\}$, $\mathrm{B}=\left\{(\mathrm{x},\mathrm{y})\in\mathbb{R}\times\mathbb{R}:\mathrm{x}^2+9\mathrm{y}^2=144\right\}$, $\mathrm{C}=\{(\mathrm{x},\mathrm{y})\in\mathbb{Z}\times\mathbb{Z}:x^2+y^2\leq 4\}$, and $D=A\cap B$. The total number of one-one functions from the set D to the set C is:

(1) 15120
(2) 19320
(3) 17160
(4) 18290

Q211. JEE Main 2025 (4 April Shift 1)

Let $f:\mathbb{R}\to\mathbb{R}$ be a continuous function satisfying $f(0)=1$ and $f(2\mathrm{x})-f(\mathrm{x})=\mathrm{x}$ for all $\mathrm{x}\in\mathbb{R}$. If $\lim_{n\to\infty}\left\{f(x)-f\left(\frac{x}{2^n}\right)\right\}=G(x)$, then $\sum_{r=1}^{10}G\left(r^2\right)$ is equal to

(1) 540
(2) 385
(3) 420
(4) 215

Q212. JEE Main 2025 (3 April Shift 1)

If the domain of the function
$f(x)=\log_e\left(\frac{2x-3}{5+4x}\right)+\sin^{-1}\left(\frac{4+3x}{2-x}\right)$ is $[\alpha,\beta)$
then $\alpha^2+4\beta$ is equal to

(1) 5
(2) 4
(3) 3
(4) 7

Q213. JEE Main 2025 (29 Jan Shift 2)

If the domain of the function $\log_5\left(18x-x^2-77\right)$ is (α,β) and the domain of the function $\log_{(x-1)}\left(\frac{2x^2+3x-2}{x^2-3x-4}\right)$ is (γ,δ), then $\alpha^2+\beta^2+\gamma^2$ is equal to :

(1) 195
(2) 179
(3) 186
(4) 174

Q214. JEE Main 2025 (28 Jan Shift 1)

If $f(x)=\frac{2^x}{2^x+\sqrt{2}}$, $\mathrm{x}\in\mathbb{R}$, then $\sum_{\mathrm{k}=1}^{81}f\left(\frac{\mathrm{k}}{82}\right)$ is equal to

(1) $81\sqrt{2}$
(2) 41
(3) 82
(4) $\frac{81}{2}$

Q215. JEE Main 2025 (28 Jan Shift 1)

Let $f : \mathbb{R} \to \mathbb{R}$ be a function defined by $f(x) = (2 + 3a)x^2 + \left(\frac{a+2}{a-1}\right)x + b, a \neq 1$. If $f(x + \mathrm{y}) = f(x) + f(\mathrm{y}) + 1 - \frac{2}{7}x\mathrm{y}$, then the value of $28\sum_{i=1}^{5} |f(i)|$ is

(1) 545 (2) 715

(3) 735 (4) 675

Q216. JEE Main 2025 (24 Jan Shift 2)

Number of functions $f : \{1, 2, \ldots, 100\} \to \{0, 1\}$, that assign 1 to exactly one of the positive integers less than or equal to 98 , is equal to _____.

Q217. JEE Main 2025 (24 Jan Shift 2)

The number of real solution(s) of the equation $x^2 + 3x + 2 = \min\{|x - 3|, |x + 2|\}$ is:

(1) 1 (2) 0

(3) 2 (4) 3

Q218. JEE Main 2025 (23 Jan Shift 2)

Let the range of the function $f(x) = 6 + 16\cos x \cdot \cos\left(\frac{\pi}{3} - x\right) \cdot \cos\left(\frac{\pi}{3} + x\right) \cdot \sin 3x \cdot \cos 6x, x \in \mathbf{R}$ be $[\alpha, \beta]$. Then the distance of the point (α, β) from the line $3x + 4y + 12 = 0$ is :

(1) 11 (2) 8

(3) 10 (4) 9

Q219. JEE Main 2024 (31 Jan Shift 1)

If $f(x) = \frac{4x+3}{6x-4}$, $x \neq \frac{2}{3}$ and $(fof)(x) = g(x)$, where $g : R - \left\{\frac{2}{3}\right\} \to R - \left\{\frac{2}{3}\right\}$, then $(gogog)(4)$ is equal to

(1) $-\frac{19}{20}$ (2) $\frac{19}{20}$

(3) -4 (4) 4

Q220. JEE Main 2024 (29 Jan Shift 1)

Let $\mathrm{f(x)} = 2^{\mathrm{x}} - \mathrm{x}^2$, $\mathrm{x} \in \mathrm{R}$. If m and n are respectively the number of points at which the curves $\mathrm{y = f(x)}$ and $\mathrm{y = f'(x)}$ intersects the x−axis, then the value of $\mathrm{m + n}$ is

Q221. JEE Main 2024 (27 Jan Shift 2)

Let $\mathrm{f : R - \left\{\frac{-1}{2}\right\} \to R}$ and $\mathrm{g : R - \left\{\frac{-5}{2}\right\} \to R}$ be defined as $\mathrm{f(x) = \frac{2x+3}{2x+1}}$ and $\mathrm{g(x) = \frac{|x|+1}{2x+5}}$. Then the domain of the function fog is :

(1) $\mathrm{R - \left\{-\frac{5}{2}\right\}}$ (2) R

(3) $\mathrm{R - \left\{-\frac{7}{4}\right\}}$ (4) $\mathrm{R - \left\{-\frac{5}{2}, -\frac{7}{4}\right\}}$

Q222. JEE Main 2024 (09 Apr Shift 1)

If a function f satisfies $f(\mathrm{m}+\mathrm{n})=f(\mathrm{m})+f(\mathrm{n})$ for all $\mathrm{m}, \mathrm{n} \in \mathbf{N}$ and $f(1)=1$, then the largest natural number λ such that $\sum_{k=1}^{2022} f(\lambda+k) \leq (2022)^2$ is equal to _____

Q223. JEE Main 2024 (06 Apr Shift 2)

Let $f(x)=\frac{1}{7-\sin 5x}$ be a function defined on $\mathbf{R}$. Then the range of the function $f(x)$ is equal to ;

(1) $\left[\frac{1}{7}, \frac{1}{6}\right]$ (2) $\left[\frac{1}{8}, \frac{1}{5}\right]$

(3) $\left[\frac{1}{7}, \frac{1}{5}\right]$ (4) $\left[\frac{1}{8}, \frac{1}{6}\right]$

Q224. JEE Main 2024 (04 Apr Shift 2)

Consider the function $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x)=\frac{2x}{\sqrt{1+9x^2}}$. If the composition of f, $\underbrace{(f \circ f \circ f \circ \cdots \circ f)}_{\text{10 times}}(x)=\frac{2^{10}x}{\sqrt{1+9\alpha x^2}}$, then the value of $\sqrt{3\alpha+1}$ is equal to _____

Q225. JEE Main 2024 (01 Feb Shift 1)

Let $f: R \to R$ and $g: R \to R$ be defined as $f(x)=\begin{cases}\log_e x, & x>0 \\ e^{-x}, & x \leq 0\end{cases}$ and $g(x)=\begin{cases}x, & x \geq 0 \\ e^x, & x<0\end{cases}$. Then, $gof: R \to R$ is:

(1) one-one but not onto

(2) neither one-one nor onto

(3) onto but not one-one

(4) both one-one and onto

Q226. JEE Main 2023 (29 Jan Shift 2)

Consider a function $\mathrm{f}: \mathbb{N} \to \mathbb{R}$, satisfying $f(1)+2f(2)+3f(3)+\ldots+xf(x)=x(x+1)f(x)$; $x \geq 2$ with $f(1)=1$. Then $\frac{1}{f(2022)}+\frac{1}{f(2028)}$ is equal to

(1) 8200 (2) 8000

(3) 8400 (4) 8100

Q227. JEE Main 2023 (24 Jan Shift 2)

If $f(x)=x^3-x^2f'(1)+xf''(2)-f'''(3)$, $x \in \mathrm{R}$, then

(1) $3f(1)+f(2)=f(3)$

(2) $f(3)-f(2)=f(1)$

(3) $2f(0)-f(1)+f(3)=f(2)$

(4) $f(1)+f(2)+f(3)=f(0)$

Q228. JEE Main 2022 (28 Jun Shift 2)

Let $S=\{1,2,3,4\}$. Then the number of elements in the set $\{f: S \times S \rightarrow S: f$ is onto and $f(a, b)=f(b, a) \geq a \forall(a, b) \in S \times S\}$ is

Q229. JEE Main 2022 (28 Jun Shift 1)

Let a function $f: \mathbb{N} \rightarrow \mathbb{N}$ be defined by $f(n)=\begin{cases}2n, & n=2,4,6,8, \ldots . \\ n-1, & n=3,7,11,15, \ldots . \\ \frac{n+1}{2}, & n=1,5,9,13, \ldots .\end{cases}$

then, f is

(1) One-one and onto

(2) One-one but not onto

(3) Onto but not one-one

(4) Neither one-one nor onto

Q230. JEE Main 2022 (27 Jul Shift 2)

The domain of the function $f(x)=\sin^{-1}\left[2x^2-3\right]+\log_2\left(\log_{\frac{1}{2}}\left(x^2-5x+5\right)\right)$, where $[t]$ is the greatest integer function, is

(1) $\left(-\sqrt{\frac{5}{2}}, \frac{5-\sqrt{5}}{2}\right)$

(2) $\left(\frac{5-\sqrt{5}}{2}, \frac{5+\sqrt{5}}{2}\right)$

(3) $\left(1, \frac{5-\sqrt{5}}{2}\right)$

(4) $\left[1, \frac{5+\sqrt{5}}{2}\right)$

Q231. JEE Main 2022 (26 Jun Shift 2)

Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x)=x-1$ and $g: R \rightarrow \{1,-1\} \rightarrow \mathbb{R}$ be defined as $g(x)=\frac{x^2}{x^2-1}$. Then the function fog is:

(1) One-one but not onto

(2) onto but not one-one

(3) Both one-one and onto

(4) Neither one-one nor onto

Q232. JEE Main 2022 (26 Jun Shift 1)

Let $f(x)=\frac{x-1}{x+1}$, $x \in R-\{0,-1,1\}$. If $f^{n+1}(x)=f(f^n(x))$ for all $n \in N$, then $f^6(6)+f^7(7)$ is equal to

(1) $\frac{7}{6}$

(2) $-\frac{3}{2}$

(3) $\frac{7}{12}$

(4) $-\frac{11}{12}$

Q233. JEE Main 2022 (25 Jul Shift 1)

The total number of functions, $f:\{1,2,3,4\} \rightarrow \{1,2,3,4,5,6\}$ such that $f(1)+f(2)=f(3)$, is equal to

(1) 60

(2) 90

(3) 108

(4) 126

Q234. JEE Main 2021 (27 Jul Shift 1)

Let $S = \{1, 2, 3, 4, 5, 6, 7\}$. Then the number of possible functions $f : S \to S$ such that $f(m \cdot n) = f(m) \cdot f(n)$ for every $m, n \in S$ and $m \cdot n \in S$, is equal to _____.

Q235. JEE Main 2021 (01 Sep Shift 2)

Let $f(x)$ be a polynomial of degree 3 such that $f(k) = -\frac{2}{k}$ for $k = 2,\ 3,\ 4,\ 5$. Then the value of $52 - 10\ f(10)$ is equal to _____ .

Chapter: Limits

Q236. JEE Main 2025 (7 April Shift 1)

$\lim_{x\to 0^+} \frac{\tan\left(5(x)^{\frac{1}{3}}\right)\log_e(1+3x^2)}{\left(\tan^{-1}3\sqrt{x}\right)^2\left(e^{5(x)^{\frac{4}{3}}}-1\right)}$ is equal to

(1) $\frac{1}{15}$ (2) 1

(3) $\frac{1}{3}$ (4) $\frac{5}{3}$

Q237. JEE Main 2025 (4 April Shift 1)

If $\lim_{x\to 1^+} \frac{(x-1)(6+\lambda\cos(x-1))+\mu\sin(1-x)}{(x-1)^3} = -1$, where $\lambda, \mu \in \mathbb{R}$, then $\lambda + \mu$ is equal to

(1) 18 (2) 20

(3) 19 (4) 17

Q238. JEE Main 2025 (3 April Shift 2)

If $\text{Lim}_{x\to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x^2}} = p$, then $96\log_e p$ is equal to _____

Q239. JEE Main 2025 (28 Jan Shift 2)

Let $f(x) = \lim_{n\to\infty}\sum_{r=0}^{n}\left(\frac{\tan\left(x/2^{r+1}\right)+\tan^3\left(x/2^{r+1}\right)}{1-\tan^2\left(x/2^{r+1}\right)}\right)$. Then $\lim_{x\to 0}\frac{e^x - e^{f(x)}}{(x-f(x))}$ is equal to

Q240. JEE Main 2025 (24 Jan Shift 1)

$\lim_{x\to 0}\text{cosec}\ x\left(\sqrt{2\cos^2 x + 3\cos x} - \sqrt{\cos^2 x + \sin x + 4}\right)$ is:

(1) 0 (2) $\frac{1}{\sqrt{15}}$

(3) $\frac{1}{2\sqrt{5}}$ (4) $-\frac{1}{2\sqrt{5}}$

Q241. JEE Main 2025 (23 Jan Shift 2)

$\lim_{x\to\infty} \frac{(2x^2-3x+5)(3x-1)^{\frac{x}{2}}}{(3x^2+5x+4)\sqrt{(3x+2)^x}}$ is equal to :

(1) $\frac{2}{\sqrt{3e}}$ (2) $\frac{2e}{\sqrt{3}}$

(3) $\frac{2}{3\sqrt{e}}$ (4) $\frac{2e}{3}$

Q242. JEE Main 2025 (22 Jan Shift 2)

If $\lim_{x\to\infty} \left(\left(\frac{e}{1-e}\right)\left(\frac{1}{e}-\frac{x}{1+x}\right)\right)^x = \alpha$, then the value of $\frac{\log_e \alpha}{1+\log_e \alpha}$ equals :

(1) e^{-1} (2) e^2

(3) e^{-2} (4) e

Q243. JEE Main 2024 (31 Jan Shift 1)

$\lim\limits_{x\to 0} \frac{e^{2|\sin x|}-2|\sin x|-1}{x^2}$

(1) is equal to -1 (2) does not exist

(3) is equal to 1 (4) is equal to 2

Q244. JEE Main 2024 (08 Apr Shift 1)

The value of $\lim_{x\to 0} 2\left(\frac{1-\cos x\sqrt{\cos 2x}\sqrt[3]{\cos 3x}\ldots\ldots\sqrt[10]{\cos 10x}}{x^2}\right)$ is

Q245. JEE Main 2024 (04 Apr Shift 1)

If $\lim_{x\to 1} \frac{(5x+1)^{1/3}-(x+5)^{1/3}}{(2x+3)^{1/2}-(x+4)^{1/2}} = \frac{m\sqrt{5}}{n(2n)^{2/3}}$, where $\gcd(m,n)=1$, then $8m+12n$ is equal to_____

Q246. JEE Main 2024 (01 Feb Shift 2)

Let $f(x)=\begin{cases} x-1, & x \text{ is even,} \\ 2x, & x \text{ is odd,} \end{cases} x\in N$. If for some $a\in N$, $f(f(f(a)))=21$, then $\lim\limits_{x\to a^-}\left\{\frac{|x|^3}{a}-\left[\frac{x}{a}\right]\right\}$, where $[t]$ denotes the greatest integer less than or equal to t, is equal to:

(1) 121 (2) 144

(3) 169 (4) 225

Q247. JEE Main 2023 (06 Apr Shift 2)

$\lim\limits_{n\to\infty}\left\{\left(2^{\frac{1}{2}}-2^{\frac{1}{3}}\right)\left(2^{\frac{1}{2}}-2^{\frac{1}{5}}\right)\ldots\left(2^{\frac{1}{2}}-2^{\frac{1}{2n+1}}\right)\right\}$ is equal to

(1) 1 (2) 0

(3) $\sqrt{2}$ (4) $\frac{1}{\sqrt{2}}$

Q248. JEE Main 2022 (26 Jun Shift 2)

$\lim\limits_{x\to 0}\frac{\cos(\sin x)-\cos x}{x^4}$ is equal to

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$

(3) $\frac{1}{4}$ (4) $\frac{1}{12}$

Q249. JEE Main 2022 (26 Jul Shift 2)

Let $\beta=\lim\limits_{x\to 0}\frac{\alpha x-(e^{3x}-1)}{\alpha x(e^{3x}-1)}$ for some $\alpha\in\mathbb{R}$. Then the value of $\alpha+\beta$ is:

(1) $\frac{14}{5}$ (2) $\frac{3}{2}$

(3) $\frac{5}{2}$ (4) $\frac{7}{2}$

Q250. JEE Main 2021 (27 Jul Shift 2)

The value of $\lim\limits_{x\to 0}\left(\frac{x}{\sqrt[8]{1-\sin x}-\sqrt[8]{1+\sin x}}\right)$ is equal to :

(1) 0 (2) 4

(3) -4 (4) -1

Q251. JEE Main 2021 (26 Feb Shift 1)

The value of $\lim\limits_{h\to 0}\left\{\frac{\sqrt{3}\sin\left(\frac{\pi}{6}+h\right)-\cos\left(\frac{\pi}{6}+h\right)}{\sqrt{3}h\left(\sqrt{3}\cos h-\sin h\right)}\right\}$ is :

(1) $\frac{4}{3}$ (2) $\frac{2}{\sqrt{3}}$

(3) $\frac{2}{3}$ (4) $\frac{3}{4}$

Q252. JEE Main 2021 (26 Aug Shift 2)

$\lim\limits_{x\to 2}\left(\sum_{n=1}^{9}\frac{x}{n(n+1)x^2+2(2n+1)x+4}\right)$ is equal to :

(1) $\frac{5}{24}$ (2) $\frac{7}{36}$

(3) $\frac{1}{5}$ (4) $\frac{9}{44}$

Q253. JEE Main 2021 (20 Jul Shift 2)

If $\lim\limits_{x\to 0}\left[\frac{\alpha x e^x-\beta\log_e(1+x)+\gamma x^2 e^{-x}}{x\sin^2 x}\right]=10,\ \alpha,\ \beta,\ \gamma\in R$, then the value of $\alpha+\beta+\gamma$ is _____.

Q254. JEE Main 2021 (17 Mar Shift 2)

The value of $\lim\limits_{n\to\infty}\frac{[r]+[2r]+\ldots+[nr]}{n^2}$, where r is non-zero real number and $[r]$ denotes the greatest integer less than or equal to r, is equal to :

(1) $\frac{r}{2}$ (2) r

(3) $2r$ (4) 0

Chapter: Continuity and Differentiability

Q255. JEE Main 2025 (3 April Shift 1)

Let $f(x)=\begin{cases}(1+ax)^{1/x} & , \quad x<0\\ 1+b & , \quad x=0\\ \frac{(x+4)^{1/2}-2}{(x+c)^{1/3}-2} & ,\end{cases}$

be continuous at $x=0$. Then $e^a bc$ is equal to

(1) 64 (2) 72

(3) 48 (4) 36

Q256. JEE Main 2025 (28 Jan Shift 1)

Let $f(x)=\begin{cases}3x, & x<0\\ \min\{1+x+[x], x+2[x]\}, & 0\le x\le 2\\ 5, & x>2,\end{cases}$

where [.] denotes greatest integer function. If α and β are the number of points, where f is not continuous and is not differentiable, respectively, then $\alpha+\beta$ equals _____

Q257. JEE Main 2025 (23 Jan Shift 1)

If the function

$f(x)=\begin{cases}\frac{2}{x}\{\sin(k_1+1)x+\sin(k_2-1)x\}, & x<0\\ 4, \quad x=0\\ \frac{2}{x}\log_e\left(\frac{2+k_1x}{2+k_2x}\right), & x>0\end{cases}$

is continuous at $x=0$, then $k_1^2+k_2^2$ is equal to

(1) 20 (2) 5

(3) 8 (4) 10

Q258. JEE Main 2025 (22 Jan Shift 1)

Let $f(x)$ be a real differentiable function such that $f(0)=1$ and $f(x+y)=f(x)f'(y)+f'(x)f(y)$ for all $x,y\in\mathbf{R}$. Then $\sum_{n=1}^{100}\log_e f(n)$ is equal to :

(1) 2525 (2) 5220

(3) 2384 (4) 2406

Q259. JEE Main 2025 (22 Jan Shift 1)

Let the function,

$f(x)=\begin{cases}-3ax^2-2, & x<1\\ a^2+bx, & x\geqslant 1\end{cases}$

be differentiable for all $x\in\mathbf{R}$, where $\mathbf{a}>1, \mathbf{b}\in\mathbf{R}$. If the area of the region enclosed by $y=f(x)$ and the line $y=-20$ is $\alpha+\beta\sqrt{3}, \alpha,\beta\in Z$, then the value of $\alpha+\beta$ is _____

Q260. JEE Main 2024 (29 Jan Shift 2)

Let $f(x)=\sqrt{\lim\limits_{r\to x}\left\{\frac{2r^2[(f(r))^2-f(x)f(r)]}{r^2-x^2}-r^3e^{\frac{f(r)}{r}}\right\}}$ be differentiable in $(-\infty,0)\cup(0,\infty)$ and $f(1)=1$. Then the value of ae, such that $f(a)=0$, is equal to _____.

