MATHS

BOOKS - JEE MAINS PREVIOUS YEAR

JEE MAIN 2021

Question

1. A die is rolled n times. If the probability of getting odd number 2 times is equal to the probability of getting even number 3 times. Find the probability of getting odd number odd times

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2. Common tangent to the curve $y^2 = 2x - 3$ and $x^2 = 4y$ lies parallel to the line

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3. $\lim_{n \to \infty} \tan\left(\sum_{r=1}^{n} \tan^{-1}\left(\frac{1}{r^2 + r + 1}\right)\right)$

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4. $\vec{a}, \vec{b}, \vec{c}$ are coplanar and $\vec{b}$ is $\perp$ to $\vec{c}$, $\vec{a} \cdot \vec{c} = 7$

$\vec{a} = -\hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + \hat{k}$ then find $2\left(\vec{a} + \vec{b} + \vec{c}\right)$

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5. Diameter of $x^2 + y^2 - 2x - 6y + 6 = 0$ is chord of circle with center $(2, 1)$ then radius of bigger circle is

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6. $\int \frac{\cos x - \sin x}{\sqrt{8 - \sin 2x}} dx = A \sin^{-1}\left(\frac{\sin x + \cos x}{B}\right), (A, B) =$

A. $(1, 3)$

B. $(-1, 3)$

C. $(1, -3)$

D. $(3, 1)$

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7. The solution of the differential equation x dy - y $dx = \sqrt{x^2 + y^2} dx$ is

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8. A man on the straight line whose arithmetic mean of reciprocal of intercepts on the axes is $\frac{1}{4}$. There are 3 marbles at A (1,1) , B(2,2) , C(4,4) . Then which marble lie on its path

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9. $f(x) = \frac{4x^3 - 3x^2}{6} - 2\sin x + (2x - 1)\cos x$, then $f(x)$ is

A. Increases in $\left(\frac{1}{2}, \infty\right)$

B. Decreases in $\left(\frac{1}{2}, \infty\right)$

C. Increases in $\left(-\infty, \frac{1}{2}\right)$

D. Decreases in $\left(-\infty, \frac{1}{2}\right)$

Answer: A

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10. $f(x) = [x - 1]\cos\left(\frac{2x - 1}{2}\right)\pi$, then $f(x)$ is

A. $f(x)$ is continous at $x \in R$

B. $f(x)$ is discontinous at $x = 1$

C. $f(x)$ is discontinous at $x = 2$

D. $f(x)$ is discontinous at all integers except 2

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11. Find the area bounded between $y^2 \geq 9x$ and $x^2 + y^2 \leq 36$

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12. $a_1, a_2, ...a_{10}$ are in G.P $\frac{a_7}{a_5} = 25$ Find $\frac{a_{10}}{a_8}$

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13. If $p, q > 0, p + q = 2$ and $p^4 + q^4 = 272$, then p and q are roots of

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14. Which of the following is tautology?

A. $A \cup (A \cap B)$

B. $B \rightarrow (A \cap A \rightarrow B)$

C. $A \cap (A \cup B)$

D. $A \cap (A \rightarrow B)) \rightarrow B$

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15. If $Z + \alpha|Z - 1| + 2i = 0$, then find the sum of maximum and minimum values of $\alpha.(\alpha \in R)$

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16. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}$ and $6A^{-1} = A^2 + cA + dI$. Then $c + d$ is

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17. There are two poles and one is three times the other and they are 150m apart and a man from there mid-point found elevation angles complementary find the height of small pole

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18. The distance of the point (1,1,9) from the point of intersection of the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ and plane x+y+z=17

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19. A abscissa of A and B are the roots of the equation $x^2 + 2ax - b^2 = 0$ and their ordinates are roots of the equation $y^2 + 2py - q^2 = 0$. The equation of the circle with AB as diameter is

A. $x^2 + y^2 + 2ax + 2py - b^2 - q^2 = 0$

B. $x^2 + y^2 + 2ax + py - b^2 - q^2 = 0$

C. $x^2 + y^2 + 2ax + 2py + b^2 + q^2 = 0$

D. None of these

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20. $\int_{-a}^{a}(|x| + |x - 2|)dx = 22$ then find $\int_{-a}^{a}(x + [x])$dx

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21. A committee has to be formed from 6 Indians and 8 foreignera such that the number of Indians should be atleast two and foreigners should be double that of Indians. In how many ways can it be formed

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22. Let a matrix M of order 3×3 has elements from the set {0,1,2}. How many matrices are possible whose sum of diagonal elements is 7 of matrix $M^T \cdot M$

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23. $g(x) = \dfrac{x - \left(\frac{1}{2}\right)}{x} - 1, f(x) = 2x - 1$, then $fog(x)$ is

A. one-one , onto

B. one-one , not onto

C. not one-one , onto

D. Not one-one , not onto

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24. $y^2 = 4ax$ is a parabola . A line segment joining focus of parabola to any moving point $\left(at^2, 2at\right)$ is made . Then locus of mid-point of the line segment is a parabola with the directrix

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

B. $x = 0$

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

D. $x = a$

Answer: B

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25. Tangent is drawn to $y = x^3$ at $P\left(t, t^3\right)$, it intersects curve again at Q.Find ordinate of point which divide PQ internally in 1:2

A. 0

B. $-2t^3$

C. $2t^3$

D. t^3

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26. Evaluate : $\lim_{x \to 0} \frac{\int_0^{x^2} \sin\sqrt{t}\, dt}{x^3}$

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

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

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

D. 1

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27. The arithmetic mean of reciprocal of intercepts of line $y = mx + c$ on the axis is $\frac{1}{4}$, then the line will pass through the point is

A. (1,1)

B. (2,2)

C. (4,4)

D. All of these

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28. Locus of mid point of a focal radius of parabola $y^2 = 4ax$ is a parabola whose focus is

A. $\left(-\frac{a}{2}, 0\right)$

B. $\left(\frac{a}{2}, 0\right)$

C. $(a, 0)$

D. $(-a, 0)$

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29. Find the minimum value of α where $\frac{4}{\sin x} + \frac{1}{1 - \sin x} = \alpha$

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30. Value of

$-{}^{15}C_1 + 2.\,.{}^{15}C_2 - 3.{}^{15}C_3 + \ldots\ldots - 15.{}^{15}C_{15} + {}^{15}C_1 + {}^{15}C_2 + \ldots.{}^{15}C_{14}$ is

A. 2^{15}

B. $2^{15} - 2$

C. $2^{15} - 1$

D. $2^{14} - 2$

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31. Evaluate $\tan\left(\frac{1}{4} \cdot \sin^{-1}\left(\frac{\sqrt{63}}{8}\right)\right)$

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32. An aeroplane from point A gives an angle of elevation 60^{o} and after 20 second when aeroplane is moving with the speed 432 km/hr and makes an angle of 30^{o} . then find the height of the aeroplane in meter

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33. The variance of 10 natural numbers 1,1,1,1 ... k is less then 10 . Find maximum value of k

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34. If $a + \alpha = 1, b + \beta = 2$ and $af(n) + \alpha f\left(\frac{1}{n}\right) = bn + \frac{\beta}{n}$, then find the value of $\frac{f(n) + f\left(\frac{1}{n}\right)}{n + \frac{1}{n}}$

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35. If A is symmetric matrix and B is skew symmetric matrix of order 3×3, then consider $\left(A^2B^2 - B^2A^2\right)X = 0$, where X is a matrix of unknown variable of 3×1 and O is a null matrix of 3×1 , then system of linear equation has

A. No Solution

B. infinity Solution

C. Unique Solution

D. None of these

Answer: B

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36. Find $\int_1^3 \left[x^2 - 2x - 2\right] dx$

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37. Let f be a twice differentiable defined on R such that $f(0) = 1, f'(0) = 2$.

If $\begin{vmatrix} f(x) & f'(x) \\ f'(x) & f''(x) \end{vmatrix} = 0 \, \forall n \in R$, then the value of $f(1)$ lie in the interval

A. $(9, 12)$

B. $(3, 6)$

C. $(6, 9)$

D. $(0, 3)$

Answer: C

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38. Find the area enclosed by the parabolas $y = 5x^2$ and $y = 2x^2 + 9$

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39. Find the point on $y = x^2 + 4$ which is at shortest distance from the line $y = 4x - 4$

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40. Given $y = y(x)$passing through (1,2) such that $x\frac{dy}{dx} + y = bx^4$ then find b if $\int_1^2 f(x)dx = \frac{62}{5}$

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41. A set $\{1,2,3,4,5\}$, two subset of A and B are chosen. Find probability such that $n(A \cap B) = 2$

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42. The general solution of the differential equation $\frac{dy}{dx} + \sin\left(\frac{x+y}{2}\right) = \sin\left(\frac{x-y}{2}\right)$

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43. The number of natural numbers less than 7,000 which can be formed by using the digits 0, 1, 3, 7, 9 (repetition of digits allowed) is equal to

A. 250

B. 374

C. 372

D. 375

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44. The number of functions f from $\{1, 2, 3, \ldots, 20\}$ onto $\{1, 2, 3, \ldots\ldots.20\}$ such that f (k) is a multiple of 3 whenever k is a multiple of 4 is:

A. $15! \times 6!$

B. $(15)^6 \times 15$

C. $5! \times 6!$

D. $15! \times 6^5$

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45. A(5,0) and B(-5,0) are two points PA =3PB Then locus of P is a circle with radius r then $4r^2 =$

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46. $x + \sqrt{3}.\, y = 2\sqrt{3}$ is tangent to a curve at $\left(\frac{3\sqrt{3}}{2}, \frac{1}{2}\right)$ then curve can be

A. $x^2 + 9y^2 = 9$

B. $2x^2 + 18y^2 = 9$

C. $y^2 = \frac{x}{6\sqrt{3}}$

D. $x^2 + y^2 = 7$

Answer: A

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47. If $n \geq 2, {}^{n+1}C_2 + 2\left(.{}^2C_2 + {}^3C_2 + {}^4C_2 + \ldots + {}^nC_2\right) =$

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48. $f(0)=1, f(2)=e^2, f'(x)=f'(2-x)$, then find the value of $\int_0^2 f(x)dx$

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49. Negation of the statement $\sim p \vee (p \wedge q)$ is

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50. Vertices of Δ are (a,c) , (2,b) , and (a,b) where a,b,c are in A.P and the centroid of Δ is $\left(\frac{10}{3}, \frac{7}{3}\right)$. If α , β are the roots of $ax^2+bx+1=0$ then $\alpha^2+\beta^2-\alpha\cdot\beta=$

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51. If normal and tangent are drawn to $(x - 2)^2 + (y - 3)^2 = 25$,at point (5,7) and area of Δ made by normal , tangent and x-axis is A . Then find 24A

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52. Sum of first four terms of GP is $\frac{65}{12}$, sum of their reciprocals is $\frac{65}{18}$ .Product of their first 3 terms is 1 and if 3rd term is α then find 2α

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53. $S_1, S_2, \ldots, S_{10}$ are 10 students , in how many ways they can be divided in 3 groups A,B and C such that all groups have atleast one student and C has maximum 3 students.

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54. Equation of plane through (1,0,2) and line of intersection of planes $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 1$ and $\vec{r} \cdot \left(\hat{i} - 2\hat{j}\right) = -2$

A. $\vec{r} \cdot \left(\hat{i} + 7\hat{j} + 3\hat{k}\right) = 7$

B. $\vec{r} \cdot \left(3\hat{i} + 10\hat{j} + 3\hat{k}\right) = 7$

C. $\vec{r} \cdot \left(\hat{i} + \hat{j} - 3\hat{k}\right) = 4$

D. $\vec{r} \cdot \left(\hat{i} + 4\hat{j} - \hat{k}\right) = -7$

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55. A curve $y = ax^2 + bx + c$ passing through the point $(1, 2)$ has slope of tangent at orign equal to 1 , then ordered triplet (a, b, c) may be

A. $\left(\frac{1}{2}, 1, 0\right)$

B. $(1, 1, 0)$

C. $\left(-\frac{1}{2}, 1, 1\right)$

D. $(2, -1, 0)$

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56. Let $f(x) = \begin{cases} -55x & x < -5 \\ 2x^3 - 3x^2 - 120x & -5 \leq x < 4 \\ 2x^3 - 3x^2 - 36x + 10 & x \geq 4 \end{cases}$

Then interval in which f(x) is monotonically increasing is

A. $(-5, -4) \cup (4, \infty)$

B. $(-\infty, -4) \cup (5, \infty)$

C. $(-5, 4) \cup (5, \infty)$

D. $(-5, -4) \cup (3, \infty)$

Answer: A

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57. Find the total number of number lying between 100 and 1000 formed using 1 , 2 , 3 , 4 , 5 and divisible by either 3 or 5

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58. Locus of centre of a circle which touches $x^2 + y^2 - 6x - 6y + 14 = 0$ externally and also touches y-axis

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59. A straight line $x + 2y = 1$ cuts the x and y axis at A and B.A circle passes through point A and B and origin.Then the sum of length of perpendicular from A and B on tangent of the circle at the origin is

A. $\frac{\sqrt{5}}{4}$

B. $\frac{\sqrt{5}}{3}$

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

D. None of these

Answer: C

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60. $\int_{-1}^{1}\left(x^2 e^{\left[x^3\right]}\right)dx$

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61. The value of

$$6+\log_{3/2}\left(\frac{1}{3\sqrt{2}}\sqrt{4-\frac{1}{3\sqrt{2}}\sqrt{4-\frac{1}{3\sqrt{2}}\sqrt{4-\frac{1}{3\sqrt{2}}\ldots}}}\right)$$ is

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62. A man watches a boat travelling towards him while standing on a top. Its deviation is 30^o . After 20sec deviation changes to 45^o. Then how much time it talkes to reach bottom of the tower ?

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63. Out of 30 observations , 10 observations are $\left(\frac{1}{2} - d\right)$ and 10 observations are d and remaining 10 are $\left(\frac{1}{2} + d\right)$. If the variance of 30 observation is $\frac{4}{3}$ then d is `

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64. $\lim_{n \to \infty}\left(1 + \left(\frac{1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{n}}{n^2}\right)\right)^n$

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65. If $x = \sum_{n=0}^{\infty} (\cos\theta)^{2n}, y = \sum_{n=0}^{\infty} (\sin\phi)^{2n}, z = \sum_{n=0}^{\infty} (\cos\phi)^{2n}. (\sin\theta)^{2n}$ Then which of the following is true ??

A. $xy + z = xyz$

B. $xy - z = (x + y)z$

C. $xyz = 4$

D. $xy + zy + zx = z$

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66. For any two statement p and q $\sim(p \vee q) \vee (\sim p \wedge q)$ logically to

A. p

B. ~p

C. q

D. ~q

Answer: B

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67. Curve passing through $(0, 0)$ and slope of tangent to any point (x, y) is $\frac{x^2 - 4x + y + 8}{x - 2}$, then curve also passes through

A. (4,4)

B. (4,5)

C. (5,5)

D. (5,4)

Answer: B

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68. The number of points where $f(x) = |2x - 1| - 3|x + 2| + \left|x^2 + x - 2\right|, n \in R$ is not differentiable is

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69. Integral value of k for which $x^2 - 2(3k - 1)x + 8k^2 - 7 > 0$

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70. Let $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}, \vec{b} = \hat{i} - \hat{j}, \vec{c} = \hat{i} - \hat{j} - \hat{k}$,and $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}, \vec{r} \cdot \vec{b} = 0$.

Find $\vec{r} \cdot \vec{a}$

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71. A = $\begin{bmatrix} 0 & -\tan\frac{\theta}{2} \\ \tan\frac{\theta}{2} & 0 \end{bmatrix}$ and $(I + A)(I - A)^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$. Find $13\left(a^2 + b^2\right)$

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72. Let α be the angle between the lines whose direction cosines satisfy the equation $l + m - n = 0$and $l^2 + m^2 - n^2 = 0$ then value of $(\sin\alpha)^4 + (\cos\alpha)^4$ is

A. $\frac{3}{8}$

B. $\frac{3}{4}$

C. $\frac{5}{8}$

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

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73. A missile fires a target . The probability of getting intercepted is $\frac{1}{3}$ and if it is not intercepted then probability of hitting the target is $\frac{3}{4}$. Three independent missiles are fired . Find the probability of all three hit.

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74. $\sqrt{3}kx + ky = 4\sqrt{3}$

$\sqrt{3}x - y = 4\sqrt{3}k$

The locus of the point of intersection of these lines form a conic with eccentricity ______

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75. The polynomial $f(x) = x^3 - bx^2 + cx - 4$ satisfies the conditions of Rolle's theorem for $x \in [1, 2]$, $f'\left(\frac{4}{3}\right) = 0$ the order pair (b, c) is

A. $(5, 8)$

B. $(-5, 8)$

C. $(-5, -8)$

D. $(5, -8)$

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76. If $\frac{x^2}{a} + \frac{y^2}{b} = 1$ and $\frac{x^2}{c} + \frac{y^2}{d} = 1$ are orthogonal then relation between a , b , c , d is

A. $a + b = c + d$

B. $a - b = c - d$

C. $a + d = c + b$

D. $a - d = c - b$

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77. The image of the point (3,5) in line x-y+1=0 lies on

A. $(x - 2)^2 + (y - 2)^2 = 4$

B. $(x - 2)^2 + (y - 2)^2 = 8$

C. $(x - 2)^2 + (y - 2)^2 = 6$

D. $(x - 2)^2 + (y + 2)^2 = 2$

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78. $xyz = 24, x, y, z \in N.$ Then find the number of order pairs (x,y,z)

A. 24

B. 30

C. 36

D. 38

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79. If $p(x)$ is a polynomial of degree 6 with coefficient of x^6 equal to 1 . If extreme value occur at x=1 and x=-1 , $\lim x \to o\left(\frac{f(x)}{x^3}\right) = 1$ then $5f(2) =$

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80. If area between two consecutive point of intersection of $y = \sin x$ and $y = \cos x$ is A then find A^4.

A. 64

B. 32

C. 28

D. 16

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81. Find the equation of the line passing through A(0,1,2) and perpendicular to line $\frac{x-1}{2} = \frac{y+1}{2} = \frac{z-1}{3}$

A. $\frac{x-0}{27} = \frac{y-1}{-24} = \frac{z-2}{5}$

B. $\frac{x-0}{27} = \frac{y-1}{24} = \frac{z-2}{2}$

C. $\frac{x-0}{27} = \frac{y-1}{-24} = \frac{z-2}{-2}$

D. $\frac{x-0}{27} = \frac{y-1}{-24} = \frac{z-2}{4}$

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82. If a,b,c are the outputs obtained when the three unbiased dicess are rolled . Find the probability that the roots of quadratic equation $ax^2 + bx + c = 0$ are equal to

A. $\frac{5}{216}$

B. $\frac{7}{216}$

C. $\frac{3}{216}$

D. $\frac{1}{36}$

Answer: A

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83. The slope of its tangent at (x, y) is $\frac{dy}{dx} = \frac{(x-2)^2 + (y+4)}{x-2}$ and the curve passes through origin then the point which passes through the curve is

A. $(2, -4)$

B. $(2, 4)$

C. $(-2, 4)$

D. $(4, -2)$

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84. If $A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$ and $A^2 = I_3$ and $xyz = 2$ and $x + y + z > 0$ find the value of $x^3 + y^3 + z^3$ is

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85. $f(x+1) = f(x) + f(1), f(x), g(x): N \rightarrow N$

$g(x)$ = any arbitrary function and $fog(x)$ is one-one

A. $f(x)$ is many-one

B. $g(x)$ is many-one

C. $g(x)$ is one-one

D. $f(x)$ and $g(x)$ both are many-one

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86. Let $(2 - i)z = (2 + i)\bar{z}$ and $(2 + i)z + (-2 + i)\bar{z} - i = 0$ be normal to the circle and $iz + \bar{z} + 1 + i = 0$ is tangent to the same circle having radius r . Then vaue of $128r^2$

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87. When x is divided by 4 leaves remainder 3 then $(2022 + x)^{2022}$ is divisided by 8 , remainder is

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88. $\lim_{x \to 0} \frac{ax - \left(e^{4x} - 1\right)}{ax\left(e^{4x} - 1\right)} = b$ .Find a-2b

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89. Contrapositive of "IF you want money then you have to do work "

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90. There is a group of 400 people of which 160 are non-vegetarian and smokers , 100 are smokers and vegetarian and remaining 140 are non smoker vegetarian. It is found that in a survey chest disorder are

$35\%, 15\%, 10\%$ respectively . A random guy is chosen and is found that he chest disorder . Find the probabability that the person is smoker and non-vegetarian

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91. If $0 < x, y < \pi$ and $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$. Find $\sin x + \cos y$

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92. The sum of length of perpendicular drawn from focii to any real tangent to the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ is always greater than a .hence Find the minimum value of a

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93. If $x^2 + 2y^2 = 1$ and $x + y = 1$ intersect and line joining them subtends an angle at the origin , then find angle

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94. $\lim_{N \to \infty}\left[\frac{1}{n} + \frac{n}{(n+1)^2} + \frac{n}{(n+2)^2} + \ldots + \frac{n}{(2n-1)^2}\right]$

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95. If $z^2 + \alpha z + \beta$ has one root $1 - 2i$, then find the value of $\alpha - \beta(\alpha, \beta, \in R)$

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96. Let $f(x) = \frac{5^x}{5^x + 5}$ Then find the value of

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

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97. If the equation of ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ then find the equation of hyperbola such that product of eccentircities of both curves equal to 1 and the axes of ellipse are coinciding with hyperbola and also hyperbola passes through the focii of ellipse.

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98. $I = \int_{-2}^{2} \left|3x^2 - 3x - 6\right| dx$. Find the value of I

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99. If α and β be root of $x^2 - 6x - 2 = 0$ with $\alpha > \beta$ if $a_n = \alpha^n - \beta^n$ for $n \geq 1$ then the value of $\frac{a_{10} - 2a_8}{3a_9}$

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100. Total number of two digit number n What is the value of n such that $\left(3^n + 7^n\right)$ is divisible by 10

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101. The shortest distance between the line $x - y = 1$ and the curve id $x^2 = 2y$

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102. If A is 3×3 matrix and $|A| = 4$. Operation $R_2 \rightarrow 2R_2 + 5R_3$ is applied on 2A to get new matrix B .Find $|B|$

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103. $cosec\left(2\cot^{-1}(5) + \cos^{-1}\left(\frac{4}{5}\right)\right)$ is equal to

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104. If $A = \begin{bmatrix} 1 & -\alpha \\ \alpha & \beta \end{bmatrix}$ and $AA^T = I$ .Then find the value of α and β

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105. Minimum value at $a^{ax} + a^{1-ax}$; $a > 0$ and $x \in R$, is

A. $\sqrt{a}$

B. $\frac{a}{\sqrt{2}}$

C. $2\sqrt{a}$

D. $\frac{1}{2\sqrt{a}}$

Answer: C

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106. If $x = y^4$ and $xy = K$, cut each other at right angle then Find $(4K)^6 =$

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107. $\int \frac{e^{3\log_e(2x)} + 5e^{2\log_e(2x)}}{e^{4\log_e(x)} + 5e^{3\log_e(x)} - 7e^{2\log_e(x)}} \cdot dx, x > 0$

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108. $I_n = \int_{\pi/4}^{\pi/2} \cot^n x \cdot dx$ Find relation between $I_2 + I_4, I_3 + I_5, I_4 + I_6,$

A. A.P

B. G.P

C. Reciprocals are in A.P

D. None of these

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109. A number is selected from 4 digit numbers of the form 5n+2 where n belongs to N containing exactly one digit as 7 . Find the probability that number when divided by 5 leaves remainder 2.

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110. Set A contain 3 elements , set B contain 5 elements , number of one-one function from $A \to B$ is "x" and number of one-one functions from $A \to A \times B$ is "y" then relation between x and y

A. $2y = 78x$

B. $4y = 91x$

C. $2y = 91x$

D. $y = 52x$

Answer: $2y = 91x$

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111. The number of all 4-digit number of the form $5n + 2(n \in n)$ having exactly one digit 7

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112. Find no. of solutions $\log_2(x - 3) = \log_4(x - 1)$

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113. Find Value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} |\sin(2x)| dx$

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114. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\cos^2 x}{1 + 3^x} dx$

A. $\frac{\pi}{4}$

B. 2π

C. $\frac{\pi}{2}$

D. 4π

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115. If the vectors $\vec{a}$ and $\vec{b}$ are mutually perpendicular, then $\vec{a} \times \left\{\vec{a} \times \left\{\vec{a} \times \left(\vec{a} \times \vec{b}\right)\right\}\right\}$ is equal to

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116. A fair coin is tossed fixed times. The probability of getting 7 heads is equal to probability of getting 9 heads. Then find the probability of getting 2 heads

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117. $x - y = 0, 2x + y = 6, x + 2y = 3$ triangle formed by these lines is

A. Right Triangle

B. Equilateral Triangle

C. Isosceles Triangle

D. None of these

Answer: C

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118. Find value of determinant of $A = \begin{vmatrix} (a+1)(a+2) & (a+2) & 1 \\ (a+3)(a+2) & (a+3) & 1 \\ (a+3)(a+4) & (a+4) & 1 \end{vmatrix}$

A. -2

B. $(a + 1)(a + 2)(a + 3)$

C. 1

D. $(a + 4)(a + 2)(a + 3)$

Answer: A

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119. $30.^{30}C_0 + 29.^{30}C_1 + \ldots + 1.^{30}C_{29} = m2^n$ and $m, n \in N$ then m+n =

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120. Sum of series $1 + \frac{2}{3} + \frac{7}{3^2} + \frac{12}{3^3} + \ldots\ldots \infty$

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121. Growth of bacteria is directly proportional to number of bacteria . At t=0 , number of bacteria = 1000 and after 2 hours population is increased by 20%. After this population becomes 2000 where $t = \dfrac{k}{\ln\left(\frac{6}{5}\right)}$. Find value of $\left(\dfrac{k}{\ln 2}\right)^2$

A. 4

B. 6

C. 16

D. 8

Answer: A

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122. Number of 7 digit possible number whose sum of digit is equal to 10 by using 1,2,3

A. 76

B. 77

C. 78

D. 80

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123. The sum of 162^{nd} power of the root of the equation $x^3 - 2x^2 + 2x - 1 = 0$ is

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124. In a G.P if $T_2 + T_6 = \frac{25}{2}, T_3T_5 = 25$ then find value of $T_2 + T_6 + T_8$

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125. $3\cos x + 4\sin x = k + 1$ then set of integral value of k

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126. $y = \frac{1}{2}x^4 - 5x^3 + 18x^2 - 19x$ what will be max. value of slope at

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127. The value of $\sum_{n=1}^{100} \int_{n-1}^{n} e^{x-[x]}\,dx =$

A. $100(e - 1)$

B. $100e$

C. $100(e + 1)$

D. $100(1 - e)$

Answer: A

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128. The number of solution of $\sqrt{3}\cos^2 x = \left(\sqrt{3} - 1\right)\cos x + 1, x \in \left[0, \frac{\pi}{2}\right]$

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129. A is 2×2 symmetric such that trace of A^2 is 1.How many such matrices are possible with integer entries ?

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130. $|f(x) - f(y)| \leq (x - y)^2 \forall x, y \in R$ and $f(0) = 1$ then

A. $f(x) < 0 \forall x \in R$

B. $f(x) > 0 \forall x \in R$

C. $f(x) = 0 \forall x \in R$

D. $f(x) = 1$

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131. Let $P(x, y)$ be a point which is a constant distance from the origin. Then equivalence relation of $(1, -1)$ is

A. $A = \left\{(x, y) \middle| x^2 + y^2 = 1 \right|\}$

B. $A = \left\{(x, y) \middle| x^2 + y^2 = 2 \right|\}$

C. $A = \left\{(x, y) \middle| x^2 + y^2 = 3 \right|\}$

D. $A = \left\{(x, y) \middle| x^2 + y^2 = 4 \right|\}$

Answer: B

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132. Find maximum value of term independent of "t" in

$$\left(tx^{\frac{1}{5}} + \frac{(1 - x)^{\frac{1}{10}}}{t}\right)^{10}, x \in (0, 1)$$

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133. $\lim_{h \to 0} 2\left(\frac{\sqrt{3}\sin\left(h+\frac{\pi}{6}\right)-\cos\left(h+\frac{\pi}{6}\right)}{h\left(\sqrt{3}\cosh-\sinh\right)}\right)$

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134. $\frac{\sin^{-1}x}{a}=\frac{\cos^{-1}x}{b}=\frac{\tan^{-1}y}{c}$ value of $\cos\left(\frac{\pi c}{a+b}\right)$

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135. Find area bounded by $y=||x-1|-2|$ with x-axis

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136. $e^{\sin y}\cos y\frac{dy}{dx}+e^{\sin y}\cos x=\cos x$ Find general solution for this

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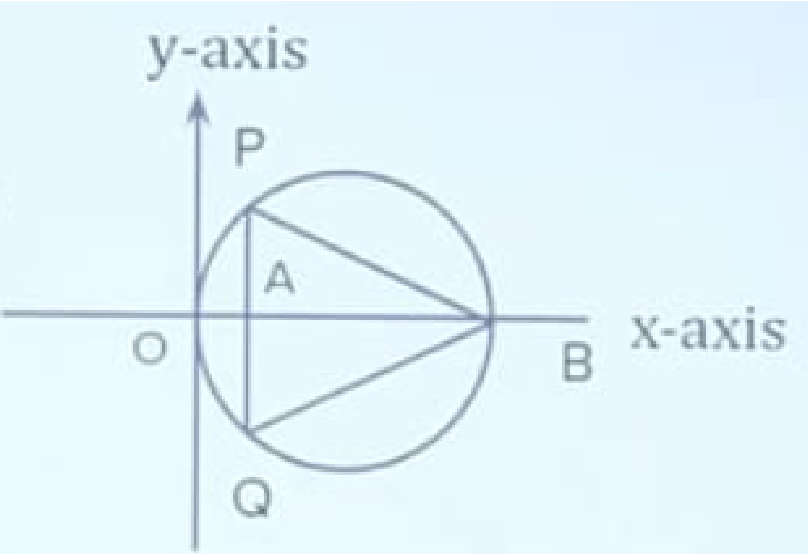
137. If OA=1 , OB=13 .Find area of ΔPQB



A. $24\sqrt{3}$

B. $24\sqrt{2}$

C. $26\sqrt{3}$

D. $26\sqrt{2}$

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138. Three planes $P_1, P_2, P_3,$ are given $3x + 15y + 21z = 9, 2x + y - z = 4, 2x + 10y + 14z = \frac{19}{5}$ respectively then which of the following is correct.

A. P_1 is parallel to P_2

B. P_3 is parallel to P_2

C. P_1 is parallel to P_3

D. P_1, P_2, P_3 are parallel to one another

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139. $\tan^{-1}a + \tan^{-1}b = \frac{\pi}{4}$. Find the value of $a + b - \frac{a^2 + b^2}{2} + \frac{a^3 + b^3}{3} - \frac{a^4 + b^4}{5} + \ldots$

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140. 3, 3 , 4 , 4 , 4 ,5 , 5 Find the probability for 7 digit number such that number is divisible by 2

A. $\frac{1}{7}$

B. $\frac{3}{7}$

C. $\frac{4}{7}$

D. $\frac{6}{7}$

Answer: B

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141. Mirror image of point $(1, 3, 5)$ w.r.t plane $4x - 5y + 2z = 8$ is (α, β, γ) then $5(\alpha + \beta + \gamma)$

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142. $f(x)$ is differentiable function at $x = a$ such that $f'(a) = 2, f(a) = 4$.