Q261. JEE Main 2024 (27 Jan Shift 2)

Consider the function $\mathrm{f}:(0,2)\to\mathrm{R}$ defined by $\mathrm{f}(\mathrm{x})=\frac{\mathrm{x}}{2}+\frac{2}{\mathrm{x}}$ and the function $\mathrm{g}(\mathrm{x})$ defined by $\mathrm{g}(\mathrm{x})=\begin{cases}\min\{\mathrm{f}(\mathrm{t})\}, & 0<\mathrm{t}\le\mathrm{x} \text{ and } 0<\mathrm{x}\le 1\\ \frac{3}{2}+\mathrm{x}, & 1<\mathrm{x}<2\end{cases}$. Then

(1) g is continuous but not differentiable at $\mathrm{x}=1$

(2) g is not continuous for all $\mathrm{x}\in(0,2)$

(3) g is neither continuous nor differentiable at $\mathrm{x}=1$

(4) g is continuous and differentiable for all $\mathrm{x}\in(0,2)$

Q262. JEE Main 2024 (05 Apr Shift 2)

Let $f:[-1,2]\to\mathbf{R}$ be given by $f(x)=2x^2+x+\left[x^2\right]-[x]$, where $[t]$ denotes the greatest integer less than or equal to t. The number of points, where f is not continuous, is :

(1) 5 (2) 6

(3) 3 (4) 4

Q263. JEE Main 2024 (04 Apr Shift 2)

If the function

$f(x)=\begin{cases}\frac{72^x-9^x-8^x+1}{\sqrt{2}-\sqrt{1+\cos x}}, & x\neq 0\\ a\log_e 2\log_e 3 & ,x=0\end{cases}$

is continuous at $x=0$, then the value of a^2 is equal to

(1) 968 (2) 1152

(3) 746 (4) 1250

Q264. JEE Main 2023 (29 Jan Shift 2)

Let f and g be twice differentiable functions on R such that

$f''(x)=g''(x)+6x$

$f'(1)=4g'(1)-3=9$

$f(2)=3\ g(2)=12$

Then which of the following is NOT true ?

(1) $g(-2)-f(-2)=20$

(2) If $-1<x<2$, then $|f(x)-g(x)|<8$

(3) $|f'(x)-g'(x)|<6\Rightarrow -1<x<1$

(4) There exists $x_0\in\left(1,\frac{3}{2}\right)$ such that $f(x_0)=g(x_0)$

Q265. JEE Main 2023 (29 Jan Shift 1)

Suppose f is a function satisfying $f(x+y)=f(x)+f(y)$ for all $x, y \in \mathbb{N}$ and $f(1)=\frac{1}{5}$. If $\sum_{n=1}^{m} \frac{f(n)}{n(n+1)(n+2)}=\frac{1}{12}$ then m is equal to _____.

Q266. JEE Main 2023 (12 Apr Shift 1)

Let $[x]$ be the greatest integer $\leq x$. Then the number of points in the interval $(-2, 1)$ where the function $f(x)=|[x]|+\sqrt{x-[x]}$ is discontinuous, is _____.

Q267. JEE Main 2023 (06 Apr Shift 1)

Let $a \in \mathbb{Z}$ and $[t]$ be the greatest integer $\leq t$, then the number of points, where the function $f(x)=[a+13 \sin x],\ x \in (0, \pi)$ is not differentiable, is _____

Q268. JEE Main 2022 (29 Jul Shift 1)

The number of points, where the function $f: R \to R,\ f(x)=|x-1| \cos|x-2| \sin|x-1|+(x-3)\left|x^2-5x+4\right|$, is NOT differentiable, is

(1) 1 (2) 2

(3) 3 (4) 4

Q269. JEE Main 2022 (28 Jun Shift 2)

Let $f, g: \boldsymbol{R} \to \boldsymbol{R}$ be functions defined by

$f(x)=\begin{cases}[x] & , \ x<0 \\ |1-x| & , \ x \geq 0\end{cases}$ and

$g(x)=\begin{cases}e^x-x, & x<0 \\ (x-1)^2-1, & x \geq 0\end{cases}$

where $[x]$ denote the greatest integer less than or equal to x. Then, the function fog is discontinuous at exactly

(1) one point (2) two points

(3) three points (4) four points

Q270. JEE Main 2022 (28 Jul Shift 2)

The function $f: R \to R$ defined by $f(x)=\lim\limits_{n \to \infty} \frac{\cos(2\pi x)-x^{2n} \sin(x-1)}{1+x^{2n+1}-x^{2n}}$ is continuous for all x in

(1) $R-\{-1\}$ (2) $R-\{-1, 1\}$

(3) $R-\{1\}$ (4) $R-\{0\}$

Q271. JEE Main 2022 (26 Jul Shift 1)

If $f(x)=\begin{cases}x+a, & x\leq 0\\ |x-4|, & x>0\end{cases}$ and $g(x)=\begin{cases}x+1, & x<0\\ (x-4)^2+b, & x\geq 0\end{cases}$ are continuous on R, then $(gof)(2)+(fog)(-2)$ is equal to:

(1) -10 (2) 10

(3) 8 (4) -8

Q272. JEE Main 2022 (25 Jun Shift 2)

Let $f(x)=\left[2x^2+1\right]$ and $g(x)=\begin{cases}2x-3, & x<0\\ 2x+3, & x\geq 0\end{cases}$, where $[t]$ is the greatest integer $\leq t$. Then, in the open interval $(-1,1)$, the number of points where fog is discontinuous is equal to _____.

Q273. JEE Main 2022 (25 Jul Shift 1)

Let $f(x)=\begin{cases}\left|4x^2-8x+5\right|, & \text{if } 8x^2-6x+1\geq 0\\ \left[4x^2-8x+5\right], & \text{if } 8x^2-6x+1<0\end{cases}$, where $[\alpha]$ denotes the greatest integer less than or equal to α. Then the number of points in R where f is not differentiable is _____ .

Q274. JEE Main 2022 (24 Jun Shift 2)

Let $f(x)=\begin{cases}\frac{\sin(x-[x])}{x-[x]}, & x\in(-2,-1)\\ \max(2x,3[|x|]), & |x|<1\\ 1, & \text{otherwise}\end{cases}$

where $[t]$ denotes greatest integer $\leq t$. If m is the number of points where f is not continuous and n is the number of points where f is not differentiable, the ordered pair (m,n) is:

(1) $(3,3)$ (2) $(2,4)$

(3) $(2,3)$ (4) $(3,4)$

Chapter: Differentiation

Q275. JEE Main 2024 (27 Jan Shift 1)

Let for a differentiable function $f:(0,\infty)\to R$, $f(x)-f(y)\geq \log_e\left(\frac{x}{y}\right)+x-y, \forall x,y\in(0,\infty)$. Then $\sum_{n=1}^{20} f'\left(\frac{1}{n^2}\right)$ is equal to

Q276. JEE Main 2024 (06 Apr Shift 2)

Suppose for a differentiable function $h, h(0)=0, h(1)=1$ and $h'(0)=h'(1)=2$. If $g(x)=h\left(e^x\right)e^{h(x)}$, then $g'(0)$ is equal to:

(1) 5 (2) 4

(3) 8 (4) 3

Q277. JEE Main 2022 (28 Jul Shift 2)

Let $x(t)=2\sqrt{2}\cos t\sqrt{\sin 2t}$ and $y(t)=2\sqrt{2}\sin t\sqrt{\sin 2t}, t\in\left(0,\frac{\pi}{2}\right)$. Then $\frac{1+\left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$ at $t=\frac{\pi}{4}$ is equal to

(1) $\frac{-2\sqrt{2}}{3}$ (2) $\frac{2}{3}$

(3) $\frac{1}{3}$ (4) $\frac{-2}{3}$

Q278. JEE Main 2021 (16 Mar Shift 2)

Let $f:S\to S$ where $S=(0,\infty)$ be a twice differentiable function such that $f(x+1)=xf(x)$. If $g:S\to R$ be defined as $g(x)=\log_e f(x)$, then the value of $|g''(5)-g''(1)|$ is equal to :

(1) $\frac{205}{144}$ (2) $\frac{197}{144}$

(3) $\frac{187}{144}$ (4) 1

Chapter: Application of Derivatives

Q279. JEE Main 2025 (7 April Shift 1)

Let $x=-1$ and $x=2$ be the critical points of the function $\mathrm{f(x)=x^3+ax^2+b\log_c|x|+1, x\neq 0}$. Let m and M respectively be the absolute minimum and the absolute maximum values of f in the interval $\left[-2,-\frac{1}{2}\right]$. Then $|\mathrm{M}+m|$ is equal to (Take $\log_c 2=0.7$):

(1) 21.1 (2) 19.8

(3) 22.1 (4) 20.9

Q280. JEE Main 2025 (4 April Shift 2)

Let $\mathrm{a>0}$. If the function $\mathrm{f(x)=6x^3-45ax^2+108a^2x+1}$ attains its local maximum and minimum values at the points x_1 and x_2 respectively such that $x_1x_2=54$, then $\mathrm{a+x_1+x_2}$ is equal to :-

(1) 15 (2) 18

(3) 24 (4) 13

Q281. JEE Main 2025 (28 Jan Shift 1)

The sum of all local minimum values of the function

$$f(x)=\begin{cases}1-2x, & x<-1\\ \frac{1}{3}(7+2|x|), & -1\le x\le 2\\ \frac{11}{18}(x-4)(x-5), & x>2\end{cases}$$

is

(1) $\frac{157}{72}$ (2) $\frac{131}{72}$

(3) $\frac{171}{72}$ (4) $\frac{167}{72}$

Q282. JEE Main 2025 (24 Jan Shift 2)

Let $(2,3)$ be the largest open interval in which the function $f(x)=2\log_e(x-2)-x^2+ax+1$ is strictly increasing and (b, c) be the largest open interval, in which the function $g(x)=(x-1)^3(x+2-a)^2$ is strictly decreasing. Then $100(a+b-c)$ is equal to :

(1) 420 (2) 360

(3) 160 (4) 280

Q283. JEE Main 2025 (23 Jan Shift 2)

A spherical chocolate ball has a layer of ice-cream of uniform thickness around it. When the thickness of the ice-cream layer is 1 cm , the ice-cream melts at the rate of 81 cm^3/min and the thickness of the ice-cream layer decreases at the rate of $\frac{1}{4\pi}$ cm/min. The surface area (in cm^2) of the chocolate ball (without the ice-cream layer) is :

(1) 196π (2) 256π

(3) 225π (4) 128π

Q284. JEE Main 2025 (23 Jan Shift 1)

If the set of all values of a, for which the equation $5x^3-15x-a=0$ has three distinct real roots, is the interval (α,β), then $\beta-2\alpha$ is equal to _____

Q285. JEE Main 2024 (09 Apr Shift 1)

A variable line L passes through the point $(3,5)$ and intersects the positive coordinate axes at the points A and B. The minimum area of the triangle OAB, where O is the origin, is :

(1) 30 (2) 25

(3) 40 (4) 35

Q286. JEE Main 2024 (09 Apr Shift 1)

Let the set of all positive values of λ, for which the point of local minimum of the function $\left(1+x\left(\lambda^2-x^2\right)\right)$ satisfies $\frac{x^2+x+2}{x^2+5x+6}<0$, be (α,β). Then $\alpha^2+\beta^2$ is equal to ____

Q287. JEE Main 2024 (08 Apr Shift 1)

Let $f(x)=4\cos^3x+3\sqrt{3}\cos^2x-10$. The number of points of local maxima of f in interval $(0,2\pi)$ is

(1) 3 (2) 4

(3) 1 (4) 2

Q288. JEE Main 2024 (06 Apr Shift 1)

The interval in which the function $f(x)=x^x, x>0$, is strictly increasing is

(1) $\left(0,\frac{1}{e}\right]$ (2) $(0,\infty)$

(3) $\left[\frac{1}{e},\infty\right)$ (4) $\left[\frac{1}{e^2},1\right)$

Q289. JEE Main 2024 (01 Feb Shift 1)

If $5f(x)+4f\left(\frac{1}{x}\right)=x^2-2, \forall x \neq 0$ and $y=9x^2f(x)$, then y is strictly increasing in:

(1) $\left(0, \frac{1}{\sqrt{5}}\right) \cup \left(\frac{1}{\sqrt{5}}, \infty\right)$

(2) $\left(-\frac{1}{\sqrt{5}}, 0\right) \cup \left(\frac{1}{\sqrt{5}}, \infty\right)$

(3) $\left(-\frac{1}{\sqrt{5}}, 0\right) \cup \left(0, \frac{1}{\sqrt{5}}\right)$

(4) $\left(-\infty, \frac{1}{\sqrt{5}}\right) \cup \left(0, \frac{1}{\sqrt{5}}\right)$

Q290. JEE Main 2023 (13 Apr Shift 1)

The set of all $a \in \mathbb{R}$ for which the equation $x|x-1|+|x+2|+a=0$ has exactly one real root, is

(1) $(-7, \infty)$

(2) $(-\infty, \infty)$

(3) $(-6, -3)$

(4) $(-\infty, -3)$

Q291. JEE Main 2023 (01 Feb Shift 2)

The sum of the abosolute maximum and minimum values of the function $f(x)=\left|x^2-5x+6\right|-3x+2$ in the interval $[-1, 3]$ is equal to :

(1) 10

(2) 12

(3) 13

(4) 24

Q292. JEE Main 2022 (26 Jul Shift 2)

Let P and Q be any points on the curves $(x-1)^2+(y+1)^2=1$ and $y=x^2$, respectively. The distance between P and Q is minimum for some value of the abscissa of P in the interval

(1) $\left(0, \frac{1}{4}\right)$

(2) $\left(\frac{1}{2}, \frac{3}{4}\right)$

(3) $\left(\frac{1}{4}, \frac{1}{2}\right)$

(4) $\left(\frac{3}{4}, 1\right)$

Q293. JEE Main 2022 (26 Jul Shift 1)

The number of distinct real roots of the equation $x^5\left(x^3-x^2-x+1\right)+x\left(3x^3-4x^2-2x+4\right)-1=0$ is

Q294. JEE Main 2022 (25 Jun Shift 2)

Let $f(x)=\left|(x-1)\left(x^2-2x-3\right)\right|+x-3, x \in \mathbb{R}$. If m and M are respectively the number of points of local minimum and local maximum of f in the interval $(0, 4)$, then $m+M$ is equal to _____.

Q295. JEE Main 2022 (25 Jun Shift 1)

Let $f: \boldsymbol{R} \rightarrow \boldsymbol{R}$ and $g: \boldsymbol{R} \rightarrow \boldsymbol{R}$ be two functions defined by $f(x)=\log_e\left(x^2+1\right)-e^{-x}+1$ and $g(x)=\frac{1-2e^{2x}}{e^x}$.

Then, for which of the following range of α, the inequality $f\left(g\left(\frac{(\alpha-1)^2}{3}\right)\right)>f\left(g\left(\alpha-\frac{5}{3}\right)\right)$ holds?

(1) $(-2, -1)$

(2) $(2, 3)$

(3) $(1, 2)$

(4) $(-1, 1)$

Q296. JEE Main 2022 (25 Jul Shift 1)

If the absolute maximum value of the function $f(x)=\left(x^2-2x+7\right)e^{\left(4x^3-12x^2-180x+31\right)}$ in the interval $[-3,0]$ is $f(\alpha)$, then

(1) $\alpha=0$ (2) $\alpha=-3$

(3) $\alpha\in(-1,0)$ (4) $\alpha\in(-3,-1)$

Q297. JEE Main 2021 (31 Aug Shift 1)

The number of real roots of the equation $e^{4x}+2e^{3x}-e^{x}-6=0$ is :

(1) 0 (2) 1

(3) 4 (4) 2

Q298. JEE Main 2021 (24 Feb Shift 1)

The minimum value of α 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_____.

Q299. JEE Main 2020 (08 Jan Shift 1)

Let $f(x)=x\cos^{-1}(-\sin|x|), x\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$, then which of the following is true?

(1) f ' is increasing in $\left(-\frac{\pi}{2},0\right)$ and decreasing in $\left(0,\frac{\pi}{2}\right)$

(2) $f'(0)=-\frac{\pi}{2}$

(3) f is not differentiable at $x=0$

(4) f ' is decreasing in $\left(-\frac{\pi}{2},0\right)$ and increasing in $\left(0,\frac{\pi}{2}\right)$

Q300. JEE Main 2020 (06 Sep Shift 2)

The set of all real values λ for which the function $f(x)=\left(1-\cos^2 x\right).\left(\lambda+\sin x\right)$,xε $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$, has exactly one maxima and exactly one minima, is :

(1) $\left(-\frac{1}{2},\frac{1}{2}\right)-\{0\}$ (2) $\left(-\frac{3}{2},\frac{3}{2}\right)$

(3) $\left(-\frac{1}{2},\frac{1}{2}\right)$ (4) $\left(-\frac{3}{2},\frac{3}{2}\right)-\{0\}$

Chapter: Indefinite Integration

Q301. JEE Main 2025 (7 April Shift 2)

If $\int\left(\frac{1}{x}+\frac{1}{x^3}\right)\left(\sqrt[23]{3x^{-24}+x^{-26}}\right)dx$ $=-\frac{\alpha}{3(\alpha+1)}\left(3x^{\beta}+x^{\gamma}\right)^{\frac{\alpha+1}{\alpha}}+C, x>0,$ $(\alpha,\beta,\gamma\in Z)$, where C is the constant of integration, then $\alpha+\beta+\gamma$ is equal to _____ .