Find $\lim_{x \to a} \dfrac{xf(a) - af(x)}{x - a}$

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143. $P_n = \alpha^n + \beta^n, \alpha + \beta = 1, \alpha \cdot \beta = -1, P_{n-1} = 11, P_{n+1} = 29, then P_n^2 =$

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144. Let $A(1, 4)$ and $B(1, -5)$ be two points let p be the point on $(x - 1)^2 + (y - 1)^2 = 1$. Find maximum value of $(PA)^2 + (PB)^2$

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145. Let L is a line of intersection of $x + 2y + z = 6$ and $y + 2z = 4$. If P (α, β, γ) is foot of perpendicular from (3,2,1) on L then Find $21(\alpha + \beta + \gamma)$

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146. How many four digit number are there where g.c.d. with 18 is 3

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147. $f(x) = \int_1^x \frac{\ln t}{1+t} dt, f(e) + f\left(\frac{1}{e}\right) =$

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148. $f(x) = \int_0^x e^t f(t) dt + e^x, f(x)$ is a differentiable function on $x \in R$ then $f(x) =$

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149. The prime factorization of a number 'n' is given as $n = 2^x \times 3^y \times 5^z, y + z = 5$ and $y^{-1} + z^{-1} = \frac{5}{6}$. Find out the odd divisors of n including 1

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150. $-16, 8, -4, 2, \ldots, A.M$ and $G.M$ of p^{th} and q^{th} term are roots of $4x^2 - 9x + 5 = 0$ then $p + q =$

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151. The value of square of slope of the common tangent to the curves $4x^2 + 9y^2 = 36$ and $(2x)^2 + (2y)^2 = 31$

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152. If A_1 is area between the curve $y = \sin x, y = \cos x$ and y-axis in 1st quadrant and A_2 is area between $y = \sin x, y = \cos x$ x=$\frac{\pi}{2}$ and x-axis in 1st quadrant . Then find $\frac{A_2}{A_1}$

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153. $\sum_{n=1}^{18}\left(x_i - \alpha\right) = 36, \sum_{n=1}^{18}\left(x_i - \beta\right)^2 = 90$ where α and β are distinct and the standard deviation of x_i is 1 then Find $|\beta - \alpha|$

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154. $\sum_{n=1}^{18}\left(x_i - \alpha\right) = 36, \sum_{n=1}^{18}\left(x_i - \beta\right)^2 = 90$ where α and β are distinct and the standard deviation of x_i is 1 then Find $|\beta - \alpha|$

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155. If $f: A \rightarrow A where$A={1,2,3,4,5,6,7,8,9,10} and $f(x) = \begin{cases} x & xiseven \\ x+1 & xisodd \end{cases}$ and $g: A \rightarrow A$ such that $g(f(x)) = f(x)$. Find the number(s) of such function

A. $\dfrac{10!}{5!\cdot 5!}$

B. 5^5

C. 10^5

D. 10^{10}

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156. Let $\hat{i} + y\hat{j} + z\hat{k}$ and $x\hat{i} - \hat{j} + \hat{k}$ are parallel then unit vector parallel to $x\hat{i} + y\hat{j} + z\hat{k}$

A. $\frac{i}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$

B. $\frac{i}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

C. $\frac{i}{\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$

D. $\frac{i}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: C

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157. If all the zeros of polynomial function $f(x) = 2x^5 + 5x^4 + 10x^3 + 10x^2 + 10x + 10$ lies in $(a, a + 1)$ where $a \in I$ then find $|a|$

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158. Locus of the mid-point of the line joining (3,2) and point on $\left(x^2 + y^2 = 1\right)$ is a circle of radius r . Find r

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159. If $f(x) = \sin^{-1}x$ and $g(x) = \dfrac{x^2 - x - 2}{2x^2 - x - 6}$ then domain of $fog(x)$ is

A. $x \in (-\infty, -2] \cup \left[-\frac{4}{3}, \infty\right) - \{2\}$

B. $x \in (-\infty, -2] \cup \left[-\frac{3}{2}, \infty\right)$

C. $x \in (-\infty, -2] \cup \left[-\frac{4}{3}, \infty\right)$

D. $x \in (-\infty, -2] \cup [-1, \infty)$

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160. If $f(x)$ is a continuous function such that

$$f(x) = \begin{cases} 2\sin\left(-\frac{\pi}{2}x\right) & x < -1 \\ \left|ax^2 + x + b\right| & -1 \le x \le 1 \\ \sin\pi x & x > 1 \end{cases}$$

. Find a+b

A. -3

B. 3

C. -1

D. 1

Answer: C

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161. The slope of the tangent to curve is $\frac{xy^2 + y}{x}$ and it intersects the line $x + 2y = 4$ at $x = -2$. $If(3, y)$ lies on the curve then y is

A. $-\frac{18}{19}$

B. 119

C. $-\frac{18}{29}$

D. None of these

Answer: A

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162. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & -1 \end{bmatrix}$ and $A^{20} + \alpha A^{19} + \beta A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Find the value of $(\alpha + \beta)$

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163. $\sum_{n=1}^{\infty} \frac{n^2 + 6n + 10}{(2n + 1)!}$

A. $\frac{41e}{8} - \frac{19}{8e} - 10$

B. $\frac{41e}{8} + \frac{19}{8e} - 10$

C. $\frac{41e}{8} - \frac{19}{8e} - 80$

D. None of these

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164. IF $z(z \in C)$ satisfy $|z + 5| \leq 5$ and $z(1 + i) + \bar{z}(1 - i) \geq -10$.If the maximum value of $|z + 1|^2$ is $\alpha + \sqrt{2}\beta$ then find $\alpha + \beta$

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165. If a triangle is inscribed in a circle of radius r , then which of the following triangle can have maximum area

A. equilateral triangle with side $\sqrt{3}r$

B. equilateral triangle with side $\sqrt{2}r$

C. isosceles triangle with side $2r$

D. right angle triangle with side $r, 2r$

Answer: A

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166. Consider the system of equation $x + 2y - 3z = a, 2x + 6y - 11z = b, x - 2y + 7c$ then

A. no solution for all a , b , c

B. unique solution for $5a = 2b + c$

C. infinite solution for $5a = 2b + c$

D. None of these

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167. The of values of x and y satisfying $3^x - 4^y = 77, 3^{\frac{x}{2}} - 2^y = 7$

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168. If $f(x) = \prod_{i=1}^{3}\left(x - a_i\right) + \sum_{i=1}^{3} a_i - 3x$ where $a_i < a_{i+1} \forall i = 1, 2, \ldots$ then $f(x) = 0$ has

A. one distinct real root

B. 2 distinct real root

C. 3 distinct real root

D. 3 real root

Answer: C

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169. Let $f(x) = \int_0^x \left((a-1)\left(t^2+t+1\right)^2 - (a+1)\left(t^4+t^2+1\right)\right)dt$ then find the total number of integral value of a for which $f'(x) = 0$ has no real root

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170. Variable x and y are related by equation $x = \int_0^y \frac{dt}{\sqrt{1+t^2}}$. The value of $\frac{d^2y}{dx^2}$ is equal to

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171. In a pack of 52 cards , a card is missing . If 2 cards are drawn randomly and found to be of spades . Then probability thatmissing card is not of spade

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172. A 3×3 matrix is formed from {0 , 1, 2, 3} and sum of diagonal elements of $A^T A$ is 9. Find number of such matrices

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173. $A = \begin{bmatrix} i & -i \\ -i & i \end{bmatrix}, A^8 \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ 64 \end{bmatrix}$ has

A. unique solutions

B. no solutions

C. Infinite solutions

D. 2 solutions

Answer: B

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174. $\frac{dy}{dx} + 2y\tan x = \sin x, y\left(\frac{\pi}{3}\right) = 0$, maximum value of y(x) is

A. $\frac{1}{8}$

B. $\frac{1}{16}$

C. $\frac{15}{4}$

D. $\frac{3}{8}$

Answer: A

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175. $81^{\cos^2 x} + 81^{\sin^2 x} = 30$. then no. of solutions in $x \in (o, \pi)$

A. 0

B. 2

C. 8

D. 4

Answer: D

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176. If $\lim_{x \to 0} \frac{aa^x - b\cos x + ce^{-x}}{x\sin x} = 2$,then $a + b + c =$

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177. $\alpha\hat{i} + \beta\hat{j}$ is obtained by rotating $\sqrt{3}\hat{i} + \hat{j}$ by $45°$ in counter direction about only $45°$. Find area of Δ made by $(0, 0), (0, \beta)$ and (α, β)

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178. $\sum_{r=1}^{\infty} \tan^{-1}\left(\frac{6^r}{2^{2r+1} + 3^{2r+1}}\right)$

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179. $\log_{10}\sin x + \log_{10}\cos x = -1, \log_{10}(\sin x + \cos x) = \frac{1}{2}\left(\log_{10}n - 1\right)$ Then n=

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180. a+2 , b+2 , c+2 are 3 observations such that b=a+c , and a+2 , b+2 , c+2 has standard deviation = d Then

A. $b^2 = 3\left(a^2 + c^2 + d^2\right)$

B. $b^2 = a^2 + c^2 - \dfrac{d^2}{9}$

C. $b^2 = a^2 + c^2 + \dfrac{d^2}{9}$

D. $b^2 = 3\left(a^2 + c^2\right) - 9d^2$

Answer: D

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181. Number of solution of $(|x| - 3)|x + 4| = 6$

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182. The locus of the midpoint of the chord of the circle $x^2 + y^2 = 25$ which is tangent of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is

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183. If n is the number of irrational terms in the expansion $\left(3^{1/4} + 5^{1/8}\right)^{60}$ then value of n is

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184. $\sqrt{x + 14 - 8\sqrt{x - 2}} + \sqrt{x + 23 - 10\sqrt{x - 2}} = 3$ Find number of real root

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185. Which one of the following Boolean expression is a tautology ?

A. $(p \wedge q) \vee (p \rightarrow q)$

B. $(p \vee q) \wedge (p \rightarrow q)$

C. $(p \wedge q) \wedge (p \rightarrow q)$

D. $(p \wedge q) \rightarrow (p \rightarrow q)$

Answer: D

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186. If $\lim_{x \rightarrow 0} \frac{\int_0^{x^2} \left(\cos^2 t\right) dt}{x \sin x}$

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187. The area under the curve $y = \sin x, y = \cos x$, y-axis is A_1 , $y = \sin x, y = \cos x$, x-axis is A_2 then $A_1 : A_2$ is

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188. If $\log_{\frac{1}{\sqrt{2}}}\left(\frac{|z|+11}{(|z|-1)^2}\right) \geq 2$ Find $|z|_{\min}$

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189. If $f(x) = \log_2\left(1 + \tan\left(\frac{\pi x}{4}\right)\right)$. Find

$$\lim_{n \to \infty} \frac{2}{n}\left(f\left(\frac{1}{n}\right) + f\left(\frac{2}{n}\right) + \ldots + f(1)\right)$$

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190. The middle term in the expansion of $\left(x^2 + \frac{1}{x^2} + 2\right)^n$ is

A. $\dfrac{(n)!}{\left(\frac{n}{2}\right)^2!}$

B. $\dfrac{(2n)!}{\left(\frac{n}{2}\right)^2!}$

C. $\dfrac{1.3.5\ldots(2n+1)}{n!} \cdot 2^n$

D. $\frac{(2n)!}{n!}$

Answer: D

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191. The equation of common tangent to the curve $y^2 = 4x$ and $xy = -1$ is

A. $2^{\frac{2}{3}} \cdot y = x + 2^{\frac{4}{3}}$

B. $2^{\frac{2}{3}} \cdot x = y + 2^{\frac{4}{3}}$

C. $y = 2^{\frac{2}{3}} \cdot x - 2^{\frac{4}{3}}$

D. $y = x - 2^{\frac{2}{3}}$

Answer: A

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192. Three normal are drawn to $y^2 = 2x$ intersect at point (a,0) .Then a must be greater than

A. 1

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

C. -1

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

Answer: A

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193. If a differential equation is given by $\frac{dy}{dx} = 2(x+1)$ and area bounded by $y(x)$ with x-axis is $\frac{4 \cdot \sqrt{8}}{3}$ then $y(1)$ is

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194. If $y = y(x)$ be the solution of differential equation $\frac{dy}{dx} + \tan x \cdot y = \sin x$.

If $y(0) = 0$ Then $y\left(\frac{\pi}{4}\right) = ?$

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195. If S_p denote sum of the series $1 + r^p + r^{2p} + \ldots \infty$ and s_p denote the sum $1 - r^p + r^{2p} - r^{3p} \ldots \infty, |r| < 1$ then $S_p + s_p$ equals

A. $2S_{2p}$

B. 0

C. $\frac{1}{2}S_{2p}$

D. $-\frac{1}{2}S_{2p}$

Answer: A

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196. Consider the sequence of number $\left[n+\sqrt{2n}+\frac{1}{2}\right]$ for $n \geq 1$ where $[.]$ means GIF. If missing Z^{+} in sequence are $n_1 < n_2 < n_3 < \ldots$ find n_{12}

A. 29

B. 5

C. 78

D. none of these

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197. Let two points be A(1,-1) and B(0,2) . If a point P(x',y') be such that the area of $\Delta PAB = 5 sq.\ unit$ and it lies on the line $3x + y - 4\lambda = 0$ then value of λ is

A. 1

B. 4

C. -3

D. 3

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198. If $A and B$ are acute positive angles satisfying the equations $3\sin^2 A + 2\sin^2 B = 1 and 3\sin 2A - 2\sin 2B = 0, then A + 2B$ is equal to π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

A. 0

B. $\frac{\pi}{2}$

C. $\frac{\pi}{3}$

D. none of these

Answer: A

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199. Let N be the set of $Z^{+}, \forall n \in N$ Let

$f(n) = (n+1)^{\frac{1}{3}} - n^{\frac{1}{3}}$ and $A = \left\{ n \in N : f_{n+1} < \frac{1}{3(n+1)^{\frac{2}{3}}} < f_n \right\}$ then

A. A=N

B. A is finite set

C. Complement of A in N is nonempty but finite

D. A and it's complement is N are both finite

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200. $\int \frac{dx}{x^4\left(1+x^3\right)^2} = a\ln\left|\frac{1+x^3}{x^3}\right| + \frac{b}{x^3} + \frac{c}{1+x^3} + d$ then

A. $a = \frac{1}{3}, b = \frac{1}{3}, c = \frac{1}{3}$

B. $a = \frac{2}{3}, b = -\frac{1}{3}, c = \frac{1}{3}$

C. $a = \frac{2}{3}, b = -\frac{1}{3}, c = -\frac{1}{3}$

D. $a = \frac{2}{3}, b = \frac{1}{3}, c = -\frac{1}{3}$

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201. Q. if $\int_0^{100} (f(x)dx = a$, then $\sum_{r=1}^{100} \left(\int_0^1 (f(r-1+x)dx) \right)$=

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202. $\frac{1}{16}$, a and b are in G.P , $\frac{1}{a}, \frac{1}{b}$ and 6 are in A.P then find 72(a+b)

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203. Find the maximum value of $\begin{vmatrix} \sin^2 x & 1+\cos^2 x & \cos 2x \\ 1+\sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & \sin 2x \end{vmatrix}$

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204. Let c be the locus of the mirror image of point on the parabola $y^2 = 4x$ w.r.t to line x=y . Then equation of tangent to c at p(2,1) is

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205. $f(x+1) = xf(x), g(x) = \ln(f(x))$ find $|g''(5) - g''(1)|$:

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206. C_1 and C_2 are two curves intersecting at $(1, 1), C_1$ satisfy $\frac{dy}{dx} = \frac{y^2 - x^2}{2xy}$ and C_2 satisfy $\frac{dy}{dx} = \frac{2xy}{-y^2 + x^2}$ then area bounded by these two curves is

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207. A six digit number is formed by the numbers 0, 1, 2, 3, 4, 5, 6, without repetition Then the probability that the number is divisible by 3 is

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208. ABCD is a rectangle .It has 5,6,7,9 points on AD ,BC ,CD, AB respectively. if α is number of Δ formed by taking one point from each side and β is number of quadrilaterals formed by one point from each side, then $|\beta - \alpha|$ =

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209. $P(x) = x^2 + bx + c, \int_0^1 P(x)dx = 1$ where $P(x)$ is divisible by (x-2) then rem. is 5,9 (b+c)= ?