Q302. JEE Main 2025 (28 Jan Shift 2)

If $f(x)=\int \frac{1}{x^{1/4}\left(1+x^{1/4}\right)} \mathrm{d} x, f(0)=-6$, then $f(1)$ is equal to :

(1) $4\left(\log_e 2-2\right)$ (2) $2-\log_{e^2} 2$

(3) $\log_{\mathrm{e}} 2+2$ (4) $4\left(\log_e 2+2\right)$

Q303. JEE Main 2025 (23 Jan Shift 2)

Let $\int x^3 \sin x \, \mathrm{d} x=g(x)+C$, where C is the constant of integration. If $8\left(g\left(\frac{\pi}{2}\right)+g'\left(\frac{\pi}{2}\right)\right)=\alpha \pi^3+\beta \pi^2+\gamma, \alpha, \beta, \gamma \in Z$, then $\alpha+\beta-\gamma$ equals :

(1) 48 (2) 55

(3) 62 (4) 47

Q304. JEE Main 2025 (23 Jan Shift 1)

Let $\mathrm{I}(x)=\int \frac{d x}{(x-11)^{\frac{11}{13}}(x+15)^{\frac{15}{13}}}$. If $\mathrm{I}(37)-\mathrm{I}(24)=\frac{1}{4}\left(\frac{1}{\mathrm{b}^{\frac{1}{13}}}-\frac{1}{\mathrm{c}^{\frac{1}{13}}}\right), \mathrm{b}, \mathrm{c} \in \mathrm{N}$, then $3(\mathrm{b}+\mathrm{c})$ is equal to

(1) 22 (2) 39 (3) 40 (4) 26

Q305. JEE Main 2025 (22 Jan Shift 2)

If $\int \mathrm{e}^x\left(\frac{x \sin^{-1} x}{\sqrt{1-x^2}}+\frac{\sin^{-1} x}{\left(1-x^2\right)^{3/2}}+\frac{x}{1-x^2}\right) \mathrm{d} x=\mathrm{g}(x)+\mathrm{C}$, where C is the constant of integration, then $g\left(\frac{1}{2}\right)$ equals :

(1) $\frac{\pi}{4} \sqrt{\frac{e}{3}}$ (2) $\frac{\pi}{6} \sqrt{\frac{e}{3}}$

(3) $\frac{\pi}{4} \sqrt{\frac{e}{2}}$ (4) $\frac{\pi}{6} \sqrt{\frac{e}{2}}$

Q306. JEE Main 2024 (29 Jan Shift 2)

If $\int \frac{\sin^{\frac{3}{2}} x+\cos^{\frac{3}{2}} x}{\sqrt{\sin^3 x \cos^3 x \sin (x-\theta)}} d x=A \sqrt{\cos \theta \tan x-\sin \theta}+B \sqrt{\cos \theta-\sin \theta \cot x}+C$, where C is the integration constant, then AB is equal to

(1) $4 \operatorname{cosec}(2\theta)$ (2) $4 \sec \theta$

(3) $2 \sec \theta$ (4) $8 \operatorname{cosec}(2\theta)$

Q307. JEE Main 2024 (27 Jan Shift 2)

The integral $\int \frac{\left(\mathrm{x}^8-\mathrm{x}^2\right) \mathrm{dx}}{\left(\mathrm{x}^{12}+3 \mathrm{x}^6+1\right) \tan^{-1}\left(\mathrm{x}^3+\frac{1}{\mathrm{x}^3}\right)}$ is equal to :

(1) $\log \left|\tan^{-1}\left(\mathrm{x}^3+\frac{1}{\mathrm{x}^3}\right)\right|^{\frac{1}{3}}+\mathrm{C}$

(2) $\log_{\mathrm{e}}\left(\left|\tan^{-1}\left(\mathrm{x}^3+\frac{1}{\mathrm{x}^3}\right)\right|\right)^{\frac{1}{2}}+\mathrm{C}$

(3) $\log_{\mathrm{e}}\left(\left|\tan^{-1}\left(\mathrm{x}^3+\frac{1}{\mathrm{x}^3}\right)\right|\right)+\mathrm{C}$

(4) $\log_{\mathrm{e}}\left(\left|\tan^{-1}\left(\mathrm{x}^3+\frac{1}{\mathrm{x}^3}\right)\right|\right)^3+\mathrm{C}$

Q308. JEE Main 2024 (08 Apr Shift 1)

Let $I(x)=\int \frac{6}{\sin^2 x(1-\cot x)^2}dx$. If $I(0)=3$, then $I\left(\frac{\pi}{12}\right)$ is equal to

(1) $2\sqrt{3}$ (2) $\sqrt{3}$

(3) $3\sqrt{3}$ (4) $6\sqrt{3}$

Q309. JEE Main 2024 (04 Apr Shift 2)

If $\int \text{cosec}^5 x dx=\alpha \cot x \,\text{cosec}\, x\left(\text{cossc}^2 x+\frac{3}{2}\right)+\beta \log_e\left|\tan\frac{x}{2}\right|+C$

where $\alpha,\beta\in\mathbb{R}$ and C is the constant of integration, then the value of $8(\alpha+\beta)$ equals _____

Q310. JEE Main 2023 (10 Apr Shift 2)

For $\alpha,\beta,\gamma,\delta\in\mathbb{N}$, if $\int\left(\left(\frac{x}{e}\right)^{2x}+\left(\frac{e}{x}\right)^{2x}\right)\log_e x dx=\frac{1}{\alpha}\left(\frac{x}{e}\right)^{\beta x}-\frac{1}{\gamma}\left(\frac{e}{x}\right)^{\delta x}+C$, where $e=\sum_{n=0}^{\infty}\frac{1}{n!}$ and C is constant of integration, then $\alpha+2\beta+3\gamma-4\delta$ is equal to

(1) 1 (2) 4

(3) -4 (4) -8

Q311. JEE Main 2023 (06 Apr Shift 1)

Let $I(x)=\int \frac{x^2(x\sec^2+\tan x)}{(x\tan x+1)^2}dx$ If $I(0)=0$, then $I\left(\frac{\pi}{4}\right)$ is equal to

(1) $\log_e\frac{(\pi+4)^2}{16}+\frac{\pi^2}{4(\pi+4)}$ (2) $\log_e\frac{(\pi+4)^2}{16}-\frac{\pi^2}{4(\pi+4)}$

(3) $\log_e\frac{(\pi+4)^2}{32}-\frac{\pi^2}{4(\pi+4)}$ (4) $\log_e\frac{(\pi+4)^2}{32}+\frac{\pi^2}{4(\pi+4)}$

Q312. JEE Main 2022 (27 Jun Shift 1)

$\int\frac{(x^2+1)e^x}{(x+1)^2}dx=f(x)e^x+C$, where C is a constant, then $\frac{d^3f}{dx^3}$ at $x=1$ is equal to

(1) $\frac{3}{4}$ (2) $\frac{3}{8}$

(3) $-\frac{3}{2}$ (4) $\frac{7}{8}$

Q313. JEE Main 2021 (25 Feb Shift 1)

The value of the integral $\int\frac{\sin\theta\cdot\sin 2\theta\left(\sin^6\theta+\sin^4\theta+\sin^2\theta\right)\sqrt{2\sin^4\theta+3\sin^2\theta+6}}{1-\cos 2\theta}d\theta$ is (where c is a constant of integration)

(1) $\frac{1}{18}\left[11-18\sin^2\theta+9\sin^4\theta-2\sin^6\theta\right]^{\frac{3}{2}}+c$

(2) $\frac{1}{18}\left[9-2\sin^6\theta-3\sin^4\theta-6\sin^2\theta\right]^{\frac{3}{2}}+c$

(3) $\frac{1}{18}\left[11-18\cos^2\theta+9\cos^4\theta-2\cos^6\theta\right]^{\frac{3}{2}}+c$

(4) $\frac{1}{18}\left[9-2\cos^6\theta-3\cos^4\theta-6\cos^2\theta\right]^{-\frac{3}{2}}+c$

Q314. JEE Main 2021 (18 Mar Shift 1)

If $f(x)=\int\frac{5x^8+7x^6}{(x^2+1+2x^7)^2}dx,\ (x\geq 0),\ f(0)=0$ and $f(1)=\frac{1}{K}$, then the value of K is

Chapter: Definite Integration

Q315. JEE Main 2025 (8 April Shift 2)

The integral $\int_{-1}^{\frac{3}{2}} \left(\left|\pi^2 x \sin(\pi x)\right|\right) dx$ is equal to:

(1) $3 + 2\pi$ (2) $4 + \pi$

(3) $1 + 3\pi$ (4) $2 + 3\pi$

Q316. JEE Main 2025 (7 April Shift 1)

The integral $\int_0^{\pi} \frac{(x+3)\sin x}{1+3\cos^2 x} dx$ is equal to :

(1) $\frac{\pi}{\sqrt{3}}(\pi + 1)$ (2) $\frac{\pi}{\sqrt{3}}(\pi + 2)$

(3) $\frac{\pi}{3\sqrt{3}}(\pi + 6)$ (4) $\frac{\pi}{2\sqrt{3}}(\pi + 4)$

Q317. JEE Main 2025 (3 April Shift 1)

Let the domain of the function

$f(x) = \log_2 \log_4 \log_6 \left(3 + 4x - x^2\right)$ be $(a,\ b)$. If $\int_0^{b-a} [x^2] dx = p - \sqrt{q} - \sqrt{r}, p, q, r \in \mathbb{N}, \gcd(p, q, r) = 1$, where $[\cdot]$ is the greatest integer function, then $p + q + r$ is equal to

(1) 10 (2) 8

(3) 11 (4) 9

Q318. JEE Main 2025 (29 Jan Shift 2)

If $24 \int_0^{\frac{\pi}{4}} \left(\sin\left|4x - \frac{\pi}{12}\right| + [2\sin x]\right) dx = 2\pi + \alpha$, where $[\cdot]$ denotes the greatest integer function, then α is equal to _____.

Q319. JEE Main 2025 (29 Jan Shift 2)

Let $f(x) = \int_0^t t\left(t^2 - 9t + 20\right) dt, 1 \le x \le 5$. If the range of f is $[\alpha, \beta]$, then $4(\alpha + \beta)$ equals :

(1) 253 (2) 154

(3) 125 (4) 157

Q320. JEE Main 2025 (29 Jan Shift 1)

Let $f : (0, \infty) \to \mathbf{R}$ be a twice differentiable function. If for some $a \neq 0$, $\int_0^1 f(\lambda x) d\lambda = a f(x)$, $f(1) = 1$ and $f(16) = \frac{1}{8}$, then $16 - f'\left(\frac{1}{16}\right)$ is equal to _____.

Q321. JEE Main 2025 (28 Jan Shift 2)

Let $f : \mathbf{R} \to \mathbf{R}$ be a twice differentiable function such that $f(2) = 1$. If $F(x) = x f(x)$ for all $x \in \mathbf{R}$, $\int_0^2 x\, F'(x) dx = 6$ and $\int_0^2 x^2\, F''(x) dx = 40$, then $F'(2) + \int_0^2 F(x) dx$ is equal to :

(1) 11 (2) 13

(3) 15 (4) 9

Q322. JEE Main 2025 (28 Jan Shift 1)

Let for some function y $= f(x), \int_0^x tf(t)dt = x^2 f(x), x > 0$ and $f(2) = 3$. Then $f(6)$ is equal to

(1) 1
(2) 3
(3) 6
(4) 2

Q323. JEE Main 2025 (28 Jan Shift 1)

If $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{96x^2\cos^2 x}{(1+e^x)}\mathrm{d}x = \pi\left(\alpha\pi^2+\beta\right), \alpha, \beta \in \mathbb{Z}$, then $(\alpha+\beta)^2$ equals

(1) 64
(2) 196
(3) 144
(4) 100

Q324. JEE Main 2025 (24 Jan Shift 1)

If $\mathrm{I}(m,n) = \int_0^1 x^{m-1}(1-x)^{n-1}dx, m, n > 0$, then $I(9,14) + I(10,13)$ is

(1) $\mathrm{I}(19,27)$
(2) $\mathrm{I}(9,1)$
(3) $I(1,13)$
(4) $\mathrm{I}(9,13)$

Q325. JEE Main 2025 (23 Jan Shift 2)

If $\mathrm{I} = \int_0^{\frac{\pi}{2}} \frac{\sin^{\frac{3}{2}} x}{\sin^{\frac{3}{2}} x + \cos^{\frac{3}{2}} x}\,\mathrm{d}x$, then $\int_0^{21} \frac{x\sin x\cos x}{\sin^4 x+\cos^4 x}\,\mathrm{d}x$ equals :

(1) $\frac{\pi^2}{12}$
(2) $\frac{\pi^2}{4}$
(3) $\frac{\pi^2}{16}$
(4) $\frac{\pi^2}{8}$

Q326. JEE Main 2025 (23 Jan Shift 1)

The value of

$$\int_{e^2}^{e^4} \frac{1}{x}\left(\frac{e^{\left((\log_e x)^2+1\right)^{-1}}}{e^{\left((\log_e x)^2+1\right)^{-1}} + e^{\left((6-\log_e x)^2+1\right)^{-1}}}\right)dx$$ is

(1) 2
(2) $\log_e 2$
(3) 1
(4) e^2

Q327. JEE Main 2025 (2 April Shift 2)

Let (a, b) be the point of intersection of the curve $x^2 = 2y$ and the straight line $y - 2x - 6 = 0$ in the second quadrant. Then the integral $I = \int_a^b \frac{9x^2}{1+5^x}dx$ is equal to :

(1) 24
(2) 27
(3) 18
(4) 21

Q328. JEE Main 2024 (31 Jan Shift 2)

Let $f, g:(0, \infty) \rightarrow R$ be two functions defined by $f(x)=\int_{-x}^{x}\left(|t|-t^2\right) e^{-t^2} dt$ and $g(x)=\int_0^{x^2} t^{\frac{1}{2}} e^{-t^2} dt$. Then the value of $9\left(f\left(\sqrt{\log_e 9}\right)+g\left(\sqrt{\log_e 9}\right)\right)$ is equal to

(1) 6
(2) 9
(3) 8
(4) 10

Q329. JEE Main 2024 (31 Jan Shift 2)

$\left|\frac{120}{\pi^3} \int_0^{\pi} \frac{x^2 \sin x \cos x}{\sin^4 x+\cos^4 x} dx\right|$ is equal to _____.

Q330. JEE Main 2024 (29 Jan Shift 2)

If $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sqrt{1-\sin 2x} dx=\alpha+\beta \sqrt{2}+\gamma \sqrt{3}$, where α, β and γ are rational numbers, then $3\alpha+4\beta-\gamma$ is equal to _____.

Q331. JEE Main 2024 (29 Jan Shift 1)

For $x \in\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, if $y(x)=\int \frac{\operatorname{cosec} x+\sin x}{\operatorname{cosec} x \sec x+\tan x \sin^2 x} dx$ and $\lim\limits_{x \rightarrow\left(\frac{\pi}{2}\right)^{-}} y(x)=0$ then $y\left(\frac{\pi}{4}\right)$ is equal to

(1) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(2) $\frac{1}{2} \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(3) $-\frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(4) $\frac{1}{\sqrt{2}} \tan^{-1}\left(-\frac{1}{2}\right)$

Q332. JEE Main 2024 (09 Apr Shift 2)

Let $\int_0^x \sqrt{1-\left(y'(t)\right)^2} dt=\int_0^x y(t) dt, 0 \leq x \leq 3, y \geq 0, y(0)=0$. Then at $x=2, y''+y+1$ is equal to

(1) 1
(2) 2
(3) $\sqrt{2}$
(4) $1/2$

Q333. JEE Main 2024 (06 Apr Shift 2)

Let $[t]$ denote the largest integer less than or equal to t. If $\int_0^3\left(\left[x^2\right]+\left[\frac{x^2}{2}\right]\right) \mathrm{d} x$
$=\mathrm{a}+\mathrm{b} \sqrt{2}-\sqrt{3}-\sqrt{5}+\mathrm{c} \sqrt{6}-\sqrt{7}$, where $\mathrm{a}, \mathrm{b}, \mathrm{c} \in \mathbf{Z}$, then $\mathrm{a}+\mathrm{b}+\mathrm{c}$ is equal to_____

Q334. JEE Main 2024 (05 Apr Shift 2)

Let $\beta(\mathrm{m}, \mathrm{n})=\int_0^1 x^{\mathrm{m}-1}(1-x)^{\mathrm{n}-1} \mathrm{~d} x, \mathrm{~m}, \mathrm{n}>0$. If $\int_0^1\left(1-x^{10}\right)^{20} \mathrm{~d} x=\mathrm{a} \times \beta(\mathrm{b}, \mathrm{c})$, then $100(\mathrm{a}+\mathrm{b}+\mathrm{c})$ equals

(1) 1021
(2) 2120
(3) 2012
(4) 1120

Q335. JEE Main 2024 (01 Feb Shift 2)

The value of $\int_0^1 \left(2x^3-3x^2-x+1\right)^{\frac{1}{3}}dx$ is equal to:

(1) 0 (2) 1

(3) 2 (4) -1

Q336. JEE Main 2024 (01 Feb Shift 1)

If $\int_{-\pi/2}^{\pi/2}\frac{8\sqrt{2}\cos x dx}{(1+e^{\sin x})(1+\sin^4 x)}=\alpha\pi+\beta\log_e\left(3+2\sqrt{2}\right)$, where $\alpha,\ \beta$ are integers, then $\alpha^2+\beta^2$ equals _____

Q337. JEE Main 2023 (31 Jan Shift 1)

The value of $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}}\frac{(2+3\sin x)}{\sin x(1+\cos x)}dx$ is equal to

(1) $\frac{7}{2}-\sqrt{3}-\log_e\sqrt{3}$ (2) $-2+3\sqrt{3}+\log_e\sqrt{3}$

(3) $\frac{10}{3}-\sqrt{3}+\log_e\sqrt{3}$ (4) $\frac{10}{3}-\sqrt{3}-\log_e\sqrt{3}$

Q338. JEE Main 2023 (11 Apr Shift 2)

Let the function $f:[0,2]\to\mathbb{R}$ be defined as $f(x)=\begin{cases}e^{\min\{x^2,x-[x]\}}, & x\in[0,1)\\ e^{[x-\log_e x]}, & x\in[1,2]\end{cases}$, where $[t]$ denotes the greatest integer less than or equal to t. Then the value of the integral $\int_0^2 xf(x)dx$ is

(1) $1+\frac{3e}{2}$ (2) $(e-1)\left(e^2+\frac{1}{2}\right)$

(3) $2e-1$ (4) $2e-\frac{1}{2}$

Q339. JEE Main 2022 (28 Jun Shift 1)

Let $[t]$ denote the greatest integer less than or equal to t. Then, the value of the integral $\int_0^1\left[-8x^2+6x-1\right]dx$ is equal to

(1) -1 (2) $-\frac{5}{4}$

(3) $\frac{\sqrt{17}-13}{8}$ (4) $\frac{\sqrt{17}-16}{8}$

Q340. JEE Main 2022 (28 Jul Shift 1)

The minimum value of the twice differentiable function $f(x)=\int_0^x e^{x-t}f'(t)dt-\left(x^2-x+1\right)e^x, x\in R$, is

(1) $-\frac{2}{\sqrt{e}}$ (2) $-2\sqrt{e}$

(3) $-\sqrt{e}$ (4) $\frac{2}{\sqrt{e}}$

Q341. JEE Main 2022 (27 Jun Shift 2)

The integral $\int_0^1\frac{1}{7^{\left[\frac{1}{x}\right]}}dx$, where $[\cdot]$ denotes the greatest integer function, is equal to

(1) $1-6\ln\left(\frac{6}{7}\right)$ (2) $1+6\ln\left(\frac{6}{7}\right)$

(3) $1-7\ln\left(\frac{6}{7}\right)$ (4) $1+7\ln\left(\frac{6}{7}\right)$

Q342. JEE Main 2022 (27 Jul Shift 2)

Let $f(x)=\min\{[x-1],[x-2],\ldots,[x-10]\}$ where $[t]$ denotes the greatest integer $\leq t$. Then $\int_0^{10} f(x)dx+\int_0^{10}(f(x))^2dx+\int_0^{10}|f(x)|dx$ is equal _____. to

Q343. JEE Main 2022 (25 Jun Shift 1)

The value of $\int_0^{\pi}\frac{e^{\cos x}\sin x}{(1+\cos^2 x)(e^{\cos x}+e^{-\cos x})}dx$ is equal to

(1) $\frac{\pi^2}{4}$ (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{6}$ (4) $\frac{\pi^2}{2}$

Q344. JEE Main 2022 (25 Jul Shift 2)

Let $[t]$ denote the greatest integer less than or equal to t. Then the value of the integral $\int_{-3}^{101}\left([\sin(\pi x)]+e^{[\cos(2\pi x)]}\right)dx$ is equal to

(1) $\frac{52(1-e)}{e}$ (2) $\frac{52}{e}$

(3) $\frac{52(2+e)}{e}$ (4) $\frac{104}{e}$

Q345. JEE Main 2021 (31 Aug Shift 2)

If $[x]$ is the greatest integer $\leq x$, then $\pi^2\int_0^2\left(\sin\frac{\pi x}{2}\right)(x-[x])^{[x]}dx$ is equal to :

(1) $2(\pi+1)$ (2) $4(\pi-1)$

(3) $2(\pi-1)$ (4) $4(\pi+1)$

Q346. JEE Main 2021 (18 Mar Shift 1)

Let $f(x)$ and $g(x)$ be two functions satisfying $f(x^2)+g(4-x)=4x^3$ and $g(4-x)+g(x)=0$, then the value of $\int_{-4}^{4}f(x^2)dx$ is

Q347. JEE Main 2021 (17 Mar Shift 2)

If the integral $\int_0^{10}\frac{[\sin 2\pi x]}{e^{x-[x]}}dx=\alpha e^{-1}+\beta e^{-\frac{1}{2}}+\gamma$, where $\alpha,\ \beta,\ \gamma$ are integers and $[x]$ denotes the greatest integer less than or equal to x, then the value of $\alpha+\beta+\gamma$ is equal to:

(1) 0 (2) 20

(3) 25 (4) 10

Chapter: Area Under Curves

Q348. JEE Main 2025 (8 April Shift 2)

Let the area of the bounded region $\{(x,y):0\leq 9x\leq y^2, y\geq 3x-6\}$ be A. Then 6 A is equal to _____

Q349. JEE Main 2025 (7 April Shift 1)

If the area of the region bounded by the curves $y = 4 - \frac{x^2}{4}$ and $y = \frac{x-4}{2}$ is equal to α, then 6α equals

(1) 250 (2) 210

(3) 240 (4) 220

Q350. JEE Main 2025 (3 April Shift 2)

The area of the region $\{(x, y) : |x - y| \leq y \leq 4\sqrt{x}\}$ is

(1) 512 (2) $\frac{1024}{3}$

(3) $\frac{512}{3}$ (4) $\frac{2048}{3}$

Q351. JEE Main 2025 (3 April Shift 1)

The area of the region bounded by the curve $y = \max\{|x|, x|x - 2|\}$, then x-axis and the lines $x = -2$ and $x = 4$ is equal to _____ .

Q352. JEE Main 2025 (28 Jan Shift 1)

The area (in sq. units) of the region
$\{(x, y) : 0 \leq y \leq 2|x| + 1, 0 \leq y \leq x^2 + 1, |x| \leq 3\}$ is

(1) $\frac{80}{3}$ (2) $\frac{64}{3}$

(3) $\frac{32}{3}$ (4) $\frac{17}{3}$

Q353. JEE Main 2025 (24 Jan Shift 2)

The area of the region enclosed by the curves $y = e^x, y = |e^x - 1|$ and y-axis is:

(1) $1 - \log_e 2$ (2) $\log_e 2$

(3) $1 + \log_e 2$ (4) $2\log_e 2 - 1$

Q354. JEE Main 2025 (24 Jan Shift 1)

The area of the region $\{(x, y) : x^2 + 4x + 2 \leq y \leq |x + 2|\}$ is equal to

(1) 7 (2) 5

(3) 24/5 (4) 20/3

Q355. JEE Main 2025 (24 Jan Shift 1)

Consider the region $R = \{(x, y) : x \leq y \leq 9 - \frac{11}{3}x^2, x \geq 0\}$.

The area, of the largest rectangle of sides parallel to the coordinate axes and inscribed in R , is:

(1) $\frac{730}{119}$ (2) $\frac{625}{111}$

(3) $\frac{821}{123}$ (4) $\frac{567}{121}$

Q356. JEE Main 2025 (23 Jan Shift 2)

If the area of the region $\left\{(x, y): -1 \leq x \leq 1, 0 \leq y \leq a + \mathrm{e}^{|x|} - \mathrm{e}^{-x}, \mathrm{a} > 0\right\}$ is $\frac{\mathrm{e}^2+8\mathrm{e}+1}{\mathrm{e}}$, then the value of a is :

(1) 8 (2) 7

(3) 5 (4) 6

Q357. JEE Main 2025 (22 Jan Shift 1)

Let $f : \mathbf{R} \to \mathbf{R}$ be a twice differentiable function such that $f(x+y) = f(x)f(y)$ for all $x, y \in \mathbf{R}$. If $f'(0) = 4\mathrm{a}$ and f satisfies $f''(x) - 3\mathrm{a}f'(x) - f(x) = 0$, $\mathrm{a} > 0$, then the area of the region $\mathrm{R} = \{(x, y) \mid 0 \leq y \leq f(\mathrm{a}x), 0 \leq x \leq 2\}$ is:

(1) $e^2 - 1$ (2) $\mathrm{e}^2 + 1$

(3) $e^4 + 1$ (4) $e^4 - 1$

Q358. JEE Main 2024 (31 Jan Shift 1)

The area of the region $\left\{(x, y): y^2 \leq 4x, x < 4, \frac{xy(x-1)(x-2)}{(x-3)(x-4)} > 0, x \neq 3\right\}$ is

(1) $\frac{16}{3}$ (2) $\frac{64}{3}$

(3) $\frac{8}{3}$ (4) $\frac{32}{3}$

Q359. JEE Main 2024 (29 Jan Shift 2)

Let the area of the region $\{(x, y): 0 \leq x \leq 3, 0 \leq y \leq \min\{x^2 + 2, 2x + 2\}\}$ be A. Then $12A$ is equal to _____.

Q360. JEE Main 2024 (08 Apr Shift 2)

The area of the region in the first quadrant inside the circle $x^2 + y^2 = 8$ and outside the parabola $y^2 = 2x$ is equal to :

(1) $\frac{\pi}{2} - \frac{1}{3}$ (2) $\pi - \frac{1}{3}$

(3) $\frac{\pi}{2} - \frac{2}{3}$ (4) $\pi - \frac{2}{3}$

Q361. JEE Main 2024 (08 Apr Shift 1)

Let $f(x)$ be a positive function such that the area bounded by $y = f(x), y = 0$ from $x = 0$ to $x = a > 0$ is $e^{-a} + 4a^2 + a - 1$. Then the differential equation, whose general solution is $y = c_1 f(x) + c_2$, where c_1 and c_2 are arbitrary constants, is

(1) $(8e^x - 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ (2) $(8e^x - 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

(3) $(8e^x + 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$ (4) $(8e^x + 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

Q362. JEE Main 2024 (05 Apr Shift 1)

The area of the region enclosed by the parabolas $y = x^2 - 5x$ and $y = 7x - x^2$ is

Q363. JEE Main 2024 (01 Feb Shift 1)

The area enclosed by the curves $xy + 4y = 16$ and $x + y = 6$ is equal to:

(1) $28 - 30\log_e 2$ (2) $30 - 28\log_e 2$

(3) $30 - 32\log_e 2$ (4) $32 - 30\log_e 2$

Q364. JEE Main 2023 (30 Jan Shift 2)

Let q be the maximum integral value of p in $[0, 10]$ for which the roots of the equation $x^2 - px + \frac{5}{4}p = 0$ are rational. Then the area of the region $\{(x, y) : 0 \le y \le (x - q)^2, 0 \le x \le q\}$ is

(1) 243 (2) 25

(3) $\frac{125}{3}$ (4) 164

Q365. JEE Main 2022 (26 Jun Shift 2)

The area of the region bounded by $y^2 = 8x$ and $y^2 = 16(3 - x)$ is equal to

(1) $\frac{32}{3}$ (2) $\frac{40}{3}$

(3) 16 (4) 9

Q366. JEE Main 2021 (17 Mar Shift 2)

Let $f : [-3, 1] \to R$ be given as $f(x) = \begin{cases} min\{(x+6),\ x^2\}, & -3 \le x \le 0 \\ max\{\sqrt{x},\ x^2\}, & 0 \le x \le 1 \end{cases}$.

If the area bounded by $y = f(x)$ and x-axis is A sq units, then the value of $6A$ is equal to

Chapter: Differential Equations

Q367. JEE Main 2025 (8 April Shift 2)

Let $f(x) = x - 1$ and $g(x) = e^x$ for $x \in \mathbb{R}$. If $\frac{dy}{dx} = \left(e^{-2\sqrt{x}} g(f(f(x))) - \frac{y}{\sqrt{x}}\right), y(0) = 0$, then $y(1)$ is :-

(1) $\frac{1-e^2}{e^4}$ (2) $\frac{2e-1}{e^3}$

(3) $\frac{e-1}{e^4}$ (4) $\frac{1-e^3}{e^4}$

Q368. JEE Main 2025 (7 April Shift 1)

Let $y = y(x)$ be the solution curve of the differential equation
$x\left(x^2 + e^x\right)dy + \left(e^x(x-2)y - x^3\right)dx = 0, x > 0$ passing through the point $(1, 0)$. Then $y(2)$ is equal to :

(1) $\frac{4}{4-e^2}$ (2) $\frac{2}{2+e^2}$

(3) $\frac{2}{2-e^2}$ (4) $\frac{4}{4+e^2}$

Q369. JEE Main 2025 (4 April Shift 2)

If a curve $y = y(x)$ passes through the point $\left(1, \frac{\pi}{2}\right)$ and satisfies the differential equation $\left(7x^4 \cot y - e^x \operatorname{cosec} y\right)\frac{dx}{dy} = x^5, x \geq 1$, then at $x = 2$, the value of cosy is:

(1) $\frac{2e^2-e}{64}$ (2) $\frac{2e^2+e}{64}$

(3) $\frac{2e^2-e}{128}$ (4) $\frac{2e^2+e}{128}$

Q370. JEE Main 2025 (4 April Shift 1)

Let $f : [0, \infty) \to \mathbb{R}$ be differentiable function such that $f(\mathrm{x}) = 1 - 2\mathrm{x} + \int_0^x e^{x-t} f(t)\mathrm{dt}$ for all $\mathrm{x} \in [0, \infty)$. Then the area of the region bounded by $\mathrm{y} = f(\mathrm{x})$ and the coordinate axes is

(1) $\sqrt{5}$ (2) $\frac{1}{2}$

(3) $\sqrt{2}$ (4) 2

Q371. JEE Main 2025 (29 Jan Shift 2)

If for the solution curve $y = f(x)$ of the differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} + (\tan x)y = \frac{2+\sec x}{(1+2\sec x)^2}$, $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right), f\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{10}$, then $f\left(\frac{\pi}{4}\right)$ is equal to :

(1) $\frac{\sqrt{3}+1}{10(4+\sqrt{3})}$ (2) $\frac{5-\sqrt{3}}{2\sqrt{2}}$

(3) $\frac{9\sqrt{3}+3}{10(4+\sqrt{3})}$ (4) $\frac{4-\sqrt{2}}{14}$

Q372. JEE Main 2025 (24 Jan Shift 2)

Let $y = y(x)$ be the solution of the differential equation $2\cos x\frac{\mathrm{d}y}{\mathrm{d}x} = \sin 2x - 4y\sin x, x \in \left(0, \frac{\pi}{2}\right)$. If $y\left(\frac{\pi}{3}\right) = 0$, then $y'\left(\frac{\pi}{4}\right) + y\left(\frac{\pi}{4}\right)$ is equal to _____ _____.

Q373. JEE Main 2025 (24 Jan Shift 2)

Let $f : (0, \infty) \to \mathbf{R}$ be a function which is differentiable at all points of its domain and satisfies the condition $x^2 f'(x) = 2xf(x) + 3$, with $f(1) = 4$. Then $2f(2)$ is equal to :

(1) 39 (2) 19

(3) 29 (4) 23

Q374. JEE Main 2025 (24 Jan Shift 1)

Let $\mathrm{y} = \mathrm{y}(\mathrm{x})$ be the solution of the differential equation $\left(xy - 5x^2\sqrt{1+x^2}\right)dx + \left(1+x^2\right)dy = 0, y(0) = 0$. Then $y(\sqrt{3})$ is equal to

(1) $\sqrt{\frac{15}{2}}$ (2) $\frac{5\sqrt{3}}{2}$

(3) $2\sqrt{2}$ (4) $\sqrt{\frac{14}{3}}$

Q375. JEE Main 2025 (23 Jan Shift 2)

Let $x = x(y)$ be the solution of the differential equation $y = \left(x - y\frac{\mathrm{d}x}{\mathrm{d}y}\right)\sin\left(\frac{x}{y}\right), y > 0$ and $x(1) = \frac{\pi}{2}$. Then $\cos(x(2))$ is equal to :

(1) $1 - 2(\log_e 2)^2$
(2) $1 - 2\left(\log_e 2\right)$
(3) $2\left(\log_e 2\right) - 1$
(4) $2(\log_e 2)^2 - 1$

Q376. JEE Main 2025 (23 Jan Shift 1)

Let a curve $y = f(x)$ pass through the points $(0, 5)$ and $(\log_e 2, k)$. If the curve satisfies the differential equation $2(3 + y)e^{2x}dx - \left(7 + e^{2x}\right)dy = 0$, then k is equal to

(1) 4
(2) 32
(3) 8
(4) 16

Q377. JEE Main 2025 (22 Jan Shift 2)

Let $y = f(x)$ be the solution of the differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} + \frac{xy}{x^2-1} = \frac{x^6+4x}{\sqrt{1-x^2}}, -1 < x < 1$ such that $f(0) = 0$. If $6\int_{-1/2}^{1/2} f(x)\mathrm{d}x = 2\pi - \alpha$ then α^2 is equal to _____ .

Q378. JEE Main 2025 (22 Jan Shift 1)

Let $x = x(y)$ be the solution of the differential equation $y^2\,\mathrm{d}x + \left(x - \frac{1}{y}\right)\mathrm{d}y = 0$. If $x(1) = 1$, then $x\left(\frac{1}{2}\right)$ is :

(1) $\frac{1}{2} + \mathrm{e}$
(2) $3 + e$
(3) $3 - e$
(4) $\frac{3}{2} + e$

Q379. JEE Main 2025 (2 April Shift 2)

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + 2y\sec^2 x = 2\sec^2 x + 3\tan x \cdot \sec^2 x$ such that $\mathrm{y}(0) = \frac{5}{4}$. Then $12\left(\mathrm{y}\left(\frac{\pi}{4}\right) - \mathrm{e}^{-2}\right)$ is equal to _____.

Q380. JEE Main 2024 (30 Jan Shift 1)

Let $y = y(x)$ be the solution of the differential equation $\sec x dy + \{2(1 - x)\tan x + x(2 - x)\}dx = 0$ such that $y(0) = 2$. Then $y(2)$ is equal to :

(1) 2
(2) $2\{1 - \sin(2)\}$
(3) $2\{\sin(2) + 1\}$
(4) 1

Q381. JEE Main 2024 (29 Jan Shift 1)

A function $y = f(x)$ satisfies $f(x)\sin 2x + \sin x - \left(1 + \cos^2 x\right)f'(x) = 0$ with condition $f(0) = 0$. Then $f\left(\frac{\pi}{2}\right)$ is equal to

(1) 1
(2) 0
(3) -1
(4) 2

Q382. JEE Main 2024 (09 Apr Shift 1)

The solution curve, of the differential equation $2y\frac{\mathrm{d}y}{\mathrm{d}x}+3=5\frac{\mathrm{d}y}{\mathrm{d}x}$, passing through the point $(0,1)$ is a conic, whose vertex lies on the line:

(1) $2x+3y=9$
(2) $2x+3y=-9$
(3) $2x+3y=-6$
(4) $2x+3y=6$

Q383. JEE Main 2024 (06 Apr Shift 2)

Suppose the solution of the differential equation $\frac{dy}{dx}=\frac{(2+\alpha)x-\beta y+2}{\beta x-2\alpha y-(\beta\gamma-4\alpha)}$ represents a circle passing through origin. Then the radius of this circle is :

(1) 2
(2) $\sqrt{17}$
(3) $\frac{1}{2}$
(4) $\frac{\sqrt{17}}{2}$

Q384. JEE Main 2024 (04 Apr Shift 2)

Let $y=y(x)$ be the solution of the differential equation $\left(x^2+4\right)^2dy+\left(2x^3y+8xy-2\right)dx=0$. If $y(0)=0$, then $y(2)$ is equal to

(1) $\frac{\pi}{32}$
(2) 2π
(3) $\frac{\pi}{8}$
(4) $\frac{\pi}{16}$

Q385. JEE Main 2024 (04 Apr Shift 1)

If the solution $y=y(x)$ of the differential equation $\left(x^4+2x^3+3x^2+2x+2\right)\mathrm{d}y-\left(2x^2+2x+3\right)\mathrm{d}x=0$ satisfies $y(-1)=-\frac{\pi}{4}$, then $y(0)$ is equal to :

(1) $\frac{\pi}{2}$
(2) $-\frac{\pi}{2}$
(3) 0
(4) $\frac{\pi}{4}$

Q386. JEE Main 2024 (01 Feb Shift 1)

Let $y=y(x)$ be the solution of the differential equation $\frac{dy}{dx}=2x(x+y)^3-x(x+y)-1, y(0)=1$. Then, $\left(\frac{1}{\sqrt{2}}+y\left(\frac{1}{\sqrt{2}}\right)\right)^2$ equals:

(1) $\frac{4}{4+\sqrt{e}}$
(2) $\frac{3}{3-\sqrt{e}}$
(3) $\frac{2}{1+\sqrt{e}}$
(4) $\frac{1}{2-\sqrt{e}}$

Q387. JEE Main 2022 (28 Jun Shift 2)

Let $x=x(y)$ be the solution of the differential equation $2ye^{\frac{x}{y^2}}dx+\left(y^2-4xe^{\frac{x}{y^2}}\right)dy=0$ such that $x(1)=0$. Then, $x(e)$ is equal to

(1) $e\log_e(2)$
(2) $-e\log_e(2)$
(3) $e^2\log_e(2)$
(4) $-e^2\log_e(2)$

Q388. JEE Main 2022 (28 Jun Shift 1)

Let the solution curve $y = y(x)$ of the differential equation, $\left[\frac{x}{\sqrt{x^2-y^2}} + e^{\frac{y}{x}}\right]x\frac{dy}{dx} = x + \left[\frac{x}{\sqrt{x^2-y^2}} + e^{\frac{y}{x}}\right]y$ pass through the points $(1, 0)$ and $(2\alpha, \alpha), \alpha > 0$. Then α is equal to

(1) $\frac{1}{2}\exp\left(\frac{\pi}{6} + \sqrt{\mathrm{e}} - 1\right)$
(2) $\frac{1}{2}\exp\left(\frac{\pi}{3} + \sqrt{e} - 1\right)$
(3) $\exp\left(\frac{\pi}{6} + \sqrt{\mathrm{e}} + 1\right)$
(4) $2\exp\left(\frac{\pi}{3} + \sqrt{\mathrm{e}} - 1\right)$

Q389. JEE Main 2022 (26 Jul Shift 2)

Suppose $y = y(x)$ be the solution curve to the differential equation $\frac{dy}{dx} - y = 2 - e^{-x}$ such that $\lim\limits_{x\to\infty} y(x)$ is finite. If a and b are respectively the $x-$ and $y-$intercept of the tangent to the curve at $x = 0$, then the value of $a - 4b$ is equal to _____.

Q390. JEE Main 2022 (25 Jun Shift 1)

Let $y = y(x)$ be the solution of the differential equation $(x+1)y' - y = \mathrm{e}^{3x}(x+1)^2$, with $y(0) = \frac{1}{3}$. Then, the point $x = -\frac{4}{3}$ for the curve $y = y(x)$ is

(1) not a critical point
(2) a point of local minima
(3) a point of local maxima
(4) a point of inflection

Q391. JEE Main 2022 (25 Jul Shift 2)

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = \frac{4y^3+2yx^2}{3xy^2+x^3}$, $y(1) = 1$. If for some $n \in N, y(2) \in [n-1, n)$, then n is equal to _____.

Q392. JEE Main 2022 (25 Jul Shift 1)

The general solution of the differential equation $\left(x - y^2\right)dx + y\left(5x + y^2\right)dy = 0$ is

(1) $\left(y^2 + x\right)^4 = C\left|\left(y^2 + 2x\right)^3\right|$
(2) $\left(y^2 + 2x\right)^4 = C\left|\left(y^2 + x\right)^3\right|$
(3) $\left|\left(y^2 + x\right)^3\right| = C\left(2y^2 + x\right)^4$
(4) $\left|\left(y^2 + 2x\right)^3\right| = C\left(2y^2 + x\right)^4$

Chapter: Straight Lines

Q393. JEE Main 2025 (8 April Shift 2)

A line passing through the point $\mathrm{P}(\mathrm{a}, \theta)$ makes an acute angle α with the positive x -axis. Let this line be rotated about the point P through an angle $\frac{\alpha}{2}$ in the clock-wise direction. If in the new position, the slope of the line is $2 - \sqrt{3}$ and its distance from the origin is $\frac{1}{\sqrt{2}}$, then the value of $3a^2\tan^2\alpha - 2\sqrt{3}$ is

(1) 4
(2) 6
(3) 5
(4) 8

Q394. JEE Main 2025 (7 April Shift 1)

Let ABC be the triangle such that the equations of lines AB and AC be $3y - x = 2$ and $x + y = 2$, respectively, and the points B and C lie on x -axis. If P is the orthocentre of the triangle ABC, then the area of the triangle PBC is equal to

(1) 4
(2) 10
(3) 8
(4) 6

Q395. JEE Main 2025 (3 April Shift 2)

Consider the lines $\mathrm{x}(3\lambda + 1) + \mathrm{y}(7\lambda + 2) = 17\lambda + 5$, λ being a parameter, all passing through a point P . One of these lines (say L) is farthest from the origin. If the distance of L from the point $(3, 6)$ is d, then the value of d^2 is

(1) 20
(2) 30
(3) 10
(4) 15

Q396. JEE Main 2025 (3 April Shift 1)

A line passes through the origin and makes equal angles with the positive coordinate axes. It intersects the lines $\mathrm{L}_1 : 2\mathrm{x} + \mathrm{y} + 6 = 0$ and $\mathrm{L}_2 : 4\mathrm{x} + 2\mathrm{y} - \mathrm{p} = 0, \mathrm{p} > 0$, at the points A and B, respectively. If $AB = \frac{9}{\sqrt{2}}$ and the foot of the perpendicular from the point A on the line L_2 is M, then $\frac{AM}{BM}$ is equal to

(1) 5
(2) 4
(3) 2
(4) 3

Q397. JEE Main 2025 (29 Jan Shift 2)

Let the line $x + y = 1$ meet the axes of x and y at A and B, respectively. A right angled triangle AMN is inscribed in the triangle OAB , where O is the origin and the points M and N lie on the lines OB and AB, respectively. If the area of the triangle AMN is $\frac{4}{9}$ of the area of the triangle OAB and AN : NB $= \lambda : 1$, then the sum of all possible value(s) of is λ :

(1) 2
(2) $\frac{5}{2}$
(3) $\frac{1}{2}$
(4) $\frac{13}{6}$

Q398. JEE Main 2025 (29 Jan Shift 1)

Let ABC be a triangle formed by the lines $7x - 6y + 3 = 0, x + 2y - 31 = 0$ and $9x - 2y - 19 = 0$. Let the point (h, k) be the image of the centroid of ΔABC in the line $3x + 6y - 53 = 0$. Then $h^2 + k^2 + hk$ is equal to:

(1) 47
(2) 37
(3) 36
(4) 40

Q399. JEE Main 2025 (28 Jan Shift 2)

Two equal sides of an isosceles triangle are along $-x+2y=4$ and $x+y=4$. If m is the slope of its third side, then the sum, of all possible distinct values of m, is :

(1) $-2\sqrt{10}$ (2) 12

(3) 6 (4) -6

Q400. JEE Main 2025 (24 Jan Shift 2)

Let the points $\left(\frac{11}{2}, \alpha\right)$ lie on or inside the triangle with sides $x+y=11, x+2y=16$ and $2x+3y=29$. Then the product of the smallest and the largest values of α is equal to :

(1) 44 (2) 22

(3) 33 (4) 55

Q401. JEE Main 2025 (24 Jan Shift 1)

Let the lines $3x-4y-\alpha=0, 8x-11y-33=0$, and $2x-3y+\lambda=0$ be concurrent. If the image of the point $(1,2)$ in the line $2x-3y+\lambda=0$ is $\left(\frac{57}{13}, \frac{-40}{13}\right)$, then $|\alpha\lambda|$ is equal to

(1) 84 (2) 113

(3) 91 (4) 101

Q402. JEE Main 2025 (23 Jan Shift 2)

A rod of length eight units moves such that its ends A and B always lie on the lines $x-y+2=0$ and $y+2=0$, respectively. If the locus of the point P, that divides the rod AB internally in the ratio $2:1$ is $9\left(x^2+\alpha y^2+\beta xy+\gamma x+28y\right)-76=0$, then $\alpha-\beta-\gamma$ is equal to :

(1) 22 (2) 21

(3) 23 (4) 24

Q403. JEE Main 2025 (22 Jan Shift 2)

Let $A(6,8), B(10\cos\alpha, -10\sin\alpha)$ and $C(-10\sin\alpha, 10\cos\alpha)$, be the vertices of a triangle. If $L(a,9)$ and $G(h,k)$ be its orthocenter and centroid respectively, then $(5a-3h+6k+100\sin 2\alpha)$ is equal to _____ -.