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210. x,y,z be a point on plane passing through (42,0,0),(0,42,0),(0,0,42) then value of

$$\frac{x-11}{(y-19)^2\cdot(z-12)^2}+\frac{y-19}{(x-11)^2\cdot(z-12)^2}+\frac{z-12}{(x-11)^2\cdot(y-19)^2}+3-\frac{x}{14(x-11)\cdot}$$

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211. If the points of interscetions of ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the circle $x^2+y^2=4b, b>4$ lie on the curve $y^2=3x^2$ then b is equal to

A. 12

B. 6

C. 10

D. 5

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212. If m is slope of common tangent of two curves $4x^2 + 9y^2 = 25$ and $4x^2 + 16y^2 = 31$ then find the value of the m^2 equal to

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213. $2^{\frac{(|z|+3)\cdot(|z|-1)}{|z|+1}} \geq \log_{\sqrt{2}}\left|5\sqrt{7}+9i\right|$. Find the minimum value of $|z|$

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214. $f(x) = \begin{cases} \dfrac{\cos^{-1}\left(1-\left\{x^2\right\}\right)\cdot\sin^{-1}(1-\{x\})}{(\{x\}(1-\{x\})(1+\{x\}))} & x \neq 0 \\ \alpha & x = 0 \end{cases}$; $x \neq 0$ .Find α if `f(x) is continuous at x=0

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215. A={2,3 , 4 , 5 . . . ,30} order pair (a,b)R(c,d) are equivalence if ad=cb then find number of elements equivalent to (4,3) is

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216. Two sides of triangle ABC are 5 and 12. Area of $\Delta ABC = 30$ Find 2R+r where R is circumradius and r is inradius.

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217. $\int_0^{10}[x]\dfrac{e^{[x]}}{e^{x-1}}dx$ where $[x]$ is GIF

A. $9(e-1)$

B. $9(e+1)$

C. $45(e-1)$

D. $45(e+1)$

Answer: C

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218. Find the interval in which $f(x) = \log_e\left|\frac{x-1}{x+1}\right| - \frac{2}{x-1}$ is increasing

A. $(-\infty, -1) \cup [0, 1) \cup (1, \infty)$

B. $(-1, 0) \cup [0, 1) \cup (1, \infty)$

C. $(-1, -\infty)$

D. $(-\infty, -1) \cup (-1, 1)$

Answer: A

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219. If $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$ and a vector $\vec{c}$ perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c}.\left(\hat{i} - \hat{j} + 3\hat{k}\right) = 8$ then find the value of $\vec{c}\cdot\left(\vec{a} \times \vec{b}\right)$

A. 90

B. -88

C. 80

D. 78

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220. Number of solution of equation

$\sin^{-1}\left(\frac{3x}{5}\right) + \sin^{-1}\left(\frac{4x}{5}\right) = \sin^{-1}x, x \in [-1, 1]$ is

A. 0

B. 1

C. 2

D. 3

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221. Points (1,-1,2) is the foot of perpendicular drawn from point (0,3,1) on the line $\frac{x-a}{l} = \frac{y-2}{3} = \frac{z-b}{4}$ find the shortest distance between this line and the line $\frac{x-1}{3} = \frac{y-2}{4} = \frac{z-3}{5}$

A. $\frac{61}{\sqrt{1314}}$

B. $\frac{71}{\sqrt{1314}}$

C. $\frac{91}{\sqrt{1314}}$

D. $\frac{31}{\sqrt{1314}}$

Answer: A

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222. If $S_n(x) = \log_{a^{1/2}} x + \log_{a^{1/3}} x + \log_{a^{1/6}} x + \log_{a^{1/11}} x + \ldots$ also $S_{24}(2x) = 1093$ and $S_{12}(2x) = 265$ then find a

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223. Consider 3 points A(-1,1) , B(3,4) and C(2,0) . The line $y = mx + c$ cuts line AC and BC at points P and Q res. If the area of $\Delta ABC = A_1$ and area of $\Delta PQC = A_2$ and $A_1 = 3A_2$ then positive value of m is

A. 1

B. $\frac{4}{15}$

C. 2

D. $\frac{15}{4}$

Answer: A

Watch Video Solution

224. Find inverse of $y = x^{\log 5}$

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225. $4+\dfrac{1}{\left(5+\dfrac{1}{4+\left(\dfrac{1}{5+\ldots\infty}\right)}\right)}=$

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226. $\cot^{-1}(\alpha)=\cot^{-1}(2)+\cot^{-1}(8)+\cot^{-1}(18)+\cot^{-1}(32)+\ldots$ then α=?

A. 1.03

B. 1

C. 1.01

D. 1.02

Answer: B

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227. $A = \begin{bmatrix} \sin\alpha & 0 \\ 0 & \sin\alpha \end{bmatrix}$ and $\det\left(A^2 - \frac{1}{2}I\right) = 0$, then a possible value of α is

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228. $kx + y + z = 1, x + ky + z = k, x + y + kz = k^2$ be the system of equations with no solution , then k=

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229. Two dice with faces $1, 2, 3, 5, 7, 11$ when rolled . Find the probability that the sum of the top faces is less than or equal to 8

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230. If $f(x) = \dfrac{\cos(\sin x) - \cos x}{x^4}$ is continuous over the domain and $f(0) = \dfrac{1}{k}$, then $k = ?$

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231. $\frac{dy}{dx} = xy - 1 + x - y, y(0) = 0$ then find $y(1)$

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232. $\left(x + x^{\log_2 x}\right)^7$ has fourth term as 4480 then x=

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233. $(2021)^{3762}$ is divided by 17 then find the remainder

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234. $\lim_{x \to 0^+} \frac{\left(\cos^{-1}\left(x - [x]^2\right)\right) \cdot \sin^{-1}\left(\left(x - [x]^2\right)\right)}{x - x^3}$

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235. Plane consisting of y-axis and passing through $(1, 2, 3)$

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236. The line $2x - y + 1 = 0$ is tangent to the circle at the point (2, 5) and the center of the circle lies on $x - 2y = 4$. The radius of the circle is

A. $3\sqrt{5}$

B. $5\sqrt{3}$

C. $2\sqrt{5}$

D. $5\sqrt{2}$

Answer: A

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237. If the complex numbers iz, z and $z + iz$ represent the three vertices of a triangle, then the area of the triangle is

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

B. $\frac{1}{2}|z|^2$

C. 1

D. $\frac{1}{2}|z + iz|^2$

Answer: B

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238. Team A contain 7 boys and n-girls , Team B has 4 boys and 6 girls. If each boy of Team A plays one match with each boy of Team B and each girl of Team A plays one match with every girls of Team B then total number of matches are 52 . Find value of n

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239. $g(\alpha) = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin^{\alpha} x}{\sin^{\alpha} x + \cos^{\alpha} x} dx$ then which of the following is correct

A. $g(\alpha)$ is stricly increasing

B. $g(\alpha)$ is stricly decreasing

C. $g(\alpha)$ has point $\alpha = -\frac{1}{2}$ as point of inflection

D. $g(\alpha)$ is even

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240. $\tan^{-1}(x+1) + \cot^{-1}\left(\frac{1}{x-1}\right) = \tan^{-1}\left(\frac{8}{31}\right)$ then sum of all the values x satisfying

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241. $x^2 + y^2 - 10x - 10y + 41 = 0$ and $x^2 + y^2 - 16x - 10y + 80 = 0$ are two circle which of the following is NOT correct

A. Distance between centers is equal to average of radii

B. Both circles passes through centres of each other

C. Centers of each circle is contained in other circle

D. Both circle intersect at 2 point

Answer: C

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242. $x^2 + y^2 - 10x - 10y + 41 = 0$ and $x^2 + y^2 - 24x - 10y + 160 = 0$ are two circle .Then the minimum distance between points lying on them is

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243. $\vec{a} = \alpha\hat{i} + \beta\hat{j} - 3\hat{k}, \vec{b} = -\beta\hat{i} - \alpha\hat{j} + \hat{k}, \vec{c} = \hat{i} - 2\hat{j} + \hat{k}$ where $\vec{a} \cdot \vec{b} = 1, \vec{b} \cdot \vec{c} = -3$ then find $\frac{1}{3}\left(\vec{a} \times \vec{b}\right) \cdot \vec{c}$

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244. In a triangle PQR . the co-ordinate of the point P and Q are (-2,4) and (4,-2) respectively . If the equation of the perpendicular bisector PR is 2x-y+2=0 , then centre of the circumcircle of the ΔPQR is

A. (-1,0)

B. (-2,-2)

C. (0,2)

D. (1,4)

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245. Let $4x + 3y \leq 75, 3x + 4y \leq 100, x, y \geq 0$ and $z = 6xy + y^2$. Find maximum value of z

A. 575

B. 600

C. 625

D. 675

Answer: C

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246. Let $(p \rightarrow q) \leftrightarrow (\sim q * p)$ is a tautology , then $p * \sim q$ is equivalent to

A. $(p \rightarrow q)$

B. $(p \vee q)$

C. $(p \leftrightarrow q)$

D. $p \wedge q$

Answer: A

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247. $\int_0^{\sqrt{\frac{\pi}{2}}} \left[\left[x^2 \right] + \cos x \right] dx$ (where [.] denotes greatest integer function)

A. $1 - \sqrt{\frac{\pi}{2}}$

B. $\sqrt{\frac{\pi}{2}}$

C. $1 + \sqrt{\frac{\pi}{2}}$

D. $\sqrt{\frac{\pi}{2}} - 1$

Answer: D

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248. Let 2x-7y+4z-11=0 and -3x-5y+4z-3=0` are two planes .If planes ax+by+cz-7=0 passes through the line of intersection of given planes and point (-2,1,3) , then find the value of 2a+b+c+7

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249. If

$\vec{r} \times \vec{a} = \vec{r} \times \vec{b}, \vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}, \vec{b} = 7\hat{i} + \hat{j} - 6\hat{k}, \vec{c} = \hat{i} + 2\hat{j} + \hat{k},$ and $\vec{r} \cdot \vec{c} = -3$

then find $\vec{r} \cdot \vec{a}$

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250. Let $A = \begin{bmatrix} 2 & 3 \\ 0 & -1 \end{bmatrix}$, the value of $\det\left(A^4\right) - \det\left(A^{10} - adj(2A)^{10}\right)\right)$

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251. Of the three independent event E_1, E_2 and E_3, the probability that only E_1 occurs is α, only E_2 occurs is β and only E_3 occurs is γ. If the probavvility p that none of events E_1, E_2 or E_3 occurs satisfy the equations $(\alpha - 2\beta)p = \alpha\beta$ and $(\beta - 3\gamma)p = 2\beta\gamma$. All the given probabilities are assumed to lie in the interval (0, 1). Then, $\frac{\text{probability of occurrence of } E_1}{\text{probability of occurrence of } E_3}$ is equal to

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252. 3 games are played in a school . If some students played exactly 2 games , and no student play all the 3 games , then which venn diagram can represents the above situtation

A. Only A is correct

B. A and B are correct

C. Only C is correct

D. None of these

Answer: D

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253. $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, B = \begin{bmatrix} \alpha \\ \beta \end{bmatrix}$ such that $AB = B$ and $a + d = 2021$, B is a non-zero matrix. find ad - bc

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254. $z \in C, S_1 = \left\{|z - 1| < \sqrt{2}\right\}, S_2 = \left\{Re(z(1 - i) \geq 1\right\}, S_3 = \{Im(z) < 1\}$.

Then $n\left(S_1 \cap S_2 \cap S_3\right)$

A. is a singletonset

B. Infinite set

C. Has exactly 2 elements

D. Null Set

Answer: B

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255. $\sin^{-1}\left[x^2 + \frac{1}{3}\right] + \cos^{-1}\left[x^2 - \frac{2}{3}\right] = x^2$ the number of solution in $x \in (1, -1)$ where [.] is the GIF.

A. 0

B. 2

C. 3

D. 4

Answer: A

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256. Variance of 3n observation is 4 , mean of first 2n observations is 6 and mean of next n observations is 3 . If 1 is added in first 2n observation and 1 is subtracted from last n observations than find new variance

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257. $y^2 = 4x - 20$,Tangent to this parabola at (6,2) is also tangent to $\frac{x^2}{2} + \frac{y^2}{b} = 1$ then find b

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258. $\sum_{r=0}^{6} .{}^{6}C_{r} \times {}^{6}C_{6-r} = ?$

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259. Computer is generating binary digits , Probability of '0' at odd position is $\frac{1}{3}$ and probability of '0' at even position is $\frac{1}{2}$. Find the probability that 10 is immediately followed by 01

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260. Find $\lim \theta \to 0 \dfrac{\tan\left(\pi \cdot \cos^2\theta\right)}{\sin\left(2\pi \sin^2\theta\right)}$

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261. $\int_0^{10} \frac{[\sin 2\pi x]}{e^{-[x]+x}} dx = \alpha e^{-1} + \beta e^{-\frac{1}{2}} + \gamma$. then find $\alpha + \beta + \gamma$

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262. $x + 2\tan x = \frac{\pi}{2}$ Find the no. of values of x if $x \in [0, 2\pi]$

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263. $f(x) = \begin{cases} \left(2 - \sin\left(\frac{1}{x}\right)\right)|x| & x \neq 0 \\ 0 & x = 0 \end{cases}$

A. Monotonic in $(-\infty, 0) \cup (0, \infty)$

B. Not Monotonic in $(-\infty, 0) \cup (0, \infty)$

C. Monotonic in $(-\infty, \infty)$

D. Not Monotonic in $(-\infty, \infty)$

Answer: B

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264. $\lim_{n \to \infty} \frac{[r] + [2r] + \ldots + [nr]}{n^2}$

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265. $f(x) = e^{-x}\sin x$, $F(x) = \int_0^x f(t)dt$, .Find $\int_0^1 e^x(F'(x) + f(x))dx$ lies in interval

A. $\left(\frac{330}{360}, \frac{331}{360}\right)$

B. $\left(\frac{327}{360}, \frac{329}{360}\right)$

C. $\left(\frac{335}{360}, \frac{336}{360}\right)$

D. None of these

Answer: A

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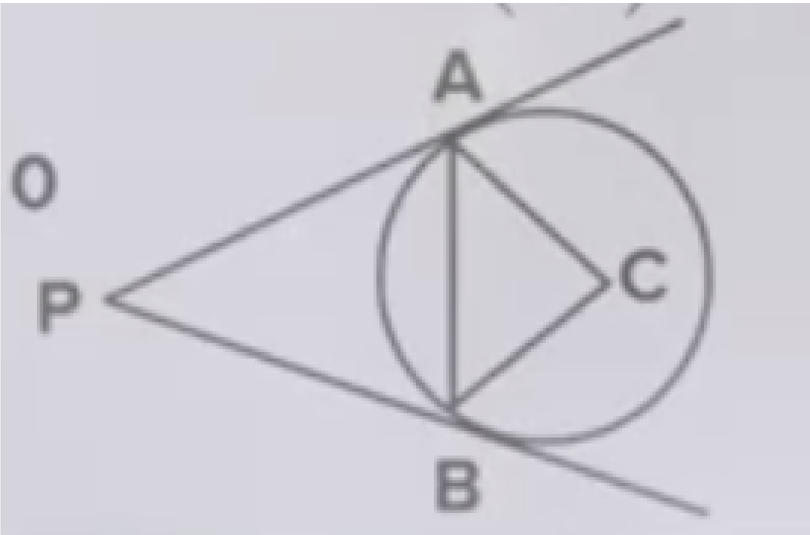
266. Angle between tangents is $\tan^{-1}\left(\frac{12}{5}\right)$, ratio of $ar\Delta PAB$ and $ar\Delta CAB =$

$x^2 - y^2 - 2x - 4y + 4 = 0$



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267. Tangent at A(3,4) of circle $x^2 + y^2 = 25$ meet x and y axis at P and Q if a circle having centre as incentre of ΔOPQ and passing through origin has radius r then r^2 is

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268. A triangle ABC in which side AB,BC,CA consist 5,3,6 points respectively, then the number of triangle that can be formed by these points are

A. 360

B. 333

C. 396

D. 320

Answer: B

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269. $If(p \wedge q) \otimes (p \oplus q)$ is a tautology, then