Q404. JEE Main 2024 (31 Jan Shift 2)

Let $A(-2,-1)$, $B(1,0)$, $C(\alpha,\beta)$ and $D(\gamma,\delta)$ be the vertices of a parallelogram $ABCD$. If the point C lies on $2x-y=5$ and the point D lies on $3x-2y=6$, then the value of $|\alpha+\beta+\gamma+\delta|$ is equal to _____.

Q405. JEE Main 2024 (09 Apr Shift 1)

A ray of light coming from the point $P(1,2)$ gets reflected from the point Q on the x-axis and then passes through the point $R(4,3)$. If the point $S(h,k)$ is such that PQRS is a parallelogram, then hk^2 is equal to :

(1) 70 (2) 80

(3) 60 (4) 90

Q406. JEE Main 2024 (05 Apr Shift 2)

Let $A(-1,1)$ and $B(2,3)$ be two points and P be a variable point above the line AB such that the area of $\triangle \mathrm{PAB}$ is 10 . If the locus of P is a$x+$ b$y=15$, then 5a + 2 b is :

(1) 6
(2) $-\frac{6}{5}$
(3) 4
(4) $-\frac{12}{5}$

Q407. JEE Main 2024 (04 Apr Shift 2)

Consider a triangle ABC having the vertices $\mathrm{A}(1,2), \mathrm{B}(\alpha, \beta)$ and $\mathrm{C}(\gamma, \delta)$ and angles $\angle ABC=\frac{\pi}{6}$ and $\angle BAC=\frac{2 \pi}{3}$. If the points B and C lie on the line $y=x+4$, then $\alpha^2+\gamma^2$ is equal to _____

Q408. JEE Main 2024 (04 Apr Shift 1)

The vertices of a triangle are $\mathrm{A}(-1,3), \mathrm{B}(-2,2)$ and $\mathrm{C}(3,-1)$. A new triangle is formed by shifting the sides of the triangle by one unit inwards. Then the equation of the side of the new triangle nearest to origin is :

(1) $x+y+(2-\sqrt{2})=0$
(2) $-x+y-(2-\sqrt{2})=0$
(3) $x+y-(2-\sqrt{2})=0$
(4) $x-y-(2+\sqrt{2})=0$

Q409. JEE Main 2023 (25 Jan Shift 2)

A triangle is formed by X-axis, Y-axis and the line $3x+4y=60$. Then the number of points $P(a,b)$ which lie strictly inside the triangle, where a is an integer and b is a multiple of a, is _____ .

Q410. JEE Main 2023 (01 Feb Shift 1)

If the orthocentre of the triangle, whose vertices are $(1,2),(2,3)$ and $(3,1)$ is (α, β), then the quadratic equation whose roots are $\alpha+4\beta$ and $4\alpha+\beta$, is

(1) $x^2-19x+90=0$
(2) $x^2-18x+80=0$
(3) $x^2-22x+120=0$
(4) $x^2-20x+99=0$

Q411. JEE Main 2022 (29 Jul Shift 2)

Let m_1, m_2 be the slopes of two adjacent sides of a square of side a such that $a^2+11a+3\left(m_1^2+m_2^2\right)=220$. 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 $72\left(\sin^4 \alpha+\cos^4 \alpha\right)+a^2-3a+13$ is equal to

(1) 119
(2) 128
(3) 145
(4) 155

Q412. JEE Main 2022 (28 Jun Shift 1)

A ray of light passing through the point $P(2,3)$ reflects on the X-axis at point A and the reflected ray passes through the point $Q(5,4)$. Let R be the point that divides the line segment AQ internally into the ratio $2:1$. Let the co-ordinates of the foot of the perpendicular M from R on the bisector of the angle PAQ be (α, β). Then, the value of $7\alpha + 3\beta$ is equal to _____.

Q413. JEE Main 2022 (27 Jul Shift 2)

The equations of the sides AB, BC and CA of a triangle ABC are $2x + y = 0,\ x + py = 39$ and $x - y = 3$ respectively and $P(2,3)$ is its circumcentre. Then which of the following is NOT true

(1) $(AC)^2 = 9p$

(2) $(AC)^2 + p^2 = 136$

(3) $32 <$area $(\Delta ABC) < 36$

(4) $34 <$ area $(\Delta ABC) < 38$

Q414. JEE Main 2022 (24 Jun Shift 1)

Let $A\left(\frac{3}{\sqrt{a}}, \sqrt{a}\right), a > 0$, be a fixed point in the xy-plane. The image of A in y-axis be B and the image of B in x-axis be C. If $D(3\cos\theta, a\sin\theta),$ is a point in the fourth quadrant such that the maximum area of ΔACD is 12 square units, then a is equal to _____

Q415. JEE Main 2021 (16 Mar Shift 2)

Let $A(-1,1),\ B(3,4)$ and C$(2,0)$ be given three points. A line $y = mx,\ m > 0$, intersects lines AC and BC at point P and Q respectively. Let A_1 and A_2 be the areas of ΔABC and ΔPQC respectively, such that $A_1 = 3A_2$, then the value of m is equal to :

(1) $\frac{4}{15}$ (2) 1

(3) 2 (4) 3

Q416. JEE Main 2020 (07 Jan Shift 1)

Let $A(1,0), B(6,2)$ and $C\left(\frac{3}{2}, 6\right)$ be the vertices of a triangle ABC. If P is a point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas, then the length of the line segment $PQ,$ where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right),$ is

Chapter: Circle

Q417. JEE Main 2025 (7 April Shift 1)

Let C_1 be the circle in the third quadrant of radius 3 , that touches both coordinate axes. Let C_2 be the circle with centre $(1,3)$ that touches C_1 externally at the point (α, β). If $(\beta - \alpha)^2 = \frac{m}{n}, \gcd(m,n) = 1$, then $m + n$ is equal to :

(1) 9 (2) 13

(3) 22 (4) 31

Q418. JEE Main 2025 (29 Jan Shift 2)

Let a circle C pass through the points $(4,2)$ and $(0,2)$, and its centre lie on $3x+2y+2=0$. Then the length of the chord, of the circle C, whose mid-point is $(1,2)$, is :

(1) $\sqrt{3}$ (2) $2\sqrt{2}$

(3) $2\sqrt{3}$ (4) $4\sqrt{2}$

Q419. JEE Main 2025 (28 Jan Shift 1)

Let the equation of the circle, which touches x-axis at the point $(a,0), a>0$ and cuts off an intercept of length b on y-axis be $x^2+y^2-\alpha x+\beta y+\gamma=0$. If the circle lies below x-axis, then the ordered pair $\left(2a, b^2\right)$ is equal to

(1) $\left(\gamma, \beta^2-4\alpha\right)$ (2) $\left(\alpha, \beta^2+4\gamma\right)$

(3) $\left(\gamma, \beta^2+4\alpha\right)$ (4) $\left(\alpha, \beta^2-4\gamma\right)$

Q420. JEE Main 2024 (30 Jan Shift 2)

Consider two circles $C_1: x^2+y^2=25$ and $C_2:\left(x-\alpha\right)^2+y^2=16$, where $\alpha \in (5,9)$. Let the angle between the two radii (one to each circle) drawn from one of the intersection points of $C_1$and C_2 be $\sin^{-1}\left(\frac{\sqrt{63}}{8}\right)$. If the length of common chord of C_1 and C_2 is β, then the value of $(\alpha\beta)^2$ equals _____.

Q421. JEE Main 2024 (08 Apr Shift 1)

Let the circles $C_1:(x-\alpha)^2+(y-\beta)^2=r_1^2$ and $C_2:(x-8)^2+\left(y-\frac{15}{2}\right)^2=r_2^2$ touch each other externally at the point $(6,6)$. If the point $(6,6)$ divides the line segment joining the centres of the circles C_1 and C_2 internally in the ratio $2:1$, then $(\alpha+\beta)+4\left(r_1^2+r_2^2\right)$ equals

(1) 125 (2) 130

(3) 110 (4) 145

Q422. JEE Main 2024 (05 Apr Shift 2)

Let $ABCD$ and $AEFG$ be squares of side 4 and 2 units, respectively. The point E is on the line segment AB and the point F is on the diagonal AC. Then the radius r of the circle passing through the point F and touching the line segments BC and CD satisfies:

(1) $r=0$ (2) $2r^2-4r+1=0$

(3) $2r^2-8r+7=0$ (4) $r^2-8r+8=0$

Q423. JEE Main 2024 (04 Apr Shift 1)

A square is inscribed in the circle $x^2+y^2-10x-6y+30=0$. One side of this square is parallel to $y=x+3$. If (x_i, y_i) are the vertices of the square, then $\Sigma\left(x_i^2+y_i^2\right)$ is equal to:

(1) 148 (2) 152

(3) 160 (4) 156

Q424. JEE Main 2023 (31 Jan Shift 2)

The set of all values of a^2 for which the line $x+y=0$ bisects two distinct chords drawn from a point $\mathrm{P}\left(\frac{1+a}{2}, \frac{1-a}{2}\right)$ on the circle $2x^2+2y^2-(1+a)x-(1-a)y=0$, is equal to :

(1) $(8, \infty)$
(2) $(0, 4]$
(3) $(4, \infty)$
(4) $(2, 12]$

Q425. JEE Main 2023 (25 Jan Shift 1)

The points of intersection of the line $ax + by = 0$, $(a \neq b)$ and the circle $x^2 + y^2 - 2x = 0$ are $A(\alpha, 0)$ and $B(1, \beta)$. The image of the circle with AB as a diameter in the line $x + y + 2 = 0$ is :

(1) $x^2+y^2+5x+5y+12=0$
(2) $x^2+y^2+3x+5y+8=0$
(3) $x^2+y^2+3x+3y+4=0$
(4) $x^2+y^2-5x-5y+12=0$

Q426. JEE Main 2023 (24 Jan Shift 2)

The locus of the middle points of the chords of the circle $C_1: (x-4)^2+(y-5)^2=4$ which subtend an angle θ_i at the centre of the circle C_i, is a circle of radius r_i. If $\theta_1=\frac{\pi}{3}$, $\theta_3=\frac{2\pi}{3}$ and ${r_1}^2={r_2}^2+{r_3}^2$, then θ_2 is equal to

(1) $\frac{\pi}{4}$
(2) $\frac{3\pi}{4}$
(3) $\frac{\pi}{6}$
(4) $\frac{\pi}{2}$

Q427. JEE Main 2023 (08 Apr Shift 1)

Consider a circle $C_1: x^2+y^2-4x-2y = \alpha-5$. Let its mirror image in the line $y=2x+1$ be another circle $C_2: 5x^2+5y^2-10fx-10gy+36=0$. Let r be the radius of C_2. Then $\alpha + r$ is equal to _____.

Q428. JEE Main 2022 (27 Jun Shift 1)

A rectangle R with end points of the one of its sides as $(1, 2)$ and $(3, 6)$ is inscribed in a circle. If the equation of a diameter of the circle is $2x-y+4=0$, then the area of R is _____.

Q429. JEE Main 2022 (26 Jun Shift 1)

Let C be a circle passing through the points $A(2, -1)$ and $B(3, 4)$. The line segment AB is not a diameter of C. If r is the radius of C and its centre lies on the circle $(x-5)^2+(y-1)^2=\frac{13}{2}$, then r^2 is equal to

(1) 32
(2) $\frac{65}{2}$
(3) $\frac{61}{2}$
(4) 30

Q430. JEE Main 2022 (25 Jun Shift 1)

Let the abscissae of the two points P and Q be the roots of $2x^2-rx+p=0$ and the ordinates of P and Q be the roots of $x^2-sx-q=0$. If the equation of the circle described on PQ as diameter is $2(x^2+y^2)-11x-14y-22=0$, then $2r+s-2q+p$ is equal to _____.

Q431. JEE Main 2021 (27 Jul Shift 1)

Let
$A = \{(x, y) \in R \times R \mid 2x^2 + 2y^2 - 2x - 2y = 1\}$
$B = \{(x, y) \in R \times R \mid 4x^2 + 4y^2 - 16y + 7 = 0\}$ and
$C = \{(x, y) \in R \times R \mid x^2 + y^2 - 4x - 2y + 5 \leq r^2\}$. Then the minimum value of $|r|$ such that $A \cup B \subseteq C$ is equal to

(1) $\frac{3+\sqrt{10}}{2}$
(2) $\frac{2+\sqrt{10}}{2}$
(3) $\frac{3+2\sqrt{5}}{2}$
(4) $1 + \sqrt{5}$

Chapter: Parabola

Q432. JEE Main 2025 (7 April Shift 1)

Let P be the parabola, whose focus is $(-2, 1)$ and directrix is $2x + y + 2 = 0$. Then the sum of the ordinates of the points on P , whose abscissa is -2 , is

(1) $\frac{3}{2}$
(2) $\frac{5}{2}$
(3) $\frac{1}{4}$
(4) $\frac{3}{4}$

Q433. JEE Main 2025 (4 April Shift 2)

The axis of a parabola is the line $y = x$ and its vertex and focus are in the first quadrant at distances $\sqrt{2}$ and $2\sqrt{2}$ units from the origin, respectively. If the point $(1, \mathrm{k})$ lies on the parabola, then a possible value of k is :-

(1) 4
(2) 9
(3) 3
(4) 8

Q434. JEE Main 2025 (29 Jan Shift 2)

Let $y^2 = 12x$ be the parabola and S be its focus. Let PQ be a focal chord of the parabola such that $(\mathrm{SP})(\mathrm{SQ}) = \frac{147}{4}$. Let C be the circle described taking PQ as a diameter. If the equation of a circle C is
$64x^2 + 64y^2 - \alpha x - 64\sqrt{3}y = \beta$, then $\beta - \alpha$ is equal to _____.

Q435. JEE Main 2025 (29 Jan Shift 1)

Two parabolas have the same focus $(4, 3)$ and their directrices are the x-axis and the y-axis, respectively. If these parabolas intersects at the points A and B, then $(AB)^2$ is equal to :

(1) 392
(2) 384
(3) 192
(4) 96

Q436. JEE Main 2025 (28 Jan Shift 2)

Let A and B be the two points of intersection of the line $y + 5 = 0$ and the mirror image of the parabola $y^2 = 4x$ with respect to the line $x + y + 4 = 0$. If d denotes the distance between A and B , and a denotes the area of $\triangle SAB$, where S is the focus of the parabola $y^2 = 4x$, then the value of $(a + d)$ is _____ -

Q437. JEE Main 2025 (28 Jan Shift 1)

Let $ABCD$ be a trapezium whose vertices lie on the parabola $y^2 = 4x$. Let the sides AD and BC of the trapezium be parallel to y -axis. If the diagonal AC is of length $\frac{25}{4}$ and it passes through the point $(1, 0)$, then the area of $ABCD$ is

(1) $\frac{75}{4}$
(2) $\frac{25}{2}$
(3) $\frac{125}{8}$
(4) $\frac{75}{8}$

Q438. JEE Main 2025 (23 Jan Shift 2)

The focus of the parabola $y^2 = 4x + 16$ is the centre of the circle C of radius 5 . If the values of λ, for which C passes through the point of intersection of the lines $3x - y = 0$ and $x + \lambda y = 4$, are λ_1 and $\lambda_2, \lambda_1 < \lambda_2$, then $12\lambda_1 + 29\lambda_2$ is equal to _____

Q439. JEE Main 2025 (23 Jan Shift 1)

If the line $3x - 2y + 12 = 0$ intersects the parabola $4y = 3x^2$ at the points A and B, then at the vertex of the parabola, the line segment AB subtends an angle equal to

(1) $\tan^{-1}\left(\frac{4}{5}\right)$
(2) $\tan^{-1}\left(\frac{9}{7}\right)$
(3) $\tan^{-1}\left(\frac{11}{9}\right)$
(4) $\frac{\pi}{2} - \tan^{-1}\left(\frac{3}{2}\right)$

Q440. JEE Main 2025 (22 Jan Shift 1)

Let the parabola $y = x^2 + \mathrm{p}x - 3$, meet the coordinate axes at the points P, Q and R . If the circle C with centre at $(-1, -1)$ passes through the points P, Q and R, then the area of $\triangle PQR$ is :

(1) 7
(2) 4
(3) 6
(4) 5

Q441. JEE Main 2024 (30 Jan Shift 1)

The maximum area of a triangle whose one vertex is at $(0, 0)$ and the other two vertices lie on the curve $y = -2x^2 + 54$ at points $(x,\ y)$ and $(-x,\ y)$ where y > 0 is :

(1) 88
(2) 122
(3) 92
(4) 108

Q442. JEE Main 2024 (09 Apr Shift 2)

Let A, B and C be three points on the parabola $y^2 = 6x$ and let the line segment AB meet the line L through C parallel to the x-axis at the point D. Let M and N respectively be the feet of the perpendiculars from A and B on L. Then $\left(\frac{AM \cdot BN}{CD}\right)^2$ is equal to _____

Q443. JEE Main 2024 (06 Apr Shift 1)

Let a conic C pass through the point $(4,-2)$ and $P(x,y), x \geq 3$, be any point on C. Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3,-5)$. If the focal distance of the point $(7,1)$ on C is d, then $12d$ equals _____

Q444. JEE Main 2022 (27 Jul Shift 2)

If the length of the latus rectum of a parabola, whose focus is (a,a) and the tangent at its vertex is $x+y=a$, is 16, then $|a|$ is equal to

(1) $2\sqrt{2}$
(2) $2\sqrt{3}$
(3) $4\sqrt{2}$
(4) 4

Q445. JEE Main 2022 (25 Jun Shift 1)

Let $x=2t, y=\frac{t^2}{3}$ be a conic. Let S be the focus and B be the point on the axis of the conic such that $SA \perp BA$, where A is any point on the conic. If k is the ordinate of the centroid of the ΔSAB, then $\lim\limits_{t\to 1} k$ is equal to

(1) $\frac{17}{18}$
(2) $\frac{19}{18}$
(3) $\frac{11}{18}$
(4) $\frac{13}{18}$

Q446. JEE Main 2022 (24 Jun Shift 2)

Let P_1 be a parabola with vertex $(3,2)$ and focus $(4,4)$ and P_2 be its mirror image with respect to the line $x+2y=6$. Then the directrix of P_2 is $x+2y=$ _____.

Q447. JEE Main 2021 (20 Jul Shift 2)

Let P be a variable point on the parabola $y=4x^2+1$. Then, the locus of the mid-point of the point P and the foot of the perpendicular drawn from the point P to the line $y=x$ is:

(1) $(3x-y)^2+(x-3y)+2=0$
(2) $2(3x-y)^2+(x-3y)+2=0$
(3) $(3x-y)^2+2(x-3y)+2=0$
(4) $2(x-3y)^2+(3x-y)+2=0$

Chapter: Ellipse

Q448. JEE Main 2025 (8 April Shift 2)

Let the ellipse $3x^2+\text{p}y^2=4$ pass through the centre C of the circle $x^2+y^2-2x-4y-11=0$ of radius r. Let f_1, f_2 be the focal distances of the point C on the ellipse. Then $6f_1f_2-r$ is equal to

(1) 74
(2) 68
(3) 70
(4) 78

Q449. JEE Main 2025 (7 April Shift 2)

Let
$A=\{(\alpha, \beta) \in \mathbf{R} \times \mathbf{R}:|\alpha-1| \leq 4 \text{ and } |\beta-5| \leq 6\}$
and
$B=\left\{(\alpha, \beta) \in \mathbf{R} \times \mathbf{R}: 16(\alpha-2)^2+9(\beta-6)^2 \leq 144\right\}$
(1) $\mathrm{B} \subset \mathrm{A}$
(2) $\mathrm{A} \cup \mathrm{B}=\{(\mathrm{x}, \mathrm{y}):-4 \leq \mathrm{x} \leq 4,-1 \leq \mathrm{y} \leq 11\}$
(3) neither $\mathrm{A} \subset \mathrm{B}$ nor $\mathrm{B} \subset \mathrm{A}$
(4) $A \subset B$

Q450. JEE Main 2025 (4 April Shift 2)

Let for two distinct values of p the lines $y=x+p$ touch the ellipse $\mathrm{E}: \frac{\mathrm{x}^2}{4^2}+\frac{\mathrm{y}^2}{3^2}=1$ at the points A and B . Let the line $\mathrm{y}=\mathrm{x}$ intersect E at the points C and D. Then the area of the quadrilateral $ABCD$ is equal to
(1) 36
(2) 24
(3) 48
(4) 20

Q451. JEE Main 2025 (3 April Shift 1)

A line passing through the point $\mathrm{P}(\sqrt{5}, \sqrt{5})$ intersects the ellipse $\frac{\mathrm{x}^2}{36}+\frac{\mathrm{y}^2}{25}=1$ at A and B such that $(PA).(PB)$ is maximum. Then $5\left(PA^2+PB^2\right)$ is equal to :
(1) 218
(2) 377
(3) 290
(4) 338

Q452. JEE Main 2025 (29 Jan Shift 2)

If $\alpha x+\beta y=109$ is the equation of the chord of the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$, whose mid point is $\left(\frac{5}{2}, \frac{1}{2}\right)$, then $\alpha+\beta$ is equal to :
(1) 58
(2) 46
(3) 37
(4) 72

Q453. JEE Main 2025 (28 Jan Shift 1)

Let $\mathrm{E}_1: \frac{x^2}{9}+\frac{y^2}{4}=1$ be an ellipse. Ellipses E_1 's are constructed such that their centres and eccentricities are same as that of E_1, and the length of minor axis of E_i is the length of major axis of $E_{i+1}(i \geq 1)$. If A_i is the area of the ellipse E_i, then $\frac{5}{\pi}\left(\sum_{i=1}^{\infty} A_i\right)$, is equal to

Q454. JEE Main 2025 (24 Jan Shift 2)

The equation of the chord, of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$, whose mid-point is $(3,1)$ is :
(1) $48x+25y=169$
(2) $5x+16y=31$
(3) $25x+101y=176$
(4) $4x+122y=134$

Q455. JEE Main 2025 (24 Jan Shift 1)

Let the product of the focal distances of the point $\left(\sqrt{3}, \frac{1}{2}\right)$ on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, (a>b)$, be $\frac{7}{4}$. Then the absolute difference of the eccentricities of two such ellipses is

(1) $\frac{1-\sqrt{3}}{\sqrt{2}}$
(2) $\frac{3-2\sqrt{2}}{2\sqrt{3}}$
(3) $\frac{3-2\sqrt{2}}{3\sqrt{2}}$
(4) $\frac{1-2\sqrt{2}}{\sqrt{3}}$

Q456. JEE Main 2025 (23 Jan Shift 2)

The length of the chord of the ellipse $\frac{x^2}{4}+\frac{y^2}{2}=1$, whose mid-point is $\left(1, \frac{1}{2}\right)$, is :

(1) $\frac{5}{3}\sqrt{15}$
(2) $\frac{1}{3}\sqrt{15}$
(3) $\frac{2}{3}\sqrt{15}$
(4) $\sqrt{15}$

Q457. JEE Main 2025 (2 April Shift 1)

If S and S' are the foci of the ellipse $\frac{x^2}{18}+\frac{y^2}{9}=1$ and P be a point on the ellipse, then $\min(SP.S'P)+\max(SP.S'P)$ is equal to :

(1) $3(1+\sqrt{2})$
(2) $3(6+\sqrt{2})$
(3) 9
(4) 27

Q458. JEE Main 2024 (09 Apr Shift 1)

Let $f(x)=x^2+9, g(x)=\frac{x}{x-9}$ and $a=f\circ g(10), b=g\circ f(3)$. If e and l denote the eccentricity and the length of the latus rectum of the ellipse $\frac{x^2}{a}+\frac{y^2}{b}=1$, then $8e^2+l^2$ is equal to.

(1) 8
(2) 16
(3) 6
(4) 12

Q459. JEE Main 2024 (01 Feb Shift 2)

Let P be a point on the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$. Let the line passing through P and parallel to $y-$axis meet the circle $x^2+y^2=9$ at point Q such that P and Q are on the same side of the $x-$axis. Then, the eccentricity of the locus of the point R on PQ such that $PR:RQ=4:3$ as P moves on the ellipse, is:

(1) $\frac{11}{19}$
(2) $\frac{13}{21}$
(3) $\frac{\sqrt{139}}{23}$
(4) $\frac{\sqrt{13}}{7}$

Q460. JEE Main 2022 (29 Jun Shift 1)

Let PQ be a focal chord of the parabola $y^2=4x$ such that it subtends an angle of $\frac{\pi}{2}$ at the point $(3,0)$. Let the line segment PQ be also a focal chord of the ellipse $E:\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, a^2>b^2$. If e is the eccentricity of the ellipse E, then the value of $\frac{1}{e^2}$ is equal to

(1) $1+\sqrt{2}$
(2) $3+2\sqrt{2}$
(3) $1+2\sqrt{3}$
(4) $4+5\sqrt{3}$

Q461. JEE Main 2021 (27 Jul Shift 1)

A ray of light through $(2,1)$ is reflected at a point P on the $y-$ axis and then passes through the point $(5,3)$. If this reflected ray is the directrix of an ellipse with eccentricity $\frac{1}{3}$ and the distance of the nearer focus from this directrix is $\frac{8}{\sqrt{53}}$, then the equation of the other directrix can be:

(1) $11x+7y+8=0$ or $11x+7y-15=0$

(2) $11x-7y-8=0$ or $11x+7y+15=0$

(3) $2x-7y+29=0$ or $2x-7y-7=0$

(4) $2x-7y-39=0$ or $2x-7y-7=0$

Q462. JEE Main 2020 (05 Sep Shift 1)

If the co-ordinates of two points A and B are $\left(\sqrt{7},0\right)$ and $\left(-\sqrt{7},0\right)$ respectively and P is any point on the conic, $9x^2+16y^2=144$, then $PA+PB$ is equal to :

(1) 16 (2) 8

(3) 6 (4) 9

Chapter: Hyperbola

Q463. JEE Main 2025 (7 April Shift 2)

Let e_1 and e_2 be the eccentricities of the ellipse $\frac{x^2}{b^2}+\frac{y^2}{25}=1$ and the hyperbola $\frac{x^2}{16}-\frac{y^2}{b^2}=1$, respectively. If $b<5$ and $e_1e_2=1$, then the eccentricity of the ellipse having its axes along the coordinate axes and passing through all four foci (two of the ellipse and two of the hyperbola) is :

(1) $\frac{4}{5}$ (2) $\frac{3}{5}$

(3) $\frac{\sqrt{7}}{4}$ (4) $\frac{\sqrt{3}}{2}$

Q464. JEE Main 2025 (4 April Shift 2)

Let the sum of the focal distances of the point $P(4,3)$ on the hyperbola $H: \frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ be $8\sqrt{\frac{5}{3}}$. If for H, the length of the latus rectum is l and the product of the focal distances of the point P is m , then $9l^2+6$ m is equal to :-

(1) 184 (2) 186

(3) 185 (4) 187

Q465. JEE Main 2025 (28 Jan Shift 2)

If A and B are the points of intersection of the circle $x^2+y^2-8x=0$ and the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ and a point P moves on the line $2x-3y+4=0$, then the centroid of $\triangle PAB$ lies on the line :

(1) $x+9y=36$ (2) $4x-9y=12$

(3) $6x-9y=20$ (4) $9x-9y=32$

Q466. JEE Main 2025 (23 Jan Shift 1)

Let the circle C touch the line $x-y+1=0$, have the centre on the positive x -axis, and cut off a chord of length $\frac{4}{\sqrt{13}}$ along the line $-3x+2y=1$. Let H be the hyperbola $\frac{x^2}{\alpha^2}-\frac{y^2}{\beta^2}=1$, whose one of the foci is the centre of C and the length of the transverse axis is the diameter of C. Then $2\alpha^2+3\beta^2$ is equal to _____

Q467. JEE Main 2025 (22 Jan Shift 2)

Let $\mathrm{E}: \frac{x^2}{\mathrm{a}^2}+\frac{y^2}{\mathrm{b}^2}=1, \mathrm{a}>\mathrm{b}$ and $\mathrm{H}: \frac{x^2}{\mathrm{A}^2}-\frac{y^2}{\mathrm{B}^2}=1$. Let the distance between the foci of E and the foci of H be $2\sqrt{3}$. If $a-A=2$, and the ratio of the eccentricities of E and H is $\frac{1}{3}$, then the sum of the lengths of their latus rectums is equal to:

(1) 10 (2) 9

(3) 8 (4) 7

Q468. JEE Main 2025 (2 April Shift 1)

Let one focus of the hyperbola $\mathrm{H}: \frac{\mathrm{x}^2}{\mathrm{a}^2}-\frac{\mathrm{y}^2}{\mathrm{b}^2}=1$ be at $(\sqrt{10}, 0)$ and the corresponding directrix be $\mathrm{x}=\frac{9}{\sqrt{10}}$. If e and l respectively are the eccentricity and the length of the latus rectum of H , then $9\left(\mathrm{e}^2+l\right)$ is equal to:

(1) 14 (2) 15

(3) 16 (4) 12

Q469. JEE Main 2024 (27 Jan Shift 2)

Let e_1 be the eccentricity of the hyperbola $\frac{\mathrm{x}^2}{16}-\frac{\mathrm{y}^2}{9}=1$ and e_2 be the eccentricity of the ellipse $\frac{\mathrm{x}^2}{\mathrm{a}^2}+\frac{\mathrm{y}^2}{\mathrm{b}^2}=1, \mathrm{a}>\mathrm{b}$, which passes through the foci of the hyperbola. If $\mathrm{e}_1\mathrm{e}_2=1$, then the length of the chord of the ellipse parallel to the x-axis and passing through $(0,2)$ is :

(1) $4\sqrt{5}$ (2) $\frac{8\sqrt{5}}{3}$

(3) $\frac{10\sqrt{5}}{3}$ (4) $3\sqrt{5}$

Q470. JEE Main 2024 (04 Apr Shift 2)

Consider a hyperbola H having centre at the origin and foci on the x-axis. Let C_1 be the circle touching the hyperbola H and having the centre at the origin. Let C_2 be the circle touching the hyperbola H at its vertex and having the centre at one of its foci. If areas (in sq units) of C_1 and C_2 are 36π and 4π, respectively, then the length (in units) of latus rectum of H is

(1) $\frac{14}{3}$ (2) $\frac{28}{3}$

(3) $\frac{11}{3}$ (4) $\frac{10}{3}$

Q471. JEE Main 2022 (28 Jun Shift 2)

Let $a > 0,\ b > 0$. Let e and l respectively be the eccentricity and length of the latus rectum of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. Let e' and l' respectively the eccentricity and length of the latus rectum of its conjugate hyperbola. If $e^2 = \frac{11}{14}l$ and $(e')^2 = \frac{11}{8}l'$, then the value of $77a + 44b$ is equal to

(1) 100 (2) 110

(3) 120 (4) 130

Q472. JEE Main 2022 (27 Jul Shift 1)

An ellipse $E : \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through the vertices of the hyperbola $H : \frac{x^2}{49} - \frac{y^2}{64} = -1$. Let the major and minor axes of the ellipse E coincide with the transverse and conjugate axes of the hyperbola H. Let the product of the eccentricities of E and H be $\frac{1}{2}$. If l is the length of the latus rectum of the ellipse E, then the value of $113l$ is equal to _____.

Chapter: Trigonometric Ratios & Identities

Q473. JEE Main 2025 (28 Jan Shift 2)

If $\sum_{r=1}^{13}\left\{\frac{1}{\sin\left(\frac{\pi}{4}+(r-1)\frac{\pi}{6}\right)\sin\left(\frac{\pi}{4}+\frac{r\pi}{6}\right)}\right\} = a\sqrt{3}+b, a, b \in \mathbf{Z}$, then a^2+b^2 is equal to :

(1) 10 (2) 4

(3) 2 (4) 8

Q474. JEE Main 2025 (23 Jan Shift 1)

If $\frac{\pi}{2} \le x \le \frac{3\pi}{4}$, then $\cos^{-1}\left(\frac{12}{13}\cos x + \frac{5}{13}\sin x\right)$ is equal to

(1) $x - \tan^{-1}\frac{4}{3}$ (2) $x + \tan^{-1}\frac{4}{5}$

(3) $x - \tan^{-1}\frac{5}{12}$ (4) $x + \tan^{-1}\frac{5}{12}$

Q475. JEE Main 2024 (08 Apr Shift 2)

If the value of $\frac{3\cos 36^\circ + 5\sin 18^\circ}{5\cos 36^\circ - 3\sin 18^\circ}$ is $\frac{a\sqrt{5}-b}{c}$, where a, b, c are natural numbers and $\gcd(a, c) = 1$, then $a + b + c$ is equal to :

(1) 40 (2) 52

(3) 50 (4) 54

Q476. JEE Main 2022 (26 Jun Shift 1)

If $\sin^2(10^\circ)\sin(20^\circ)\sin(40^\circ)\sin(50^\circ)\sin(70^\circ) = \alpha - \frac{1}{16}\sin(10^\circ)$, then $16 + \alpha^{-1}$ is equal to _____.

Q477. JEE Main 2022 (25 Jul Shift 2)

The value of $2\sin\frac{\pi}{22}\sin\frac{3\pi}{22}\sin\frac{5\pi}{22}\sin\frac{7\pi}{22}\sin\frac{9\pi}{22}$ is equal to:

(1) $\frac{1}{16}$ (2) $\frac{5}{16}$

(3) $\frac{7}{16}$ (4) $\frac{3}{16}$

Q478. JEE Main 2021 (31 Aug Shift 1)

$\operatorname{cosec} 18^{\circ}$ is a root of the equation:

(1) $x^2 - 2x - 4 = 0$ (2) $4x^2 + 2x - 1 = 0$

(3) $x^2 + 2x - 4 = 0$ (4) $x^2 - 2x + 4 = 0$

Q479. JEE Main 2021 (26 Feb Shift 1)

The number of integral values of k for which the equation $3\sin x + 4\cos x = k + 1$ has a solution, $k \in R$ is _____.

Chapter: Trigonometric Equations

Q480. JEE Main 2025 (7 April Shift 1)

If for $\theta \in \left[-\frac{\pi}{3}, 0\right]$, the points $(x, y) = \left(3\tan\left(\theta + \frac{\pi}{3}\right), 2\tan\left(\theta + \frac{\pi}{6}\right)\right)$ lie on $xy + \alpha x + \beta y + \gamma = 0$, then $\alpha^2 + \beta^2 + \gamma^2$ is equal to :

(1) 80 (2) 72

(3) 96 (4) 75

Q481. JEE Main 2025 (3 April Shift 2)

The number of solutions of equation $(4 - \sqrt{3})\sin x - 2\sqrt{3}\cos^2 x = -\frac{4}{1+\sqrt{3}}, x \in \left[-2\pi, \frac{5\pi}{2}\right]$ is

(1) 4 (2) 3

(3) 6 (4) 5

Q482. JEE Main 2025 (22 Jan Shift 2)

The sum of all values of $\theta \in [0, 2\pi]$ satisfying $2\sin^2\theta = \cos 2\theta$ and $2\cos^2\theta = 3\sin\theta$ is

(1) 4π (2) $\frac{5\pi}{6}$

(3) π (4) $\frac{\pi}{2}$

Chapter: Inverse Trigonometric Functions

Q483. JEE Main 2025 (4 April Shift 2)

The sum of the infinite series

$\cot^{-1}\left(\frac{7}{4}\right) + \cot^{-1}\left(\frac{19}{4}\right) + \cot^{-1}\left(\frac{39}{4}\right) + \cot^{-1}\left(\frac{67}{4}\right) + \ldots$. is :-

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

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

Q484. JEE Main 2025 (24 Jan Shift 2)

If $\alpha > \beta > \gamma > 0$, then the expression $\cot^{-1}\left\{\beta + \frac{(1+\beta^2)}{(\alpha-\beta)}\right\} + \cot^{-1}\left\{\gamma + \frac{(1+\gamma^2)}{(\beta-\gamma)}\right\} + \cot^{-1}\left\{\alpha + \frac{(1+\alpha^2)}{(\gamma-\alpha)}\right\}$ is equal to :

(1) π
(2) 0
(3) $\frac{\pi}{2} - (\alpha + \beta + \gamma)$
(4) 3π

Q485. JEE Main 2025 (24 Jan Shift 1)

If for some $\alpha, \beta; \alpha \leq \beta, \alpha + \beta - 8$ and $\sec^2\left(\tan^{-1}\alpha\right) + \operatorname{cosec}^2\left(\cot^{-1}\beta\right) - 36$, then $\alpha^2 + \beta$ is_____.

Q486. JEE Main 2025 (22 Jan Shift 1)

Using the principal values of the inverse trigonometric functions, the sum of the maximum and the minimum values of $16\left(\left(\sec^{-1}x\right)^2 + \left(\operatorname{cosec}^{-1}x\right)^2\right)$ is :

(1) $24\pi^2$
(2) $22\pi^2$
(3) $31\pi^2$
(4) $18\pi^2$

Q487. JEE Main 2025 (2 April Shift 2)

If $y = \cos\left(\frac{\pi}{3} + \cos^{-1}\frac{x}{2}\right)$, then $(x-y)^2 + 3y^2$ is equal to _____.

Q488. JEE Main 2024 (31 Jan Shift 1)

For $\alpha, \beta, \gamma \neq 0$. If $\sin^{-1}\alpha + \sin^{-1}\beta + \sin^{-1}\gamma = \pi$ and $(\alpha + \beta + \gamma)(\alpha - \gamma + \beta) = 3\alpha\beta$, then γ equal to

(1) $\frac{\sqrt{3}}{2}$
(2) $\frac{1}{\sqrt{2}}$
(3) $\frac{\sqrt{3}-1}{2\sqrt{2}}$
(4) $\sqrt{3}$

Q489. JEE Main 2024 (06 Apr Shift 1)

For $n \in \mathrm{N}$, if $\cot^{-1}3 + \cot^{-1}4 + \cot^{-1}5 + \cot^{-1}n = \frac{\pi}{4}$, then n is equal to_____

Q490. JEE Main 2024 (04 Apr Shift 2)

Given that the inverse trigonometric function assumes principal values only. Let x, y be any two real numbers in $[-1, 1]$ such that $\cos^{-1}x - \sin^{-1}y = \alpha$, $\frac{-\pi}{2} \leq \alpha \leq \pi$.