A. $\otimes$ $is \rightarrow$ and $\oplus$ is $\vee$

B. $\otimes$ is $\wedge$ and $\oplus$ is $\wedge$

C. $\otimes$ is $\vee$ and $\oplus$ is $\vee$

D. $\otimes$ is $\vee$ and $\oplus$ is $\wedge$

Answer: A

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270. If $\sin^{-1}\left[x^2 + \frac{1}{3}\right] + \cos^{-1}\left[x^2 - \frac{2}{3}\right] = x^2$ then number of values of $x \in [-1, 1]$ is/are (where [.] is GIF)

A. 0

B. 1

C. 2

D. 3

Answer: A

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271. If $\begin{vmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{vmatrix} = 0$ and x,y,z are in A.P with common difference d , $x \neq 3d$ then value of k^2 is

A. 36

B. 72

C. 6

D. $6\sqrt{2}$

Answer: B

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272. Tangent at A(3,4) of circle $x^2 + y^2 = 25$ meet x and y axis at P and Q if a circle having centre as incentre of ΔOPQ and passing through origin has radius r then r^2 is

A. $\dfrac{625}{72}$

B. $\frac{625}{256}$

C. $\frac{625}{64}$

D. $\frac{625}{32}$

Answer: A

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273. If curve $y(x)$ satisfied by differential equation $2\left(x^2 + x^{\frac{5}{4}}\right)dy - y\left(x + x^{\frac{1}{4}}\right)dx = 2x^{\frac{9}{4}}dx$ and passing through $\left(1, \frac{4}{3} - \ln 2\right)$, then value of $y(16)$ is

A. $\frac{128}{3} - \frac{16}{3}\ln 9 + \frac{4}{3}\ln 2$

B. $\frac{64}{3} - \frac{16}{3}\ln 9 + \frac{2}{3}\ln 2$

C. $\frac{128}{3} + \frac{16}{3}\ln 9 - \frac{4}{3}\ln 2$

D. $\frac{64}{3} + \frac{16}{3}\ln 9 - \frac{2}{3}\ln 2$

Answer: A

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274. If $\cos x(3\sin x+\cos x+3)dy=dx+y\sin x(\cos x+3+3\sin x)dx$ then $y\left(\frac{\pi}{3}\right)$ equal to

A. $2\ln\left(\frac{1+\sqrt{3}}{1+2\sqrt{3}}\right)$

B. $2\ln\left(\frac{1+2\sqrt{3}}{1+\sqrt{3}}\right)$

C. $\ln\left(\frac{2\sqrt{3}-1}{1+\sqrt{3}}\right)$

D. $\ln\left(\frac{\sqrt{3}-1}{1+2\sqrt{3}}\right)$

Answer: A

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275. If image of point A(2,3,1) in the lines $\frac{x-1}{2}=\frac{y-4}{1}=\frac{z+3}{-1}$ lies on the plane $\alpha x+\beta y+\gamma z=24$ also the line $\frac{x-1}{1}=\frac{1-y}{2}=\frac{z-6}{15}$ lies in the plane then $\alpha + \beta + \gamma = ?$

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276. The number of solution of the equation $|\cot x| = \cot x + \frac{1}{\sin x}(0 \leq x \leq 2\pi)$ is

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277. Find the equation of the planes parallel to the planes $x - 2y + 2z = 3$ which is at a unit distance from the point$(1, 2, 3)$.

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278. $f(x) = \int \frac{5x^8 + 7x^6}{\left(x^2 + 1 + 2x^7\right)^2}dx$, if $f(0) = 0$ then find $f(1) = \frac{1}{k}$. Then k is

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279. $f(x) = \frac{\operatorname{cosec}^{-1}x}{\sqrt{x^2 - [x]^2}}$ Find the domain

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280. $f(x) = \sqrt{x}, g(x) = \sqrt{1 - x}$ find common domain of $f + g, f - g, \frac{f}{g}, \frac{g}{f}$

A. $x \in (0, 1)$

B. $x \in [0, 1)$

C. $x \in [0, 1]$

D. $x \in (0, 1]$

Answer: A

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281. Form the differential equation, if $y^2 = 4a(x + b)$, where a,b are arbitary constants.

A. $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$

B. $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) - y = 0$

C. $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) + y = 0$

D. None of these

Answer: A

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282. If $\left(1 + x + 2x^2\right)^{20} = a_0 + a_1x + a_2x^2 + \ldots + a_{40}x^{40}$ then $a_1 + a_3 + a_5 + \ldots + a_{37} =$

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283. $\frac{1}{3^2 - 1} + \frac{1}{5^2 - 1} + \frac{1}{7^2 - 1} + \ldots + \frac{1}{201^2 - 1}$ is equal to

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284. Find the value of $3+\frac{1}{4+\left(\frac{1}{3+\frac{1}{4+\frac{1}{3+\ldots\infty}}}\right)}$ is equal to

A. $4+\sqrt{3}$

B. $1.5+\sqrt{3}$

C. $2+\sqrt{3}$

D. $3+2\sqrt{3}$

Answer: B

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285. The sum of all the 4-digit distibct numbers that can be formed with the digit 1,2,2and 3 is

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286. The number of integral value of m so that the abscissa of point of intersection of lines 3x+4y=9 and y=mx+1 is also an integers is

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287. M,N,O,P are circle $x^2 + y^2 = 1, x^2 + y^2 - 2x = 0, x^2 + y^2 - 2y = 0, x^2 + y^2 - 2x - 2y = 0$ Centers of thses circles are joined then shape formed is

A. rhombus

B. rectangle

C. square

D. Parallelogram

Answer: C

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288. $\lim_{x \to 0} \frac{\sin^{-1}x - \tan^{-1}x}{3x^3} = L$ then find (6L+1)

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289. Find the number of times 3 appeared in all the numbers from 1 to 1000

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290. $\vec{a}$ has components 3P and 1 in rectangular cartesian system. $\vec{a}$ is rotated counterclockwise about origin such that its components now become $\sqrt{10}$ and $P+1$ then a value of "P" is

A. $-\frac{5}{4}$

B. $\frac{4}{5}$

C. 1

D. -1

Answer: D

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291. $f(x) = \begin{cases} \frac{1}{|x|} & |x| \geq 1 \\ ax^2 + b & |x| < 1 \end{cases}$ Find the possible value of a and b given that $f(x)$ is differentiable at x=1

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292. There are 25 teacher in a school , the average age of teacher is 40. If a teacher of 60 years of age is retired than a new teacher is appointed in place of him and the average decreases to 39 . find the age of teacher appointed

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293. If $I = \int \left(\frac{(2x - 1)\cos\left(\sqrt{4x^2 - 4x + 6}\right)}{\sqrt{4x^2 - 4x + 6}} \right) dx$

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

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295. $x^2 + y^2 - 10x - 10y + 41 = 0$ and $x^2 + y^2 - 22x - 10y + 137 = 0$

A. Meet at 1 point

B. Meet at 2 points

C. Does not meet

D. have same center

Answer: A

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296. The values of x in $(0, \pi)$ satisfying the equation.

$$\begin{vmatrix} 1+\sin^2 x & \sin^2 x & \sin^2 x \\ \cos^2 x & 1+\cos^2 x & \cos^2 x \\ 4\sin 2x & 4\sin 2x & 1+4\sin 2x \end{vmatrix} = 0, \text{ are}$$

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297. $100^{\alpha} - 199\beta = 100(100) + 99(101) + 98(102) + \ldots + 1(199)$. then find the slope of line with point (α, β) and origin.

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298. If z_1 and z_2 are the roots of the equation $z^2 + az + 12 = 0$ and z_1, z_2 forms an equilateral triangle with origin. Find $|a|$

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299. Find the equation of line passing through (1,3) and inclined at angle $\tan^{-1}\left(\sqrt{2}\right)$ with $y = 3\sqrt{2}x + 1$

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300. Let P_1 be the plane $x - 2y + 2z = 0$ and a point $A(1, 2, 3)$. Let there be another plane P_2 which is parrallel to P_1 and at unit distance from A. If P_2 is $ax + by + cz + d = 0$ then +ve value of $\left(\frac{b - d}{c - a}\right)$

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301. Four points lying on the curves $x^2y^2 = 1$ form a square such that mid-points os sides also lies on the given curve. Find the square of area of the square

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302. If $2A + B = \begin{bmatrix} 0 & 0 & 3 \\ 10 & 1 & 9 \\ -1 & 4 & 0 \end{bmatrix}$ and $A - 2B = \begin{bmatrix} 0 & -5 & 9 \\ -5 & 3 & 2 \\ -3 & 2 & 0 \end{bmatrix}$ Find the value of

$\left(t_r(A) - t_r(B)\right)$

A. 1

B. -2

C. -1

D. 2

Answer: D

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303. Let system of equation $\alpha u + \beta v + \gamma w = 0, \beta u + \gamma v + \alpha w = 0, \gamma u + \alpha v + \beta w = 0$ has non trial solution and α, β, γ are distinct root $x^3 + ax^2 + bx + c = 0$ then find value of $\frac{a^2}{b}$

A. 0

B. 1

C. 2

D. 3

Answer: A

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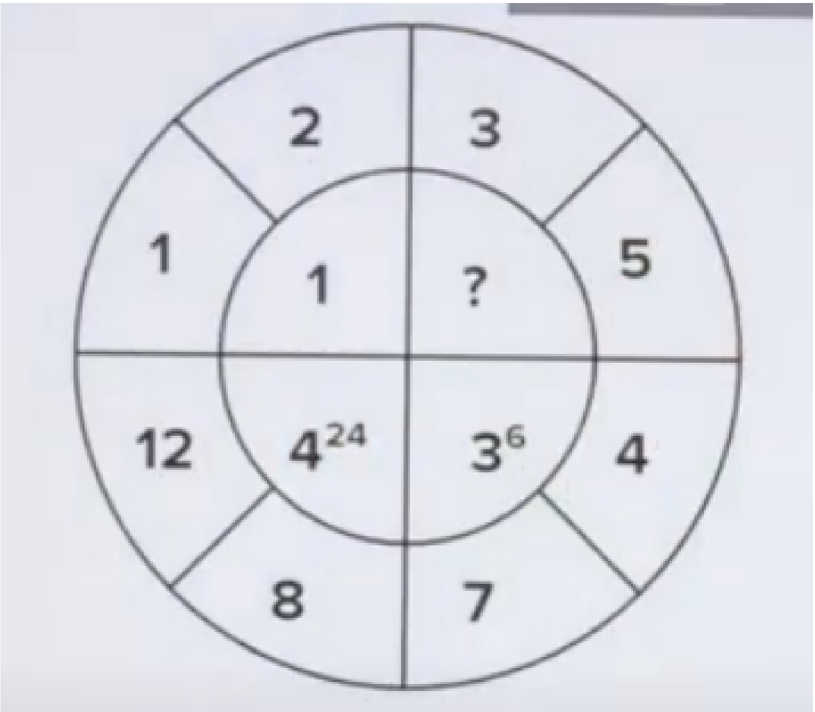
304. Find the missing terms in



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305. If S_1 is the sum of first 2n terms and S_2 is the sum of first 4n term and S_2 - S_1 is equal to 1000 then S_3 sum of first 6n terms of same A.P

A. 3000

B. 5000

C. 7000

D. 9000

Answer: A

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306. $z = -1 + \sqrt{3}i, \omega$ is complex number such that $|z\omega| = 1, arg(z) - arg(w) = \frac{\pi}{2}$ .Find area of triangle made

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307. Find locus of centre of circle which touches between $x^2 + y^2 = 9$ internally and $(x - 2)^2 + y^2 = 1$ externally

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308. Out of 2n terms , n terms are 'a' and rest are '-a'. If we add 'b' to all the terms than mean is 5 and standard deviation is 20 then $a^2 + b^2 = ?$

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309. $xdy - ydx = \sqrt{x^2 - y^2}dx, y(1) = 0.$ then area curve above x-axis on $x \in \left[1, e^{\pi}\right]$ is

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310. $\vec{a}$ and $\vec{b}are \perp$ vector $|\vec{a}| = |\vec{b}| = 1$ then angle between $\vec{a} + \vec{b} + \left(\vec{a} \times \vec{b}\right)$ and $\vec{a}$

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311. $f: R \rightarrow R$ defined by $f(x). f(y) = f(x + y) \forall x, y \in R$ and $f(x) \neq 0$ for $x \in R$, f is differential at x=0 and $f'(0) = 3$ then $\lim_{h \rightarrow 0}\frac{1}{h}[f(h) - 1] =$

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312. There are 5 independent trials , probability of exactly one success is 0.4096 , probability of exactly 2 success is 0.2048. Find probability of exactly 3 success

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313. $\left(\dfrac{x+1}{x^{\frac{2}{3}} - x^{\frac{1}{3}} + 1} - \dfrac{x-1}{x + x^{\frac{1}{2}}}\right)^{10}$ find term independent of x

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314. $P(x)$ is a polynomial such that $P(x) = f\left(x^3\right) + xg\left(x^3\right)$, $P(x)$ is divided by $x^2 + x + 1$ Find the value of $P(1)$.

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315. $\frac{x^2}{27} + y^2 = 1$tangent is drawn at $\left(3\sqrt{3}\cos\theta, \sin\theta\right)$. If tangent meet x-axis and y-axis at A and B . Minimumvalue of sum of intercepts is at θ

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{8}$

D. $\frac{\pi}{3}$

Answer: A

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316. One side of equilateral triangle is $x + y = 3$, centroid is $(0, 0)$, then $r + R =$ (where r is inradius and R is circumradius)

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317. 10,7,8 are sides of triangle . Find projection of side of length '10' on '7' is

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318. $4y^2 = x^2(4 - x)(x - 2)$, find area bounded by curve

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319. If $15\sin^4\alpha + 10\cos^4\alpha = 6$, then $27\sec^6\alpha + 8cosec^6\alpha =$

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320. If $P = \begin{bmatrix} 2 & -1 \\ 5 & -3 \end{bmatrix}$ and $P^n = 5I - 8P$ then value of n is

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321. If If $g(x) = \int_0^x f(t)dt$ where $f(x)$ is a continuous functions on [0,3] such that $\forall x \in [0, 1], f(x)$ has ranges $\left[\frac{1}{3}, 1\right]$ and $\forall x \in (1, 3], f(x)$ has ranges $\left[0, \frac{1}{2}\right]$ Then the maximum range in which $g(x)$ can lie is

A. $\left[\frac{1}{3}, 2\right]$

B. $(1, 2)$

C. $\left[\frac{5}{6}, 3\right]$

D. $\left[1, \frac{4}{3}\right]$

Answer: A

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322. Which of the following is a tautology

A. $((p \rightarrow q) \wedge \sim q) \rightarrow p \wedge q$

B. $((p \rightarrow q) \wedge \sim q) \rightarrow p$

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

D. $((p \rightarrow q) \wedge \sim q) \rightarrow \sim q$

Answer: D

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323. If system of equation $4x - \lambda y + 2z = 0, 2x + 2y + z = 0, \mu x + 2y + 3z = 0$ has non trivial solution than

A. $\lambda = 6, \mu = 2$

B. $\lambda \in R, \mu = 6$

C. $\lambda = 5, \mu \in R$

D. None of these

Answer: B

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324. Let the curve is $x^2 - 2y^2 = 4$ Tangent drawn at $P\left(4, \sqrt{6}\right)$ cuts the x-axis at R and latus rectum at $Q\left(x_1, y_1\right)\left(x_1 > 0\right)$, F be focus nearest to P. Then $ar\Delta QPF$

A. $2 - \dfrac{\sqrt{6}}{7}$

B. $2 - \dfrac{\sqrt{6}}{2}$

C. $\dfrac{3}{2}$

D. $\dfrac{\sqrt{6}}{2}$

Answer: B

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325. If $\dfrac{dy}{dx} = (y + 1)\left[(y + 1)e^{\frac{x^2}{2}} - x\right], y(0) = 2 then y'(1)$ is equal to

A. $\dfrac{15}{4\sqrt{e}}$

B. $\dfrac{13}{2\sqrt{e}}$

C. $\dfrac{15}{7\sqrt{e}}$

D. $\dfrac{17}{4\sqrt{e}}$

Answer: A

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326. Let A and B are two square matrix of order n. A relation R is defined such that $R = \{(A, B) : A = P^{-1}BP$ for some invertible P} , then R is