Then, the minimum value of $x^2 + y^2 + 2xy\sin\alpha$ is

(1) 0
(2) -1
(3) $\frac{1}{2}$
(4) $-\frac{1}{2}$

Q491. JEE Main 2023 (31 Jan Shift 2)

Let $(a, b) \subset (0, 2\pi)$ be the largest interval for which $\sin^{-1}(\sin\theta) - \cos^{-1}(\sin\theta) > 0, \theta \in (0, 2\pi)$, holds. If $\alpha x^2 + \beta x + \sin^{-1}\left(x^2 - 6x + 10\right) + \cos^{-1}\left(x^2 - 6x + 10\right) = 0$ and $\alpha - \beta = b - a$, then α is equal to;

(1) $\frac{\pi}{8}$ (2) $\frac{\pi}{48}$

(3) $\frac{\pi}{16}$ (4) $\frac{\pi}{12}$

Q492. JEE Main 2022 (27 Jun Shift 2)

The value of $\cot\left(\sum_{n=1}^{50} \tan^{-1}\left(\frac{1}{1+n+n^2}\right)\right)$ is

(1) $\frac{25}{26}$ (2) $\frac{50}{51}$

(3) $\frac{26}{25}$ (4) $\frac{52}{51}$

Q493. JEE Main 2022 (26 Jul Shift 2)

If $0 < x < \frac{1}{\sqrt{2}}$ and $\frac{\sin^{-1}x}{\alpha} = \frac{\cos^{-1}x}{\beta}$, then a value of $\sin\left(\frac{2\pi\alpha}{\alpha+\beta}\right)$ is

(1) $4\sqrt{(1-x^2)}\left(1-2x^2\right)$

(2) $4x\sqrt{(1-x^2)}\left(1-2x^2\right)$

(3) $2x\sqrt{(1-x^2)}\left(1-4x^2\right)$

(4) $4\sqrt{(1-x^2)}\left(1-4x^2\right)$

Q494. JEE Main 2022 (25 Jul Shift 2)

Let $x = \sin\left(2\tan^{-1}\alpha\right)$ and $y = \sin\left(\frac{1}{2}\tan^{-1}\frac{4}{3}\right)$. If $S = \left\{\alpha \in \mathbb{R} : y^2 = 1 - x\right\}$, then $\sum_{\alpha\in S} 16\alpha^3$ is equal to _____.

Q495. JEE Main 2021 (17 Mar Shift 1)

If $\cot^{-1}(\alpha) = \cot^{-1}2 + \cot^{-1}8 + \cot^{-1}18 + \cot^{-1}32 + \ldots$. upto 100 terms, then α is:

(1) 1.01 (2) 1.00

(3) 1.02 (4) 1.03

Chapter: Vector Algebra

Q496. JEE Main 2025 (8 April Shift 2)

Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$. Let $\hat{c}$ be a unit vector in the plane of the vectors $\vec{a}$ and $\vec{b}$ and be perpendicular to $\vec{a}$. Then such a vector $\hat{c}$ is :

(1) $\frac{1}{\sqrt{5}}(\hat{j} - 2\hat{k})$ (2) $\frac{1}{\sqrt{3}}(-\hat{i} + \hat{j} - \hat{k})$

(3) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$ (4) $\frac{1}{\sqrt{2}}(-\hat{i} + \hat{k})$

Q497. JEE Main 2025 (4 April Shift 2)

Let the three sides of a triangle ABC be given by the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $3\hat{i}-4\hat{j}-4\hat{k}$. Let G be the centroid of the triangle ABC. Then $6\left(|\overrightarrow{AG}|^2+|\overrightarrow{BG}|^2+|\overrightarrow{CG}|^2\right)$ is equal to _____

Q498. JEE Main 2025 (4 April Shift 1)

Consider two vectors $\vec{u}=3\hat{i}-\hat{j}$ and $\vec{v}=2\hat{i}+\hat{j}-\lambda\hat{k}, \lambda>0$. The angle between them is given by $\cos^{-1}\left(\frac{\sqrt{5}}{2\sqrt{7}}\right)$. Let $\vec{v}=\vec{v_1}+\vec{v_2}$, where $\vec{v_1}$ is parallel to $\vec{u}$ and $\vec{v_2}$ is perpendicular to $\vec{u}$. Then the value $\left|\vec{v_1}\right|^2+\left|\vec{v_2}\right|^2$ is equal to

(1) $\frac{23}{2}$
(2) 14
(3) $\frac{25}{2}$
(4) 10

Q499. JEE Main 2025 (3 April Shift 1)

Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=3\hat{i}+2\hat{j}-\hat{k}, \vec{c}=\lambda\hat{j}+\mu\hat{k}$ and $\hat{d}$ be a unit vector such that $\vec{a}\times\hat{d}=\vec{b}\times\hat{d}$ and $\vec{c}\cdot\hat{d}=1$, If $\vec{c}$ is perpendicular to $\vec{a}$, then $|3\lambda\hat{d}+\mu\vec{c}|^2$ is equal to _____ .

Q500. JEE Main 2025 (29 Jan Shift 1)

Let $\vec{a}=2\hat{i}-\hat{j}+3\hat{k}$, $\vec{b}=3\hat{i}-5\hat{j}+\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a}\times\vec{c}=\vec{c}\times\vec{b}$ and $(\vec{a}+\vec{c})\cdot(\vec{b}+\vec{c})=168$. Then the maximum value of $|\vec{c}|^2$ is :

(1) 462
(2) 77
(3) 154
(4) 308

Q501. JEE Main 2025 (28 Jan Shift 2)

Let A, B, C be three points in xy-plane, whose position vector are given by $\sqrt{3}\hat{i}+\hat{j}, \hat{i}+\sqrt{3}\hat{j}$ and $a\hat{i}+(1-a)\hat{j}$ respectively with respect to the origin O . If the distance of the point C from the line bisecting the angle between the vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$ is $\frac{9}{\sqrt{2}}$, then the sum of all the possible values of a is :

(1) 2
(2) $9/2$
(3) 1
(4) 0

Q502. JEE Main 2025 (24 Jan Shift 2)

Let $\vec{a}=3\hat{i}-\hat{j}+2\hat{k}$, $\vec{b}=\vec{a}\times(\hat{i}-2\hat{k})$ and $\vec{c}=\vec{b}\times\hat{k}$. Then the projection of $\vec{c}-2\hat{j}$ on $\vec{a}$ is :

(1) $2\sqrt{14}$
(2) $\sqrt{14}$
(3) $3\sqrt{7}$
(4) $2\sqrt{7}$

Q503. JEE Main 2025 (24 Jan Shift 2)

Let the position vectors of three vertices of a triangle be $4\vec{p}+\vec{q}-3\vec{r}, -5\vec{p}+\vec{q}+2\vec{r}$ and $2\overrightarrow{\mathrm{p}}-\overrightarrow{\mathrm{q}}+2\overrightarrow{\mathrm{r}}$. If the position vectors of the orthocenter and the circumcenter of the triangle are $\frac{\vec{p}+\vec{q}+\vec{r}}{4}$ and $\alpha\vec{p}+\beta\vec{q}+\gamma\vec{r}$ respectively, then $\alpha+2\beta+5\gamma$ is equal to :

(1) 3 (2) 4

(3) 1 (4) 6

Q504. JEE Main 2025 (24 Jan Shift 1)

Let $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}, \vec{b}=3\hat{i}+\hat{j}-\hat{k}$ and $\vec{c}$ be three vectors such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$. If the vector $\vec{C}$ is perpendicular to $\vec{b}$ and $\vec{a}\cdot\vec{c}=5$, then $|\vec{c}|$ is equal to

(1) $\sqrt{\frac{11}{6}}$ (2) $\frac{1}{3\sqrt{2}}$

(3) 16 (4) 18

Q505. JEE Main 2025 (23 Jan Shift 1)

Let the position vectors of the vertices A, B and C of a tetrahedron $ABCD$ be $\hat{\mathbf{i}}+2\hat{\mathbf{j}}+\hat{\mathbf{k}}, \hat{\mathbf{i}}+3\hat{\mathbf{j}}-2\hat{k}$ and $2\hat{i}+\hat{j}-\hat{k}$ respectively. The altitude from the vertex D to the opposite face ABC meets the median line segment through A of the triangle ABC at the point E. If the length of AD is $\frac{\sqrt{110}}{3}$ and the volume of the tetrahedron is $\frac{\sqrt{805}}{6\sqrt{2}}$, then the position vector of E is

(1) $\frac{1}{12}(7\hat{\mathbf{i}}+4\hat{\mathbf{j}}+3\hat{k})$ (2) $\frac{1}{2}(\hat{i}+4\hat{j}+7\hat{k})$

(3) $\frac{1}{6}(12\hat{i}+12\hat{j}+\hat{k})$ (4) $\frac{1}{6}(7\hat{\mathrm{i}}+12\hat{\mathrm{j}}+\hat{\mathrm{k}})$

Q506. JEE Main 2025 (22 Jan Shift 2)

Let $\vec{a}$ and $\vec{b}$ be two unit vectors such that the angle between them is $\frac{\pi}{3}$. If $\lambda\vec{a}+2\vec{b}$ and $3\vec{a}-\lambda\vec{b}$ are perpendicular to each other, then the number of values of λ in $[-1,3]$ is :

(1) 2 (2) 1

(3) 0 (4) 3

Q507. JEE Main 2025 (2 April Shift 2)

Let $\vec{a}=2\hat{i}-3\hat{j}+k, \vec{b}=3\hat{i}+2\hat{j}+5k$ and a vector $\vec{c}$ be such that $(\overrightarrow{\mathrm{a}}-\overrightarrow{\mathrm{c}})\times\overrightarrow{\mathrm{b}}=-18\hat{\mathrm{i}}-3\hat{\mathrm{j}}+12\mathrm{k}$ and $\overrightarrow{\mathrm{a}}\cdot\overrightarrow{\mathrm{c}}=3$. If $\overrightarrow{\mathrm{b}}\times\overrightarrow{\mathrm{c}}=\overrightarrow{\mathrm{d}}$, then $|\overrightarrow{\mathrm{a}}\cdot\overrightarrow{\mathrm{d}}|$ is equal to :

(1) 18 (2) 12

(3) 9 (4) 15

Q508. JEE Main 2024 (31 Jan Shift 2)

Let $\vec{a}=3\hat{i}+2\hat{j}+\hat{k}, \vec{b}=2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{c}$ be a vector such that $\left(\vec{a}+\vec{b}\right)\times\vec{c}=2\left(\vec{a}\times\vec{b}\right)+24\hat{j}-6\hat{k}$ and $\left(\vec{a}-\vec{b}+\hat{i}\right).\vec{c}=-3$. Then $\left|\vec{c}\right|^2$ is equal to _____.

Q509. JEE Main 2024 (30 Jan Shift 2)

Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\left|\vec{b}\right|=1$ and $\left|\vec{b}\times\vec{a}\right|=2$ Then $\left|\left(\vec{b}\times\vec{a}\right)-\vec{b}\right|^2$ is equal to

(1) 3 (2) 5

(3) 1 (4) 4

Q510. JEE Main 2024 (27 Jan Shift 1)

If $\vec{a}=\hat{i}+2\hat{j}+\hat{k}$, $\vec{b}=3\left(\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{c}$ be the vector such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\cdot\vec{c}=3$, then $\vec{a}\cdot\left(\left(\vec{c}\times\vec{b}\right)-\vec{b}-\vec{c}\right)$ is equal to

(1) 32 (2) 24

(3) 20 (4) 36

Q511. JEE Main 2024 (09 Apr Shift 1)

Let three vectors $\vec{a}=\alpha\hat{i}+4\hat{j}+2\hat{k}, \vec{b}=5\hat{i}+3\hat{j}+4\hat{k}, \vec{c}=x\hat{i}+y\hat{j}+z\hat{k}$ form a triangle such that $\vec{c}=\vec{a}-\vec{b}$ and the area of the triangle is $5\sqrt{6}$. If α is a positive real number, then $|\vec{c}|^2$ is equal to:

(1) 16 (2) 14

(3) 12 (4) 10

Q512. JEE Main 2024 (08 Apr Shift 1)

Let $\vec{a}=9\hat{i}-13\hat{j}+25\hat{k}, \vec{b}=3\hat{i}+7\hat{j}-13\hat{k}$ and $\vec{c}=17\hat{i}-2\hat{j}+\hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r}\times\vec{a}=(\vec{b}+\vec{c})\times\vec{a}$ and $\vec{r}\cdot(\vec{b}-\vec{c})=0$, then $\frac{|593\vec{r}+67\vec{a}|^2}{(593)^2}$ is equal to_____

Q513. JEE Main 2024 (05 Apr Shift 2)

Let $\vec{a}=2\hat{i}+5\hat{j}-\hat{k}, \vec{b}=2\hat{i}-2\hat{j}+2\hat{k}$ and $\vec{c}$ be three vectors such that $(\vec{c}+\hat{i})\times(\vec{a}+\vec{b}+\hat{i})=\vec{a}\times(\vec{c}+\hat{i})$. If $\vec{a}\cdot\vec{c}=-29$, then $\vec{c}\cdot(-2\hat{i}+\hat{j}+\hat{k})$ is equal to:

(1) 15 (2) 12

(3) 10 (4) 5

Q514. JEE Main 2023 (25 Jan Shift 1)

The vector $\vec{a} = -\hat{i} + 2\hat{j} + \hat{k}$ is rotated through a right angle, passing through the y-axis in its way and the resulting vector is $\vec{b}$. Then the projection of $3\vec{a} + \sqrt{2}\vec{b}$ on $\vec{c} = 5\hat{i} + 4\hat{j} + 3\hat{k}$ is

(1) $3\sqrt{2}$ (2) 1

(3) $\sqrt{6}$ (4) $2\sqrt{3}$

Q515. JEE Main 2023 (24 Jan Shift 1)

Let $\vec{u} = \hat{i} - \hat{j} - 2\hat{k}$, $\vec{v} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{v} \cdot \vec{w} = 2$ and $\vec{v} \times \vec{w} = \vec{u} + \lambda\vec{v}$, then $\vec{u} \cdot \vec{w}$ is equal to

(1) 1 (2) $\frac{3}{2}$

(3) 2 (4) $-\frac{2}{3}$

Q516. JEE Main 2022 (29 Jun Shift 2)

Let $A,\ B,\ C$ be three points whose position vectors respectively are:

$\vec{a} = \hat{i} + 4\hat{j} + 3\hat{k}$

$\vec{b} = 2\hat{i} + \alpha\hat{j} + 4\hat{k},\ \alpha \in R$

$\vec{c} = 3\hat{i} - 2\hat{j} + 5\hat{k}$

If α is the smallest positive integer for which $\vec{a}, \vec{b}, \vec{c}$ are non-collinear, then the length of the median, $\triangle ABC$, through A is:

(1) $\frac{\sqrt{82}}{2}$ (2) $\frac{\sqrt{62}}{2}$

(3) $\frac{\sqrt{69}}{2}$ (4) $\frac{\sqrt{66}}{2}$

Q517. JEE Main 2022 (28 Jul Shift 1)

Let the vectors $\vec{a} = (1+t)\hat{i} + (1-t)\hat{j} + \hat{k}$, $\vec{b} = (1-t)\hat{i} + (1+\mathrm{t})\hat{j} + 2\hat{k}$ and $\vec{c} = t\hat{i} - t\hat{j} + \hat{k},\ t \in R$ be such that for $\alpha, \beta, \gamma \in R,\ \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c} = \vec{0} \Rightarrow \alpha = \beta = \gamma = 0$. Then, the set of all values of t is

(1) a non-empty finite set (2) equal to N

(3) equal to $R - \{0\}$ (4) equal to R

Q518. JEE Main 2022 (27 Jun Shift 1)

Let $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 2\hat{k}$. Then the number of vectors $\vec{b}$ such that $\vec{b} \times \vec{c} = \vec{a}$ and $\left|\vec{b}\right| \in \{1, 2, \ldots, 10\}$ is

(1) 0 (2) 1

(3) 2 (4) 3

Q519. JEE Main 2021 (16 Mar Shift 2)

Let $\vec{a}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+5\hat{k}$. If $\vec{r}\times\vec{a}=\vec{b}\times\vec{r}, \vec{r}\cdot\left(\alpha\hat{i}+2\hat{j}+\hat{k}\right)=3$ and $\vec{r}\cdot\left(2\hat{i}+5\hat{j}-\alpha\hat{k}\right)=-1, \alpha\in R$, then the value of $\alpha+\left|\vec{r}\right|^2$ is equal to :

(1) 9 (2) 15

(3) 13 (4) 11

Q520. JEE Main 2020 (09 Jan Shift 2)

Let $\vec{a},\vec{b}$ and $\vec{c}$ be three vectors such that $\left|\vec{a}\right|=\sqrt{3}, \left|\vec{b}\right|=5, \vec{b}\cdot\vec{c}=10$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. If $\vec{a}$ is perpendicular to the vector $\vec{b}\times\vec{c}$, then $\left|\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right|$ is equal to _____.

Chapter: Three Dimensional Geometry

Q521. JEE Main 2025 (8 April Shift 2)

Let the area of the triangle formed by the lines $x+2=y-1=z, \frac{x-3}{5}=\frac{y}{-1}=\frac{z-1}{1}$ and $\frac{x}{-3}=\frac{y-3}{3}=\frac{z-2}{1}$ be A. Then A^2 is equal to _____.

Q522. JEE Main 2025 (7 April Shift 2)

If the equation of the line passing through the point $\left(0,-\frac{1}{2},0\right)$ and perpendicular to the lines $\vec{r}=\lambda(\hat{i}+a\hat{j}+b\hat{k})$ and

$\vec{r}=(\hat{i}-\hat{j}-6\hat{k})+\mu(-b\hat{i}+a\hat{j}+5\hat{k})$

is $\frac{x-1}{-2}=\frac{y+4}{d}=\frac{z-c}{-4}$, then $a+b+c+d$ is equal to :

(1) 10 (2) 14

(3) 13 (4) 12

Q523. JEE Main 2025 (4 April Shift 2)

Let the values of p , for which the shortest distance between the lines $\frac{x+1}{3}=\frac{y}{4}=\frac{z}{5}$ and $\vec{r}=(p\hat{i}+2\hat{j}+\hat{k})+\lambda(2\hat{i}+3\hat{j}+4\hat{k})$ is $\frac{1}{\sqrt{6}}$, be a, b, $(a<b)$. Then the length of the latus rectum of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is :-

(1) 9 (2) $\frac{3}{2}$

(3) $\frac{2}{3}$ (4) 18

Q524. JEE Main 2025 (4 April Shift 1)

Let the shortest distance between the lines $\frac{x-3}{3}=\frac{y-\alpha}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-\beta}{4}$ be $3\sqrt{30}$. Then the positive value of $5\alpha+\beta$ is

(1) 42 (2) 46

(3) 48 (4) 40

Q525. JEE Main 2025 (4 April Shift 1)

Let A and B be two distinct points on the line L : $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$. Both A and B are at a distance $2\sqrt{17}$ from the foot of perpendicular drawn from the point $(1,2,3)$ on the line L . If O is the origin, then $\overrightarrow{OA}\cdot\overrightarrow{OB}$ is equal to:

(1) 49 (2) 47

(3) 21 (4) 62

Q526. JEE Main 2025 (3 April Shift 1)

Let a line passing through the point $(4,1,0)$ intersect the line L_1; $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ at the point A (α,β,γ) and the line $L_2: x-6=y=-z+4$ at the point $B(a,b,c)$.