A. equivalence

B. reflexive only

C. symmetric only

D. transitive only

Answer: A

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327. Let

$f: R - \{3\} \rightarrow R\{1\}: f(x) = \dfrac{x - 2}{x - 3}$ and $g: R \rightarrow R, g(x) = 2x - 3$ and $f^{-1}(x) + g^{-1}(x)$

then sum of all value of x is

A. 2

B. 3

C. 5

D. 7

Answer: C

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328. In a ΔABC whose cicumradius is 2 . A pole standing inside the ΔABC and angle of elevation of top of the pole from points A,B,C is 60° then find height of pole

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329. Image of point (1,3,a) in the plane $\vec{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)-b=0 is(-3,5,2)$ then $|a+b|$

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330. $f(x)=\begin{cases}\frac{\sin(a+1)x+\sin 2x}{2x} & x<0\\ b & x=0\\ \frac{\sqrt{x-bx^3}-\sqrt{x}}{bx^{\frac{5}{2}}} & x>0\end{cases}$,$f(x)$ is a continous at $x=0$ then $|a+b|$ is equal to

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331. $\sum_{k=0}^{10}\left(2^k+3\right)^{10}C_k=\alpha\cdot 2^{10}+\beta\cdot 3^{10}$ then value of $\alpha+\beta$

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332. Let $f(x)$ be a cubic polynomial such that it has maxima at x=-1 , min at x=1 , $\int_{-1}^{1} f(x)dx = 18, f(2) = 10$ then find the sum of coff. of $f(x)$

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333. Total number of integral terms in $\left(4^{\frac{1}{4}} + 5^{\frac{1}{6}}\right)^{120}$ is _______

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334. Find $\int_{-1}^{1} \ln\left(\sqrt{1 - x} + \sqrt{1 + x}\right)dx$

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335. A tangent and normal are drawn to a curve $y^2 = 2x$ at A(2,2). Tangent cuts x-axis at point T and normal cuts curve again at P . Then find the value of ΔATP

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336. Find the coefficient of x^{256} in $(1 - x)^{101} \cdot \left(x^2 + x + 1\right)^{100}$

A. ${}^{100}C_{15}$

B. $-{}^{100}C_{15}$

C. ${}^{100}C_{18}$

D. ${}^{100}C_{16}$

Answer: B

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337. If in $\Delta ABC \cos B = \frac{3}{5}, AB = 5$ and $R = 5$ (R is circumradius). then find area of Δ

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338. Let $y = mx + c, m > 0$ be the focal chord of $y^2 = -64x$ which is tangent to $(x + 10)^2 + y^2 = 4$ then the value of $\left(4\sqrt{2}(m + c)\right.$ is =

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339. If the shortest distance between the lines is equal to 9

$\vec{r}_1 = \alpha\hat{i} + 2\hat{j} + 2\hat{k} + \lambda\left(\hat{i} - 2\hat{j} + 2\hat{k}\right), \lambda \in R, \alpha > 0$

and $\vec{r}_2 = -4\hat{i} - \hat{j} + \mu\left(3\hat{i} - 2\hat{j} - 2\hat{k}\right), \mu \in R,$ is a then α is

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340. $x^2 + 3^{\frac{1}{4}}x + \sqrt{3} = 0$ where α and β are roots of equation then find the value of $\alpha^{96}\left(\alpha^{12} - 1\right) + \beta^{96}\left(\beta^{12} - 1\right)$

A. $3^{24} \cdot 52$

B. $3^{24} \cdot 56$

C. $3^{25} \cdot 52$

D. $3^{25} \cdot 56$

Answer: A

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341. Form a team of 15 players , 6 are bowlers , 7 are batsman ,2 are wicket keepers. Find the number of ways to form a team of 11 players having atleast 4 bowlers 5 batsman , 1 wicket keeper.

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342. The word EXAMINATION is given then find the probability that the M is at the $4th$ place

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343. $\vec{a}, \vec{b}, \vec{c}$ are mutually $\perp$ unit vectors equally inclined to $\vec{a} + \vec{b} + \vec{c}$ at an angle θ then find the value of $36\cos^2(2\theta)$

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344. $\int_0^a e^{x - [x]} dx = 10e - 9$ then find a

A. $10 + \ln(1 + e)$

B. $10 - \ln(1 + e)$

C. $10 + \ln(2)$

D. $10 + \ln(3)$

Answer: C

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345. $|z \cdot \omega| = 1, arg(z) - arg(\omega) = \frac{3\pi}{2}$. Find the $arg\left[\frac{1 - 2\bar{z}\omega}{1 + 3\bar{z}\omega}\right]$

A. $\frac{\pi}{4}$

B. $-\frac{\pi}{4}$

C. $\frac{3\pi}{4}$

D. $-\frac{3\pi}{4}$

Answer: D

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346. $\lim_{x \to 0}\left(2 - \cos x\sqrt{\cos 2x}\right)^{\frac{x^2+2}{x}} = e^{\alpha}$, then $\alpha =$

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347. The mean of 6 number is 6.5 and its variance is 10.25 . If 4 numbers are 2,4.5 and 7 , then find the other two

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348. If $f(x) = \begin{cases} \sin x - e^x & x < 0 \\ a + [-x] & 0 \leq x < 1 \\ 2x - b & x \geq 1 \end{cases}$ is continuous in $(-\infty, 1]$, find the value of a+b

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349. The number of solution of $\tan^{-1}\left(\sqrt{x(x-1)}\right) + \sin^{-1}\left(\sqrt{x^2 + x + 1}\right) = \frac{\pi}{2}$ are

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350. The logical equivalence of the boolean expression $\sim(p \wedge \sim q) \vee (q \vee \sim p)$

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351. $a_{ij} = \begin{cases} 1 & i = j \\ -x & |i - j| = 1 \\ 2x + 1 & otherwise \end{cases}$, $A = \{a_{ij}\}_{3 \times 3} f(x) = \det(A)$. then sum of maximum and minimum vaues of f(x) is

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352. If $f(x) = 3x - 2$ and $(gof)^{-1} = x - 2$ then find the function of $g(x)$

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353. Coefficient of $a^3b^4c^5$ in expansion of $(bc + ca + ab)^6$

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354. Let a,b,c,d be in A.P with common difference λ. If

$$\begin{vmatrix} x + a - c & x + b & x + a \\ x - 1 & x + c & x + b \\ x - b + d & x + d & x + c \end{vmatrix} = 2 \text{ then } \lambda^2 = .$$

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355. The probabillity of selecting integers $a \in [-5, 30]$, such that $x^2 + 2(a+4)x - 5a + 64 > 0$, for all $x \in R$ is

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356. The probabillity of selecting integers $a \in [-5, 30]$, such that $x^2 + 2(a+4)x - 5a + 64 > 0$, for all $x \in R$ is

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357. $x\frac{dy}{dx} \cdot \tan\left(\frac{y}{x}\right) = y\tan\left(\frac{y}{x}\right) - x, y\left(\frac{1}{2}\right) = \frac{\pi}{6}$ then the area bounded by $x = 0, x = \frac{1}{\sqrt{2}}, y = y(x)$

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358. A continuous and differentiable function $f(x)$ is increasing in $\left(-\infty, \frac{3}{2}\right)$ and decreasing in $\left(\frac{3}{2}, \infty\right)$ then $x = \frac{3}{2}$ is

A. point if local maxima

B. point of local minima

C. point of inflection

D. None of these

Answer: A

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359. $\vec{a} \cdot \vec{b} = \left|\vec{a} \times \vec{b}\right|$ then $\left|\vec{a} - \vec{b}\right|$ is

A. $\sqrt{a^2 + b^2 + \sqrt{2}ab}$

B. $\sqrt{a^2 + b^2 - \sqrt{2ab}}$

C. $\sqrt{a^2 + b^2 + \sqrt{2ab}}$

D. $\sqrt{a^2 + b^2 - \sqrt{2}ab}$

Answer: D

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360. If (α, β) is the point on $y^2 = 6x$, that is closest to $\left(3, \frac{3}{2}\right)$ then find the value of $2(\alpha + \beta)$

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361. If $f(x) = x + 1.$ Find

$$\lim_{n \to \infty} \frac{1}{n}\left(1 + f\left(\frac{5}{n}\right) + f\left(\frac{10}{n}\right) + \ldots + f\left(5\left(\frac{n-1}{n}\right)\right)\right)$$

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362. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} [[x] + \sin x]dx = ?$

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363. $f(x) = x^3 - 3x^2 - \frac{3}{2}f'(2) + f'(1)$ is double differenciation function then find the sum of all minimas

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364. $Re\left\{(1 + \cos\theta + 2i\sin\theta)^{-1}\right\} = 4$ then find θ

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365. If ΔABC is right angled triangle with a,b and c and smallest angle θ. If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are also the sides of right angled triangle then find the $\sin\theta$

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366. If $f(x) = \frac{5x + 3}{6x - a}$ and $f(f(x)) = x$ then value of a is

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367. If $\log_{9\frac{1}{2}} x + \log_{9\frac{1}{3}} x + \ldots$ upto 21 terms = 504 . Find x

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368. $\lim_{x \to 0} \frac{\alpha e^x + \beta \ln(1+x) + \gamma e^{-x}}{x \sin^2 x} = 10$ then find $(\alpha + \beta + \gamma)$

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369. Probability of only one of A and B is 1-k

Probability of only one of A and C is 1-2k

Probability of only one of C and B is 1-k

$P(A \cap B \cap C) = k^2, k \in (0, 1)$ then Find $P(A \cup B \cup C)$

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370. If a,b,7,10,11,15, mean=10, variance=$\frac{20}{3}$ and variance is then find value of a and b

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371. $g(t)=\begin{cases}\max\left(t^3-6t^2+9t-3,0\right) & t\in[0,3]\\ 4-t & t\in(3,4)\end{cases}$, find the point of non-differentiability

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372. If element of matrix A is defined as $A=\left[a_{ij}\right]_{3\times3}$ where $A=\begin{cases}(-1)^{j-i} & i<j\\ 2 & i=j\\ (-1)^{j+i} & i>j\end{cases}$, then the value of $\left|3Adj\left(2A^{-1}\right)\right|$ is

A. 72

B. 36

C. 108

D. 48

Answer: C

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373. In a $\triangle ABC$ if $|\overrightarrow{AB}| = 7, |\overrightarrow{BC}| = 5,$ and $|\overrightarrow{CA}| = 3.$. If the projection of $\overrightarrow{BC}$ on $\overrightarrow{CA}$ is $\frac{n}{2}$, then the value of n is

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374. The value of $\tan\left(2\tan^{-1}\left(\frac{3}{5}\right) + \sin^{-1}\left(\frac{5}{13}\right)\right)$ is

A. $\frac{220}{21}$

B. $\frac{110}{21}$

C. $\frac{55}{21}$

D. $\frac{20}{11}$

Answer: A

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375. The value of x satisfying the equation $\log_{x+1}\left(2x^2+7x+5\right)+\log_{2x+5}(x+1)^2=4$ is

A. -2

B. 2

C. -4

D. 4

Answer: B

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376. If $A=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ $B=\sum_{r=1}^{2021} A^r$ then value of $|B|$ is

A. 2021

B. $(2021)^2$

C. -2021

D. 0

Answer: A

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377. A:if 2+4=7 , then 3+4=8

B:if 3+5=8,then earth is flat

C:If A and B are true then 5+4=11

A. A is true B and C are false

B. B is true A and C are false

C. C is true B and A are false

D. B is false A and C are true

Answer: D

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378. If $x = ay - 1 = z - 2,$ and $x = 3y - 2 = bz - 2$ lie in same plane then the value of a and b is

A. a=2,b=3

B. a=1,b=1

C. $b = 1, a \in R - \{0\}$

D. a=3,b=2

Answer: C

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379. Two circle pass through $(-1, 4)$ and their centres lie on $x^2 + y^2 + 2x + 4y = 4$. If r_1 and r_2 are maximum and minimum radii and $\frac{r_1}{r_2} = a + b\sqrt{2}$ then value of a+b is

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380. The number of solution of $\sin^7 x + \cos^7 x = 1, x \in [0, 4\pi]$

A. 7

B. 11

C. 9

D. 5

Answer: D

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381. Let S_n denote sum of first n-terms of an A.P where $S_{10} = 530, S_5 = 140$ then find S_{20} -S_6

A. 1872

B. 1842

C. 1852

D. 1862

Answer: D

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382. Find the domain of $f(x) = \dfrac{\cos^{-1}\left(\sqrt{x^2 - x + 1}\right)}{\sqrt{\sin^{-1}\left(\frac{2x-1}{2}\right)}}$ is the integral $(\alpha, \beta]$ then $\alpha + \beta$

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383. $11^n > 10^n + 9^n$ then number of integers satisfy the relation when $n \in \{1, 2, 3, \ldots 100\}$

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384. How many number can be formed by using digits 0,2,4,6,8 greater then 10000 where repetition of digits are not allowed

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385. $A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, number of matrices 'B' which can be formed such that $AB = BA$ where B can have elements $\{1, 2, 3, 4, 5\}$

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386. 4 dies are rolled , outcomes of dies are filled in 2×2 matrices. Find the probability that the matrices is nonsingular and all entries are different.

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387. If $E_1 : \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a > b. E_2$ is an ellipse which touches E_1 at the ends of major axis of E_1 and end of major axis of E_1 are the focii of E_2 and the eccentricity of both the ellipse are equal then find e

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388. Find the interval where $f(x) = \begin{cases} -\frac{4}{3}x^3 + 2x^2 + 3x & x > 0 \\ 2xe^x & x \leq 0 \end{cases}$ increasing

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389. $\int \frac{e^x\left(2 - x^2\right)}{(1 - x)\sqrt{1 - x^2}}dx$

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390. If $[x]$ denotes the greatest integer function and $\left[e^x\right]^2 + \left[e^x + 1\right] - 3 = 0$ then $x \in$

A. $(1, e)$

B. $\left(1, \frac{1}{e}\right)$

C. $\left(\log_e 2, \log_e 3\right)$

D. $\left[0, \log_e 2\right)$

Answer: D

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391. Let ω be a cube of unity . If $r_1, r_2,$ and r_3 be the numbers obtained on the die. Then probability of $\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$ is

A. $\frac{1}{18}$

B. $\frac{1}{9}$

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

D. $\frac{1}{36}$

Answer: C

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392. $\left(2x^r + \frac{1}{x^2}\right)^{10}$ terms independent of x is 180 , find the value of r

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393. If $36x^2 + 36y^2 - 108x + 120y + c = 0$ circle does not cut or touches the coordinate axis., : then find the range of c.

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394. If $f(1) + f(2) + f(3) = 3$ and $A = \{0, 1, 2, 3, ... 9\}$, then find the number of bijective function $f: A \rightarrow A$ which satisfy?

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395. If a curve $y^2 = \alpha x$ and line $2x + y = k$ (k<0), where line is a tangent to $x^2 - y^2 = 3$ and the curve then find the value of α

A. -24

B. 24

C. -19

D. 19

Answer: A

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396. If 'n' is the number of solution of $z^2 + 3\bar{z} = 0$ where $z \in C$ then find

$$\sum_{k=0}^{\infty} \frac{1}{n^k}$$

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397. The number of elements in the set $x \in R : (|x| - 3)(|x + 4|) = 6$ is equal to

A. 3

B. 4

C. 2

D. 1

Answer: C

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398. $\int_0^{100\pi} \frac{\sin^2 x}{e^{\left(\frac{x}{\pi}\right) - \left[\frac{x}{\pi}\right]}} dx = \frac{\alpha . \pi^3}{1 + 4\pi^2}$, $\alpha \in R$ and [x] is greatest integer

A. $50(e - 1)$

B. $150\left(e^{-1} - 1\right)$

C. $200\left(1 - e^{-1}\right)$

D. $100\left(1 - e^{-1}\right)$

Answer: C

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399. what is the projection of $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ on the $\vec{b} = \hat{i} + \hat{j}$

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400. Find the value of λ and μ for which the system of equations

$x + y + z = 6$

$3x + 5y + 5z = 26$

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

has no solution

A. $\lambda = 2, \mu \neq 10$

B. $\lambda \neq 2, \mu = 10$

C. $\lambda \neq 3, \mu = 10$

D. $\lambda \neq 2, \mu \neq 10$

Answer: A

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401. The sum of all natural number belonging to the set $\{1, 2, 3...100\}$, whose $H.C.F$ with 2304 is ____

A. 2449

B. 1633

C. 1449

D. 2633

Answer: B

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402. $16x^2 - 9y^2 + 32x + 36y - 164 = 0$ find the focus of centroid of $\triangle$ PSS' where P is a point on hyperbola ,S,S' are focus.