Then $\begin{vmatrix}1 & 0 & 1\\ \alpha & \beta & \gamma\\ \mathrm{a} & \mathrm{b} & \mathrm{c}\end{vmatrix}$ is equal to

(1) 8 (2) 16

(3) 12 (4) 6

Q527. JEE Main 2025 (3 April Shift 1)

Line L_1 passes through the point $(1,2,3)$ and is parallel to Z -axis. Line L_2 passes through the point $(\lambda,5,6)$ and is parallel to y-axis. Let for $\lambda=\lambda_1,\lambda_2,\lambda_2<\lambda_1$, the shortest distance between the two lines be 3 . Then the square of the distance of the point $(\lambda_1,\lambda_2,7)$ from the line L_1 is

(1) 40 (2) 32

(3) 25 (4) 37

Q528. JEE Main 2025 (29 Jan Shift 2)

Let a straight line L pass through the point $P(2,-1,3)$ and be perpendicular to the lines $\frac{x-1}{2}=\frac{y+1}{1}=\frac{z-3}{-2}$ and $\frac{x-3}{1}=\frac{y-2}{3}=\frac{z+2}{4}$. If the line L intersects the yz-plane at the point Q, then the distance between the points P and Q is :

(1) $\sqrt{10}$ (2) $2\sqrt{3}$

(3) 2 (4) 3

Q529. JEE Main 2025 (29 Jan Shift 2)

Let P be the foot of the perpendicular from the point $(1,2,2)$ on the line L : $\frac{x-1}{1}=\frac{y+1}{-1}=\frac{z-2}{2}$. Let the line $\vec{r}=(-\hat{i}+\hat{j}-2\hat{k})+\lambda(\hat{i}-\hat{j}+\hat{k}),\lambda\in\mathbf{R}$, intersect the line L at Q . Then $2(\mathrm{PQ})^2$ is equal to :

(1) 25 (2) 19

(3) 29 (4) 27

Q530. JEE Main 2025 (29 Jan Shift 1)

Let $\overrightarrow{\mathrm{a}}=\hat{i}+2\hat{j}+\hat{k}$ and $\overrightarrow{\mathrm{b}}=2\hat{i}+7\hat{j}+3\hat{k}$. Let $\mathrm{L}_1:\overrightarrow{\mathrm{r}}=(-\hat{i}+2\hat{j}+\hat{k})+\lambda\overrightarrow{\mathrm{a}},\lambda\in\mathbf{R}$ and $\mathrm{L}_2:\overrightarrow{\mathrm{r}}=(\hat{j}+\hat{k})+\mu\overrightarrow{\mathrm{b}},\mu\in\mathbf{R}$ be two lines. If the line L_3 passes through the point of intersection of L_1 and L_2, and is parallel to $\vec{a}+\vec{b}$, then L_3 passes through the point :

(1) $(5,17,4)$ (2) $(2,8,5)$

(3) $(8,26,12)$ (4) $(-1,-1,1)$

Q531. JEE Main 2025 (28 Jan Shift 1)

If the image of the point $(4,4,3)$ in the line $\frac{x-1}{2}=\frac{y-2}{1}=\frac{z-1}{3}$ is (α,β,γ), then $\alpha+\beta+\gamma$ is equal to

(1) 9 (2) 12

(3) 7 (4) 8

Q532. JEE Main 2025 (24 Jan Shift 2)

Let P be the image of the point $\mathrm{Q}(7,-2,5)$ in the line $\mathrm{L}:\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$ and $\mathrm{R}(5,\mathrm{p},\mathrm{q})$ be a point on L. Then the square of the area of $\triangle PQR$ is _____.

Q533. JEE Main 2025 (24 Jan Shift 1)

Let in a $\triangle ABC$, the length of the side AC be 6 , the vertex B be $(1,2,3)$ and the vertices A, C lie on the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$. Then the area (in sq. units) of $\triangle$ABC is:

(1) 17 (2) 21

(3) 56 (4) 42

Q534. JEE Main 2025 (24 Jan Shift 1)

Let the line passing through the points $(-1,2,1)$ and parallel to the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$ intersect the line $\frac{x+2}{3}=\frac{y-3}{2}=\frac{z-4}{1}$ at the point P. Then the distance of P from the point $Q(4,-5,1)$ is

(1) 5 (2) $5\sqrt{5}$

(3) $5\sqrt{6}$ (4) 10

Q535. JEE Main 2025 (23 Jan Shift 2)

Let the point A divide the line segment joining the points $P(-1,-1,2)$ and $Q(5,5,10)$ internally in the ratio $\mathrm{r}:1(\mathrm{r}>0)$. If O is the origin and $(\overrightarrow{\mathrm{OQ}}\cdot\overrightarrow{\mathrm{OA}})-\frac{1}{5}|\overrightarrow{\mathrm{OP}}\times\overrightarrow{\mathrm{OA}}|^2=10$, then the value of r is :

(1) $\sqrt{7}$ (2) 14

(3) 3 (4) 7

Q536. JEE Main 2025 (23 Jan Shift 1)

Let P be the foot of the perpendicular from the point $Q(10,-3,-1)$ on the line $\frac{x-3}{7}=\frac{y-2}{-1}=\frac{z+1}{-2}$. Then the area of the right angled triangle PQR, where R is the point $(3,-2,1)$, is

(1) $9\sqrt{15}$
(2) $\sqrt{30}$
(3) $8\sqrt{15}$
(4) $3\sqrt{30}$

Q537. JEE Main 2025 (22 Jan Shift 2)

The perpendicular distance, of the line $\frac{x-1}{2}=\frac{y+2}{-1}=\frac{z+3}{2}$ from the point $\mathrm{P}(2,-10,1)$, is :

(1) 6
(2) $5\sqrt{2}$
(3) $4\sqrt{3}$
(4) $3\sqrt{5}$

Q538. JEE Main 2025 (22 Jan Shift 1)

Let $\mathrm{L}_1: \frac{x-1}{3}=\frac{y-1}{-1}=\frac{z+1}{0}$ and $\mathrm{L}_2: \frac{x-2}{2}=\frac{y}{0}=\frac{z+4}{\alpha}, \alpha \in \mathbf{R}$, be two lines, which intersect at the point B. If P is the foot of perpendicular from the point $A(1,1,-1)$ on L_2, then the value of $26\alpha(\mathrm{PB})^2$ is _____

Q539. JEE Main 2025 (2 April Shift 2)

If the image of the point $\mathrm{P}(1,0,3)$ in the line joining the points $\mathrm{A}(4,7,1)$ and $\mathrm{B}(3,5,3)$ is $\mathrm{Q}(\alpha,\beta,\gamma)$, then $\alpha+\beta+\gamma$ is equal to

(1) $\frac{47}{3}$
(2) $\frac{46}{3}$
(3) 18
(4) 13

Q540. JEE Main 2024 (09 Apr Shift 1)

Let the line L intersect the lines $x-2=-y=z-1, 2(x+1)=2(y-1)=z+1$ and be parallel to the line $\frac{x-2}{3}=\frac{y-1}{1}=\frac{z-2}{2}$. Then which of the following points lies on L?

(1) $\left(-\frac{1}{3},1,-1\right)$
(2) $\left(-\frac{1}{3},-1,1\right)$
(3) $\left(-\frac{1}{3},1,1\right)$
(4) $\left(-\frac{1}{3},-1,-1\right)$

Q541. JEE Main 2024 (06 Apr Shift 1)

The shortest distance between the lines $\frac{x-3}{2}=\frac{y+15}{-7}=\frac{z-9}{5}$ and $\frac{x+1}{2}=\frac{y-1}{1}=\frac{z-9}{-3}$ is

(1) $8\sqrt{3}$
(2) $4\sqrt{3}$
(3) $5\sqrt{3}$
(4) $6\sqrt{3}$

Q542. JEE Main 2024 (06 Apr Shift 1)

Let P be the point $(10,-2,-1)$ and Q be the foot of the perpendicular drawn from the point $R(1,7,6)$ on the line passing through the points $(2,-5,11)$ and $(-6,7,-5)$. Then the length of the line segment PQ is equal to _____

Q543. JEE Main 2024 (01 Feb Shift 2)

If the mirror image of the point $P(3,4,9)$ in the line $\frac{x-1}{3}=\frac{y+1}{2}=\frac{z-2}{1}$ is (α,β,γ), then $14(\alpha+\beta+\gamma)$ is:

(1) 102 (2) 138

(3) 108 (4) 132

Q544. JEE Main 2024 (01 Feb Shift 2)

Let P and Q be the points on the line $\frac{x+3}{8}=\frac{y-4}{2}=\frac{z+1}{2}$ which are at a distance of 6 units from the point $R(1,2,3)$. If the centroid of the triangle PQR is (α,β,γ), then $\alpha^2+\beta^2+\gamma^2$ is:

(1) 26 (2) 36

(3) 18 (4) 24

Q545. JEE Main 2024 (01 Feb Shift 1)

Let the line of the shortest distance between the lines $L_1:\vec{r}=\left(\hat{i}+2\hat{j}+3\widehat{k}\right)+\lambda\left(\hat{i}-\hat{j}+\widehat{k}\right)$ and $L_2:\vec{r}=\left(4\hat{i}+5\hat{j}+6\widehat{k}\right)+\mu\left(\hat{i}+\hat{j}-\widehat{k}\right)$ intersect L_1 and L_2 at P and Q respectively. If (α,β,γ) is the midpoint of the line segment PQ, then $2(\alpha+\beta+\gamma)$ is equal to_____

Q546. JEE Main 2023 (30 Jan Shift 1)

The line l_1 passes through the point $(2,6,2)$ and is perpendicular to the plane $2x+y-2z=10$. Then the shortest distance between the line l_1 and the line $\frac{x+1}{2}=\frac{y+4}{-3}=\frac{z}{2}$ is:

(1) 7 (2) $\frac{19}{3}$

(3) $\frac{19}{2}$ (4) 9

Q547. JEE Main 2022 (27 Jul Shift 2)

If the length of the perpendicular drawn from the point $P(a,4,2), a>0$ on the line $\frac{x+1}{2}=\frac{y-3}{3}=\frac{z-1}{-1}$ is $2\sqrt{6}$ units and $Q(\alpha_1,\alpha_2,\alpha_3)$ is the image of the point P in this line, then $a+\sum_{i=1}^{3}\alpha_i$ is equal to

(1) 7 (2) 8

(3) 12 (4) 14

Q548. JEE Main 2021 (27 Jul Shift 2)

For real numbers α and $\beta\neq 0$, if the point of intersection of the straight lines $\frac{x-\alpha}{1}=\frac{y-1}{2}=\frac{z-1}{3}$ and $\frac{x-4}{\beta}=\frac{y-6}{3}=\frac{z-7}{3}$ lies on the plane $x+2y-z=8$, then $\alpha-\beta$ is equal to :

(1) 5 (2) 9

(3) 3 (4) 7

Q549. JEE Main 2021 (27 Aug Shift 2)

The angle between the straight lines, whose direction cosines l, m, n are given by the equations $2l + 2\,m - n = 0$ and $mn + nl + \mathrm{lm} = 0$, is:

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{2}$

(3) $\cos^{-1}\left(\frac{8}{9}\right)$ (4) $\pi - \cos^{-1}\left(\frac{4}{9}\right)$

Q550. JEE Main 2021 (16 Mar Shift 1)

Let the position vectors of two points P and Q be $3\hat{\mathrm{i}} - \hat{\mathrm{j}} + 2\widehat{\mathrm{k}}$ and $\hat{\mathrm{i}} + 2\hat{\mathrm{j}} - 4\widehat{\mathrm{k}}$, respectively. Let R and S be two points such that the direction ratios of lines PR and QS are $(4, -1, 2)$ and $(-2, 1, -2)$, respectively. Let lines PR and QS intersect at T. If the vector $\overrightarrow{TA}$ is perpendicular to both $\overrightarrow{PR}$ and $\overrightarrow{QS}$ and the length of vector $\overrightarrow{TA}$ is $\sqrt{5}$ units, then the modulus of a position vector of A is :

(1) $\sqrt{482}$ (2) $\sqrt{171}$

(3) $\sqrt{5}$ (4) $\sqrt{227}$

ANSWER KEYS

1. (3)	**2.** (4)	**3.** (1)	**4.** 117	**5.** (2)	**6.** (4)	**7.** (2)	**8.** 3
9. (2)	**10.** (2)	**11.** (3)	**12.** 6	**13.** 25	**14.** 38	**15.** 3	**16.** (3)
17. (1)	**18.** (3)	**19.** (2)	**20.** 11	**21.** 22	**22.** (4)	**23.** (4)	**24.** (2)
25. (1)	**26.** (2)	**27.** (1)	**28.** 49	**29.** (1)	**30.** 5	**31.** (1)	**32.** (4)
33. (4)	**34.** 36	**35.** (2)	**36.** (1)	**37.** (1)	**38.** 6	**39.** (2)	**40.** (2)
41. 4	**42.** (3)	**43.** (4)	**44.** (4)	**45.** (4)	**46.** (3)	**47.** (3)	**48.** 11132
49. (1)	**50.** (4)	**51.** (2)	**52.** (2)	**53.** (4)	**54.** 474	**55.** (2)	**56.** (2)
57. (1)	**58.** (4)	**59.** (1)	**60.** (2)	**61.** 1	**62.** (3)	**63.** (3)	**64.** (4)
65. (2)	**66.** (3)	**67.** (4)	**68.** 13	**69.** 14	**70.** 1405	**71.** (4)	**72.** 17280
73. (1)	**74.** (2)	**75.** (1)	**76.** (2)	**77.** 11376	**78.** (4)	**79.** (1)	**80.** (3)
81. (3)	**82.** (3)	**83.** 21	**84.** (2)	**85.** (3)	**86.** 40	**87.** 45	**88.** (1)
89. 63	**90.** (4)	**91.** (1)	**92.** (4)	**93.** (3)	**94.** (3)	**95.** (4)	**96.** (1)
97. (1)	**98.** 5	**99.** (1)	**100.** 2035	**101.** (4)	**102.** (1)	**103.** 118	**104.** 138
105. 1	**106.** 1	**107.** (4)	**108.** 9	**109.** (2)	**110.** (2)	**111.** (4)	**112.** (1)
113. (1)	**114.** (4)	**115.** (3)	**116.** (3)	**117.** (2)	**118.** 33	**119.** (2)	**120.** (3)
121. 37	**122.** 238	**123.** (3)	**124.** (3)	**125.** 4	**126.** (2)	**127.** (4)	**128.** (1)
129. 6	**130.** (3)	**131.** (3)	**132.** (3)	**133.** 1613	**134.** (4)	**135.** 34	**136.** (4)
137. 10	**138.** (4)	**139.** 2	**140.** (1)	**141.** (4)	**142.** (1)	**143.** (2)	**144.** (4)
145. (2)	**146.** (3)	**147.** 50	**148.** 24	**149.** 108	**150.** (1)	**151.** (2)	**152.** (1)
153. (1)	**154.** (3)	**155.** (4)	**156.** (3)	**157.** (1)	**158.** (1)	**159.** 450	**160.** (2)
161. 6	**162.** (1)	**163.** (1)	**164.** 1	**165.** (2)	**166.** (3)	**167.** (2)	**168.** (1)
169. (4)	**170.** 183	**171.** (1)	**172.** (1)	**173.** (1)	**174.** (2)	**175.** (2)	**176.** (2)
177. (3)	**178.** 4949	**179.** (1)	**180.** (1)	**181.** 12	**182.** 19	**183.** (2)	**184.** (1)
185. (3)	**186.** (4)	**187.** (4)	**188.** (3)	**189.** (3)	**190.** (3)	**191.** (4)	**192.** (4)
193. (2)	**194.** (2)	**195.** (4)	**196.** (2)	**197.** 3	**198.** (2)	**199.** (4)	**200.** (4)
201. 169	**202.** (1)	**203.** (1)	**204.** (1)	**205.** 29	**206.** 96	**207.** (4)	**208.** (4)
209. (4)	**210.** (3)	**211.** (2)	**212.** (2)	**213.** (3)	**214.** (4)	**215.** (4)	**216.** 392
217. (3)	**218.** (1)	**219.** (4)	**220.** 5	**221.** (1)	**222.** 1010	**223.** (4)	**224.** 1024
225. (2)	**226.** (4)	**227.** (3)	**228.** 37	**229.** (1)	**230.** (3)	**231.** (4)	**232.** (2)
233. (2)	**234.** 490	**235.** 26	**236.** (3)	**237.** (1)	**238.** 32	**239.** 1	**240.** (4)
241. (3)	**242.** (4)	**243.** (4)	**244.** 55	**245.** 100	**246.** (2)	**247.** (2)	**248.** (2)
249. (3)	**250.** (3)	**251.** (3)	**252.** (4)	**253.** 3	**254.** (1)	**255.** (3)	**256.** 5

257. (4)	**258.** (1)	**259.** 34	**260.** 2	**261.** (1)	**262.** (4)	**263.** (2)	**264.** (2)
265. 10	**266.** 2	**267.** 25	**268.** (2)	**269.** (2)	**270.** (2)	**271.** (4)	**272.** 62
273. 3	**274.** (3)	**275.** 2890	**276.** (2)	**277.** (4)	**278.** (1)	**279.** (1)	**280.** (2)
281. (1)	**282.** (2)	**283.** (2)	**284.** 30	**285.** (1)	**286.** 39	**287.** (4)	**288.** (3)
289. (2)	**290.** (2)	**291.** (1)	**292.** (3)	**293.** 3	**294.** 3	**295.** (2)	**296.** (2)
297. (2)	**298.** 9	**299.** (4)	**300.** (4)	**301.** 19	**302.** (1)	**303.** (2)	**304.** (2)
305. (2)	**306.** (4)	**307.** (1)	**308.** (3)	**309.** 1	**310.** (2)	**311.** (3)	**312.** (1)
313. (3)	**314.** 4	**315.** (3)	**316.** (3)	**317.** (1)	**318.** 12	**319.** (4)	**320.** 112
321. (1)	**322.** (1)	**323.** (4)	**324.** (4)	**325.** (3)	**326.** (3)	**327.** (1)	**328.** (3)
329. 15	**330.** 6	**331.** (4)	**332.** (1)	**333.** 23	**334.** (2)	**335.** (1)	**336.** 8
337. (3)	**338.** (4)	**339.** (3)	**340.** (1)	**341.** (2)	**342.** 385	**343.** (2)	**344.** (2)
345. (2)	**346.** 512	**347.** (1)	**348.** 15	**349.** (1)	**350.** (2)	**351.** 12	**352.** (2)
353. (1)	**354.** (4)	**355.** (4)	**356.** (3)	**357.** (1)	**358.** (4)	**359.** 164	**360.** (4)
361. (4)	**362.** 72	**363.** (3)	**364.** (1)	**365.** (3)	**366.** 41	**367.** (3)	**368.** (4)
369. (3)	**370.** (2)	**371.** (4)	**372.** 1	**373.** (1)	**374.** (2)	**375.** (4)	**376.** (3)
377. 27	**378.** (3)	**379.** 21	**380.** (1)	**381.** (1)	**382.** (1)	**383.** (4)	**384.** (1)
385. (4)	**386.** (4)	**387.** (4)	**388.** (1)	**389.** 3	**390.** (2)	**391.** 3	**392.** (1)
393. (1)	**394.** (4)	**395.** (1)	**396.** (4)	**397.** (1)	**398.** (2)	**399.** (3)	**400.** (3)
401. (3)	**402.** (3)	**403.** 145	**404.** 32	**405.** (1)	**406.** (4)	**407.** 14	**408.** (3)
409. 31	**410.** (4)	**411.** (2)	**412.** 31	**413.** (4)	**414.** 8	**415.** (2)	**416.** 5
417. (3)	**418.** (3)	**419.** (4)	**420.** 1575	**421.** (2)	**422.** (4)	**423.** (2)	**424.** (1)
425. (1)	**426.** (4)	**427.** 2	**428.** 16	**429.** (2)	**430.** 7	**431.** (3)	**432.** (1)
433. (2)	**434.** 1328	**435.** (3)	**436.** 14	**437.** (1)	**438.** 15	**439.** (2)	**440.** (3)
441. (4)	**442.** 36	**443.** 75	**444.** (3)	**445.** (4)	**446.** 10	**447.** (2)	**448.** (3)
449. (1)	**450.** (2)	**451.** (4)	**452.** (1)	**453.** 54	**454.** (1)	**455.** (2)	**456.** (3)
457. (4)	**458.** (1)	**459.** (4)	**460.** (2)	**461.** (3)	**462.** (2)	**463.** (2)	**464.** (3)
465. (3)	**466.** 19	**467.** (3)	**468.** (3)	**469.** (3)	**470.** (2)	**471.** (4)	**472.** 1552
473. (4)	**474.** (3)	**475.** (2)	**476.** 80	**477.** (1)	**478.** (1)	**479.** 11	**480.** (4)
481. (4)	**482.** (3)	**483.** (4)	**484.** (1)	**485.** 14	**486.** (2)	**487.** 3	**488.** (1)
489. 47	**490.** (1)	**491.** (4)	**492.** (3)	**493.** (2)	**494.** 130	**495.** (1)	**496.** (4)
497. 164	**498.** (2)	**499.** 5	**500.** (4)	**501.** (3)	**502.** (1)	**503.** (1)	**504.** (1)
505. (4)	**506.** (3)	**507.** (4)	**508.** 38	**509.** (2)	**510.** (2)	**511.** (2)	**512.** 569
513. (4)	**514.** (1)	**515.** (1)	**516.** (1)	**517.** (3)	**518.** (1)	**519.** (2)	**520.** 30

521. 56	**522.** (2)	**523.** (3)	**524.** (2)	**525.** (2)	**526.** (1)	**527.** (3)	**528.** (4)
529. (4)	**530.** (3)	**531.** (1)	**532.** 957	**533.** (2)	**534.** (2)	**535.** (4)	**536.** (4)
537. (4)	**538.** 216	**539.** (2)	**540.** (1)	**541.** (2)	**542.** 13	**543.** (3)	**544.** (3)
545. 21	**546.** (4)	**547.** (2)	**548.** (4)	**549.** (2)	**550.** (2)		