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403. $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to

A. $\sim p$

B. p

C. $\sim q$

D. q

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404. If $S_{3n} = 2S_n$ then find the value of $\frac{S_{4n}}{S_{2n}}$

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405. Area under the curve when $2x^2 \le y \le 4 - 2x$

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406. $\left(1 + \frac{2}{3} + \frac{6}{3^2} + \frac{10}{3^3} + \ldots + \infty\right)^{\log_{0.25}\left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \ldots + \infty\right)}$ is equal L and then find L^2

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407. If the coeff. of middle term of $(1+x)^{20}$ is A and coeff. of middle term of $(1+x)^{19}$ are B and C then find the value of $\dfrac{A}{B+C}$

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408. $\int_{\frac{\pi}{24}}^{5\frac{\pi}{24}} \dfrac{dx}{1+\sqrt[3]{\tan 2x}}$

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409. $\sin x+\sin 2x+\sin 3x+\sin 4x=0.$ Find sum of roots that lying in $[0, 2\pi]$

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410. In class 12 there are 8 students. In class 11 there are 6 students .In class 10 there are 5 students . Total ways of selecting 10 students , such that there are at least 2 students from each class and at most 5 students from 11 students of Class 10 and 11 combined is 100k. Then find value of k

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411. For a parabola , it's vertex is at 2 units from the origin. focus is at distances of 4unit from the origin. A pair of tangents are drawn from origin to the parabola which meet it at P and Q . Find the area of ΔOPQ (O:origin)

A. 16

B. 32

C. $16\sqrt{2}$

D. $32\sqrt{2}$

Answer: A

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412. If $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through $\left(\sqrt{\frac{3}{2}}, 1\right)$, $e = \frac{1}{\sqrt{3}}$, circle centred at one of the focus and radius $\frac{2}{\sqrt{3}}$. these ellipse and circle intersect at two points . Find square of the distance between the two points is

A. $\frac{4}{3}$

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

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

D. $\frac{32}{3}$

Answer: C

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413. Let $S = \left\{n \in N, \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}^n \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \forall a, b, c, d \in R.\right.$ Find the number of 2-digit numbers in S

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414. If $\left[\frac{x+1}{x^{\frac{2}{3}}+1-x^{\frac{1}{3}}}-\frac{x-1}{x+\sqrt{x}}\right]^{10}$ then find the independent of x

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415. $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix} a, b, c, d \in \{-3, -2, -1, 0, 1, 2, 3\}, f(A)=\det(A)$ then find the probability that $f(A)=15$

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416. $\vec{p}=3\hat{i}+2\hat{j}+\hat{k}, \vec{q}=2\hat{i}+\hat{j}+\hat{k}, \vec{r}$ is $\perp$ to both $\vec{p}+\vec{q}$ and $\left(\vec{p}-\vec{q}\right), \left|\vec{r}\right|=\sqrt{3}. \vec{r}=a\hat{i}+b\hat{j}+c\hat{k}.$ then find $\left|\vec{a}\right|+\left|\vec{b}\right|+\left|\vec{c}\right|$.

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417. $\frac{1}{a-b}+\frac{1}{a-2b}+\frac{1}{a-3b}+\ldots+\frac{1}{a-nb}=\alpha.n+\beta n^2+\gamma.n^3, \frac{b}{a}$ is smaller then $\left(\frac{b}{a}\right)^3$ and other higher powers are neglected . then find γ

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418. A spherical balloon of radius 16m subtends 60° at eye of an observer on the ground. The angle of elevation of centre from the same point observation if 75° . Find the height of top most point of the balloon

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419. $f(x)=\begin{cases}\mu & x=2\\ e^{\left(\frac{\tan(x-2)}{x-[x]}\right)} & x<2\\ \dfrac{\left|x^2-5x+6\right|\lambda}{\left(-x^2+5x-6\right).\mu} & x>2\end{cases}$ $f(x)$is continuous then find the value of $\mu+\lambda$

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420. if α and β are the roots of equation $x^2 + 5\sqrt{2}x + 10 = 0, P_n = \alpha^n - \beta^n, \frac{P_{17}P_{20} + 5\sqrt{2}\,P_{17}P_{19}}{P_{18}P_{19} + 5\sqrt{2}\,P_{18}^2} = ?$

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421. 9 different balls are to be arranged in 4 different boxes number B_1, B_2, B_3 and B_4 . If the probability that B_3 has exactly three balls is $k\left(\frac{3}{4}\right)^9$ then find k

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422. If $\frac{\sin x}{a} = \frac{\cos x}{b} = \frac{\tan x}{c} = k$ and $bc + \frac{1}{ck} + \frac{ak}{1 + bk} = ?$

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423. $|z - (3i + 2)| \leq 2$ then find the min value of $|2z - 6 + 5i|$

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424. The number of real solution of equation $e^{6x} + e^{4x} + 2e^{3x} + 12e^{2x} + e^{x} - 1 = 0$

A. 0

B. 1

C. 6

D. 8

Answer: B

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425. A hyperbola with equation $\frac{(x - 1)^2}{16} - \frac{(y + 2)^2}{9} = 1$ is given a triangle is formed with two vertices as the focus of the hyperbola and the third vertix lies on hyperbola . the locus of centroid of triangle is

A. $16(x - 1)^2 - 9(y + 2)^2 = 16$

B. $9(x - 1)^2 - 16(y + 2)^2 = 16$

C. $9(x - 1)^2 + 16(y + 2)^2 = 16$

D. $16(x - 1)^2 + 9(y + 2)^2 = 16$

Answer: B

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426. If $A = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}$ then find the value of A^{50}

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427. $x^2 - |x| - 12 = 0$ then find the number of solution

A. 1

B. 2

C. 3

D. 4

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428. $a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{k}, c\hat{i} + c\hat{j} + b\hat{k}$ are coplaner vector then find the relation between a, b, c and find value of c

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429. If $|\vec{a}| = 2, |\vec{b}| = 5, |\vec{a} \times \vec{b}| = 8$ then find value of $|\vec{a} \cdot \vec{b}|$

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430. $\int_{-1}^{1} \log\left(x + \sqrt{x^2 + 1}\right) dx$

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431. If $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ then $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$` then find the number of solution

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432. If $.^{n}P_{r} = {}^{n}P_{r+1}, {}^{n}C_{r} = {}^{n}C_{r-1}$ then find value of r

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433. Find the value of $\cot\left(\frac{\pi}{24}\right)$

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434. If a+b+c=1 , ab+bc+ca=-2 and abc=1 then find the value of $a^4 + b^4 + c^4$

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435. $y = p(x)$ and $y = q(x)$ are lines can be written as $\left(y - p_x\right)\left(y - q_x\right) = 0$ then find angle bisector of $x^2 - 4xy - 5y^2 = 0$

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436. Equation of circle $Re\left(z^2\right) + 2(img(z))^2 + 2Re(z) = 0$ where $z = x + iy$ .A line passes through the vetex of parabola $x^2 - 6x + y + 13 = 0$ and center of circle, then the y intercept of the line is ____?

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437. If $f(x) = \begin{cases} 5x+1 & x < 2 \\ \int_0^x ((5+|1-t|))dt & x \geq 2 \end{cases}$

A. $f(x)$ is differentiable $\forall x \in R$

B. $f(x)$ continuous at x=2 but not differentiable at x=2

C. $f(x)$ continuous at x=2 but not differentiable at x=1

D. None of these

Answer: B

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438. $P(0), P(J) = \left(\frac{1}{3}\right)^j, j = 1, 2, 3$ then find the value of $P(J)$ when J is even and positive integer

A. $\frac{1}{8}$

B. $\frac{1}{9}$

C. $\frac{1}{64}$

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

Answer: A

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439. Find the value of $\sum_{n=8}^{100}\left[\frac{(-1)^n \cdot n}{2}\right]$ where $[x]$ greatest integer function

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440. $\frac{x-k}{1}=\frac{y-2}{2}=\frac{z-3}{1}, \frac{x+1}{1}=\frac{y+2}{2}=\frac{z+3}{1}$ coplanar then find k

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441. The number of irrational terms in $\left(2^{\frac{1}{3}}+3^{\frac{1}{4}}\right)^{12}$

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442. " We will play only if weather is good and ground isn't wet" Find the Negation of above statement

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443. Which of the following value is just greater than $\left[1+\frac{1}{10^{100}}\right]^{10^{100}}$

A. 1

B. 2

C. 3

D. 4

Answer: C

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444. If a rectangle is inscribed in a equilateral triangle of side $2\sqrt{2}$ then side of maximum area of rectangle is

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445. If the first sample A of 100 items has the mean 15 and standard deviation 3 and second sample B has 150 items. If the combined mean and standard deviation of itmes of both the sample is 15.6 and $\sqrt{13.44}$ then then standard deviation of items of sample B is

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446. If the function $f(x): A \to B$ and $g(x): B \to C$ are defined such that $(g(f(x)))^{-1}$ exist then $f(x)$ and $g(x)$ are

A. one-one and onto

B. many-one and onto

C. one-one and into

D. many-one and into

Answer: A

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447. A coin is tossed n times . If the probability of getting at least one head is greater than 0.9 then the minimum vaue of n is

A. 3

B. 5

C. 4

D. 2

Answer: C

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448. If $\vec{x}$ and $\vec{y}$ are two vector such that $|\vec{x}| = |\vec{y}|$ and $|\vec{x} - \vec{y}| = n|\vec{x} + \vec{y}|$ then angle between $\vec{x}$ and $\vec{y}$

A. $\cos^{-1}\left(\frac{1 - n}{1 + n}\right)$

B. $\cos^{-1}\left(\frac{1 + n^2}{1 - n^2}\right)$

C. $\cos^{-1}\left(\frac{1 + n}{n - 2}\right)$

D. $\cos^{-1}\left(\frac{1 - n^2}{1 + n^2}\right)$

Answer: D

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449. If $.^nC_0 + 3.^nC_1 + 5^nC_2 + 7^nC_3 + \dots till(n + 1)term = 2^{100} \cdot 101$ then the value of $2\left[\frac{n - 1}{2}\right]$ where [.] is G.I.F)

A. 98

B. 97

C. 96

D. 100

Answer: A

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450. If $y = f(x)$ is the solution of DIE $xdy = \left(y + x^3 \cos x\right)dx$ and $f(\pi) = 0$ then $f\left(\frac{\pi}{2}\right)$ is

A. $\frac{\pi^2}{4} + \frac{\pi}{6}$

B. $\frac{\pi^2}{4} + \frac{\pi}{2}$

C. $\frac{\pi^2}{6} + \frac{\pi}{4}$

D. $\frac{\pi^2}{6} + \frac{\pi}{6}$

Answer: B

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451. If $f(x) = \dfrac{P(x)}{\sin(x-2)}$ $f(x)$ is continous at x=2 and $f(2) = 7$. $P(x)$ is polynomial where $P''(x)$ is constant and $P(3) = 9$ then find the value of $P(5)$.

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452. $\left(2 + \dfrac{x}{3}\right)^n$ if the coefficient of x^7 and x^8 is same then find value of n

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453. Let f be defined as

$$f(x) = \begin{cases} (1 + |\sin x|)^{\frac{3a}{|\sin x|}}, & -\frac{\pi}{4} < x < 0 \\ b, & x = 0 \\ e^{\cot 4x/\cot 2x}, & 0 < x < \frac{\pi}{4} \end{cases}$$

If f is continuous at x = 0, then the value of $6a + b^2$ is equal to

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454. If the coefficient of x^7 in $\left(x^2 + \frac{1}{bx}\right)^{11}$ is equal to coefficient at x^{-7} in $\left(x + \frac{1}{bx^2}\right)^{11}$ Then find value of b

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455. Find the probability that two digit number of the form $2^n - 2$ is divisible by 3

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456. $\lim n \to \infty \frac{1}{n} \sum_{j=0}^{n} \frac{(2j - 1) + 8n}{(2j - 1) + 4n}$

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457. If $\sin\theta + \cos\theta = \frac{1}{2}$ then find the value of $16(\sin 2\theta + \cos 4\theta + \sin 6\theta)$

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458. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{dx}{\left(1 + e^{x\cos x}\right) \cdot \left(\sin^4 x + \cos^4 x\right)}$

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459. If α, β are root of $x^2 + 20^{\frac{1}{4}}x + \sqrt{5} = 0$ then find the value of $\alpha^8 + \beta^8$

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460. $A = \begin{bmatrix} 1 & 2 \\ -4 & 1 \end{bmatrix}, A^{-1} = \alpha I + \beta A$ then find the value of $\alpha + \beta$

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461. If $\lim_{x \to 2} \frac{x^2 f(2) - 4f(x)}{x - 2}$. Given that $f(2) = 4, f'(2) = 1$

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462. Find the value of $\left(\vec{a} + \vec{b}\right) \times \left[\vec{a} \times \left(\left(\vec{a} - \vec{b}\right) \times \vec{b}\right)\right]$

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463. $\sec y\left(\frac{dy}{dx}\right) = \sin(x + y) + \sin(x - y)$ if $y(0) = 0$ then find $5y'\left(\frac{\pi}{2}\right)$

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464. Find the area bounded by $y = \max\{0, \ln x\}$ and $y < 2^x$ where $\frac{1}{2} < x < 1$

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465. For the given data 6, 10, 7, 13, a, 12, b, 12 if the mean is 9 , variance is $\frac{37}{4}$ then find the value of $(a - b)^2$

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466. $\log_3 2, \log_3\left(2^x - 5\right), \log_3\left(2^x - \frac{7}{2}\right)$ are in A.P. then the value of x =?

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467. Let $f(x) = \begin{vmatrix} \sin^2 x & -2 + \cos^2 x & \cos 2x \\ 2 + \sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & 1 + \cos 2x \end{vmatrix}, x \in [0, \pi]$ then the maximum value of $f(x)$ is

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468. From the point $(-1, 1)$, two tangents are drawn to $x^2 + y^2 - 2x - 6y + 6 = 0$ that meet the circle at A & B . A point D on the circle such that $AD = AB$ then find the area of ΔABD

A. 2

B. 4

C. $2 + \sqrt{2}$

D. 1

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469. $f(x) = \min\{x - [x], 1 + [x] - x\}$ x lies in [0,3] , p is the number of points where it is discontinous q is the numbers of points where it is not differentiable . then find the value of $p + q$

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470. Circle with center (2,3) passes through origin . P , Q are two points on the circle such that OC is perpendicular to both CP and CQ then find the point P and Q

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471. $\ln\left(\frac{dy}{dx}\right) = 3x + 4y$ and $y(0) = 0$. then find $y\left(-\frac{2}{3}\ln 2\right)$

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472. Let a plane p passes through the point $(3, 7, -7)$ and contain the line , $\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$, or distance of the plane p from the origin is d then d^2 is

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473. $((p \vee q) \wedge \sim p) \to q$

A. $(p \vee q)$

B. $(p \wedge q)$

C. $\sim p \vee q$

D. $p \wedge \sim q$

Answer: A

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474. $\log_5 \log_4 \log_3 \left(18x - 77 - x^2\right)$ has domain (a,b) then $\int_a^b \frac{\sin^3 x}{\sin^3 x + \sin^3(a + b - x)} dx$

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475. If

$S_1 = \left\{z : |z - 3 - 2i|^2 = 8\right\}, S_2 = \left\{z : \left|z - \bar{z}\right| = 8\right\}$ and $S_3 = \{z : re(z) \geq 5\} then S_1 \cap$

has

A. infinite many element

B. only one element

C. No element

D. two element

Answer: B

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476. If $e^{-x}\int_3^x \left\{3t^2 + 2t + 4f'(t)\right\}dt = f(x)$ and $f'(4) = \dfrac{\alpha e^{\beta} - 224}{\left(e^{\beta} - 4\right)^2}$ then value of $(\alpha + \beta)$

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477. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 4\hat{i} + 3\hat{j} + \hat{k}$ then value of $\left(\left(\vec{a} + \vec{b}\right) \times \left(\vec{a} - \left(\vec{a} - \vec{b}\right) \times \vec{b}\right)\right) \times \vec{c}$ is

A. $30\hat{i} - 34\hat{j} + 36\hat{k}$

B. $30\hat{i} + 34\hat{j} + 36\hat{k}$

C. $30\hat{i} + 34\hat{j} - 36\hat{k}$

D. None of these

Answer: A

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478. $\lim_{x \to 0} \dfrac{x}{(1 + \sin x)^{\frac{1}{8}} - (1 - \sin x)^{\frac{1}{8}}} = ?$

A. -8

B. -4

C. 0

D. 4

Answer: B

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479. If $\tan\left(\frac{\pi}{9}\right), x, \tan\left(\frac{7\pi}{18}\right)$ are in A.P. and $\tan\left(\frac{\pi}{9}\right), y, \tan\left(\frac{5\pi}{18}\right)$ are also in A.P then find $|x - 2y|$

A. 0

B. 4

C. 1

D. 3

Answer: A

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480. $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$, then sum of all elements in $A + A^2 + A^3 + \dots + A^{26}$ is

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481. Find the area between the parabola $y = x^2$ and a line $y + x = 2$

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482. $e^{4x} - e^{3x} - 4e^{2x} - e^x + 1 = 0$ then the number of solution of equation is

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483. A and B are square matrices of same order such that $A^5 = B^5$ and $A^2B^3 = B^2A^3$. If $A^2 - B^2$ invertible then $\det\left(A^3 + B^3\right) = ?$

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484. For an ellipse E, centre lies at the point $(3, -4)$, one of the foci is at $(4, -4)$ and one of vertices is at $(5, -4)$. If the equation of tangent on the ellipse E is $mx - y = 4(m > 0)$. then find the value of $5m^2$

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485. $f(x) = \int_a^x g(t)dt$ and $f(x)$ has 5 roots between (a, b) . Find the number of roots of $g(x)g'(x)$ between (a, b)

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486. If a circle touched y-axis at $(0, 6)$ and x-intercept is $6\sqrt{5}$ then find the value of radius of circle

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487. $f(x) = \begin{cases} \max(\sin t) & 0 \leq t \leq x \quad x \in [0, \pi] \\ 2 + \cos x & x > \pi \end{cases}$ Find number of points where $f(X)$ is not continuous and differentiable

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488. $\alpha = \min\left\{8^{2\sin 3x} \cdot 4^{4\cos 3x}\right\}$

$\beta = \max\left\{8^{2\sin 3x} \cdot 4^{4\cos 3x}\right\}$

$8x^2 + bx + c = 0$ are the root of $\alpha^{\frac{1}{5}}$ and $\beta^{\frac{1}{5}}$ then find $c - b$

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489. $f(x) = \dfrac{1 - \sin x + \cos x}{1 + \sin x + \cos x}$ discontinuous at $x = \pi$. Find $f(\pi)$ so that $f(x)$ is continuous $x = \pi$

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490. Two sides of a parallelogram having equation $4x + 5y = 0$ and $7x + 2y = 0$. One of the diagonal is $11x + 7y = 9$. Then the other diagonal will surely passes through

A. (2,2)

B. (1,3)

C. (1,2)

D. none

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491. Three vectors $\vec{a}, \vec{b}, \vec{c}$ with magnitude $\sqrt{2}, 1, 2$ respectively follows the relation $\vec{a} = \vec{b} \times \left(\vec{b} \times \vec{c}\right)$ the acute angle between the vectors $\vec{b}$ and $\vec{c} is \theta$. then find the value of $1 + \tan\theta$ is

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492. If $\left(x + x^3\right)dy = \left(y + yx^2 + x^3\right)dx$ and $y(1) = 0$ then $y(2)$ is

A. $\ln\left(\frac{17}{2}\right)$

B. 0

C. $\ln\left(\frac{5}{2}\right)$

D. $\ln\left(\frac{2}{5}\right)$

Answer: C

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493. The point $P(a, b)$ undergoes following transformation to a new co-ordinate $P'\left(-\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$

(i) Reflection about $y = x$

(ii) Translation through 2 unit in the positive direction of x-axis

(iii)Rotation through an angle $\frac{\pi}{4}$ in anti-clockwise sense about the origin

Then the value of $2a - b$ is

A. 1

B. 7

C. 4

D. 9

Answer: D

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494. For what value of x is the ninth term in the expansion of

$$\left(3^{\log_3\sqrt{25^{x-1}+7}}+3^{-\frac{1}{8}\log_3\left(5^{x-1}+1\right)}\right)^{10}$$ is equal to 180

A. -1

B. 1

C. 0

D. 2

Answer: B

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495. The sum of squares of distance of point P from (0,0) (0,1) (1,0),(1,1) = 18 then locus is at circle of diameter then find d^2

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496. $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{k}, \vec{a} \times \vec{c} = \vec{b}, \vec{a} \cdot \vec{c} = 3$ then Find $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$

A. -2

B. 2

C. 6

D. -6

Answer: A

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497. A Circle centre=(-15,0) and radius=$\frac{15}{2}$. Chord to circle passes through $(-30, 0)$ & tangent to $y^2 = 30x$. Length of chord=

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498. Ellipse $\frac{x^2}{8} + \frac{y^2}{4} = 1$ then tangent at P(2nd quard) perpendicular to $x + 2dy = 0$ eccentricity = e ,SS' is foci . then find $\left(5 - e^2\right) \cdot \Delta SPS'$

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499. If $\int_{-\frac{1}{\sqrt{2}}}^{\frac{1}{\sqrt{2}}} \left(\left(\frac{x-1}{x+1}\right)^2 + \left(\frac{x+1}{x-1}\right)^2 - 2\right)^{\frac{1}{2}} dx$

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500. If $\ln(x + y) = 4xy$. find $\frac{d^2y}{dx^2}$

at $x = 0$

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501. Mean and standard deviation of 20 observations are 10 and 2.5. It is observed that one entery was taken as 25 instead of 35 , then correct mean and variance is ?

A. 10.5 , 26

B. 10.5 , 25

C. 11 , 26

D. 11 , 25

Answer: A

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502. Find $\sum r^2 . {}^{20}C_r$

A. 2^{20}

B. 2^{21}

C. 210×2^{19}

D. 2^{19}

Answer: C

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503. $a + ar + ar^2 + \ldots + \infty = 15$

$a^2 + (ar)^2 + \left(ar^2\right)^2 + \ldots + \infty = 150$.

Find $ar^2 + ar^4 + ar^6 + \ldots \infty$

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

B. $\frac{2}{5}$

C. $\frac{1}{6}$

D. None

Answer: A

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504. Find 3 digit number using digit 0,1,2,3,4,5 where repetation is not allowed and number formed should be even number

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505. $f(x)=\cos\left(2\tan^{-1}\left(\sin\left(\cot^{-1}\sqrt{\frac{1-x}{x}}\right)\right)\right)$ then

A. $(1-x)^2\cdot f'(x)-2(f(x))^2=0$

B. $(1-x)^2\cdot f'(x)+2(f(x))^2=0$

C. $(1+x)^2\cdot f'(x)-2(f(x))^2=0$

D. $(1+x)^2\cdot f'(x)+2(f(x))^2=0$

Answer: B

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506. Find the value of $\frac{1}{1+x}+\frac{2}{1+x^{2}}+\frac{2^{2}}{1+x^{4}}+\ldots+\frac{2^{100}}{1+x^{200}}$

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507. In hospital 89% has disease A and 98% has disease B , K% is the numbber of patient who has both , then K can't be the subset of

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508. $P(A)=p, P(B)=2p, P(\text{exactly one out of A and B occurs})=\frac{5}{9}$ then what will be maximum value of p ?

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509. $S=\left\{3x^{2} \leq 4y \leq 6x+2y\right\}$ find the area

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510. $(1+y)\tan^2 x + \tan x \cdot \frac{dy}{dx} + y = 0$ .If $\lim_{x \to 0^+} x \cdot y(x) = 1$ then $y\left(\frac{\pi}{4}\right) = ?$

A. $\frac{\pi}{4} - 1$

B. $\frac{\pi}{4}$

C. $-\frac{\pi}{4}$

D. None

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511. Let $Arg\left(\frac{z+1}{z-1}\right) = \frac{\pi}{4}$ then locus of z be a circle whose radius and centre respectively are ?

A. $\sqrt{2}, (0, 1)$

B. $\sqrt{2}, (0, -1)$

C. $\sqrt{2}, (0, 0)$

D. $1, (1, 1)$

Answer: B

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512. If A and B are two square matrices of order 2×2 such that $A = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 \\ i & 1 \end{bmatrix}$ (where $i = \sqrt{-1}$) and $A^T B^{2021} A = Q$ then value of AQA^T is

A. $\begin{bmatrix} 1 & 0 \\ i & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 \\ 2021i & 1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 \\ 2020i & 1 \end{bmatrix}$

Answer: B

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513. Minimum value of n for which $\dfrac{(2i)^n}{(1-i)^{n-2}}$ is positive integer

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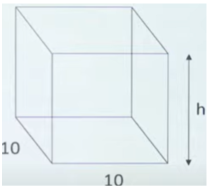
514. Angle between two body diagonal is $\cos^{-1}\left(\dfrac{1}{5}\right)$ then find height h



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515. $\left(\sqrt{3}+i\right)^{100} = 2^{99}(p+iq)$ then p and q are the roots of which of the following quadratic equation?

A. $x^2 - \left(\sqrt{3}+1\right)x - \sqrt{3} = 0$

B. $x^2 - \left(\sqrt{3}-1\right)x - \sqrt{3} = 0$

C. $x^2 + \left(\sqrt{3} + 1\right)x + \sqrt{3} = 0$

D. None

Answer: B

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516. $2\sin\left(\frac{\pi}{8}\right)\sin\left(\frac{2\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)\sin\left(\frac{5\pi}{8}\right)\sin\left(\frac{6\pi}{8}\right)\sin\left(\frac{7\pi}{8}\right) = ?$

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517. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{1 + \sin^2 x}{1 + \pi^{\sin x}} dx =$

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518. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} = A$ then $A^{2025} - A^{2020} =$

A. A^5

B. A^6

C. $A^6 - A$

D. $A^5 - A$

Answer: C

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519. α, β are roots of $x^2 - x + 2\lambda = 0$ and α, γ are roots of $3x^2 - 10x + 27\lambda = 0$. Find the value of $\frac{\beta\gamma}{\lambda} =$

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520. $f(x) = \left(\frac{2}{x}\right)^{x^2}$. Find maximum value of $f(x)$.

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521. $\lim_{x \to 2} \sum_{n=1}^{9} \frac{x}{n(n+1)x^2 + 2(2n+1)x + 4}$

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522. Find locus of mid point of chord of $x^2 - y^2 = 4$ such that this chord touches $y^2 = 8x$

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523. $\sum_{r=1}^{9} \tan^{-1}\left(\frac{1}{2r^2}\right) =$

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524. If the line $x = 2y$ touches circle C at (2,1) & C cuts $C_1 = x^2 + y^2 + 2y - 5 = 0$ such that common chord is diameter of C_1. Find diameter of C.

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525. $\int_0^5 \frac{x+[x]}{e^{x-[x]}} dx = \alpha e^{-1} + \beta \text{then} (\alpha+\beta)^2 = ?$

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526. $a_1, a_2, a_3, a_4 \dots a_{10}$ are in A.P with d=-3

$b_1, b_2, b_3, b_4 \dots b_{10}$ are in G.P , with r=2

$C_k = a\_k + b_k \text{where} k \in (1, 10)$

$C_2 = 12, C_3 = 13$ then $\sum_{k=1}^{10} C_k$

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527. If $2x^2 dy + \left(e^y - 2x\right) dx = 0$ and $y(e) = 1$ then find the value of $y(1)$

A. $\ln 2$

B. 2

C. 0

D. ln3

Answer: A

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528. If A dice is rolled till 6 comes , then probability of $P\left(\frac{x \geq 5}{x \geq 2}\right)$ is

A. $\frac{1}{6}$

B. $\frac{24}{36}$

C. $\frac{25}{36}$

D. $\frac{18}{36}$

Answer: C

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529. The mean and variance of the 4 observations $3, 7, x, y(\text{where} x > y)$ is 5 and 10 respectively . the mean of the observation $4 + x + y, 7 + x, x + y, x - y$ will be

A. 10

B. 12

C. 8

D. 14

Answer: B

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530. Let the plane P passes through the point (1,2,3) and it contains the line of intersection of $\vec{r} \cdot \left(\hat{i} + \hat{j} + 4\hat{k}\right) = 16 \text{and} \vec{r} \cdot \left(-\hat{i} + \hat{j} + \hat{k}\right) = 6$. Then which of the following point does not lie on P?

A. (-8,8,6)

B. (-4,3,5)

C. (8,-5,1)

D. (-8,8,5)

Answer: D

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531. If the function $f(x) = 2x^3 - 6x^2 - 18x$ has local maxima at $x = a$ and local minima at $x = b$ and the area bounded by $y = f(x)$ from $x = a$ to $x = b$ is A. Then find the value of $4A$

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532. $I = \int_6^{16} \frac{\ln x^2}{\ln x^2 + \ln(x - 22)^2} dx$?

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533. $I = \int \frac{dx}{\left(x^2 + x + 1\right)^2} = A\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right) + B\frac{2x+1}{x^2+x+1}$ then Find the value of A and B

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534. If $\frac{z+i}{z+2i}$ is purely real then find the locus of z

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535. $\sum_{k=0}^{20}\left(.^{20}C_k\right)^2 = ?$

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536. A(0,6) and B(2t,0), where t is a parameter midpoint of A and B is M. perpendicular bisector of AB cuts y-axis at C then Find the locus of midpoint of MC

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537. A dice has probability of occurence of a number $\left(\frac{1}{6}+x\right)$ and the number opposite to it on dice is $\left(\frac{1}{6}-x\right)$ and the rest of the number has probability $\frac{1}{6}$. The probability that when the dice is rolled twice and the sum 7 is $\frac{13}{96}$ then find the value of x

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538. If $u(n)=\prod_{r=0}^{n}\left(1+\frac{r^2}{n^2}\right)^r$ then $\lim_{n\to\infty}(u)^{\frac{-4}{n^2}}$

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539. P(2,-4) is a point on $y^2=8x$. Tangent and normal at P cuts directrix at A and B respectively. If ABPQ is a square then find the sum of coordinates of Q.

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540. If α and β are the roots of $x^2 + bx + c = 0$ Find

$$\lim_{x \to \beta} \frac{e^{2\left(x^2 + bx + c\right)} - 1 - 2\left(x^2 + bx + c\right)}{(x - \beta)^2}$$

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541. $\left(\sin^{-1}x\right)^2 - \left(\cos^{-1}x\right)^2 = a$ for $o < x < 1$ find $2x^2 - 1$

A. $\sin\left(\frac{4a}{\pi}\right)$

B. $\sin\left(\frac{2a}{\pi}\right)$

C. $\cos\left(\frac{4a}{\pi}\right)$

D. $\cos\left(\frac{2a}{\pi}\right)$

Answer: A

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542. If $\dfrac{\sin A}{\sin B}=\dfrac{\sin(A-C)}{\sin(C-B)}$ then

A. b^2, c^2, a^2 are in A.P

B. a^2, b^2, c^2 are in A.P

C. c^2, b^2, a^2 are in A.P

D. none

Answer: A

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543. Variance of 1st n natural number $1, 2, 3, \ldots n$ is 14 then n is

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544. Find the value of $\dfrac{3}{2}x^2+\dfrac{5}{3}x^3+\dfrac{7}{4}x^4+\ldots+\infty \quad \text{if} \quad 0<x<1$

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545. If $\frac{x^2}{b^2} + \frac{y^2}{4a^2} = 1$ and minimum area with coordinate axes of tangent is Kab . then the value of K is

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546. If $2x - y - z = 3, x + y - 2z = \alpha, 3x + 3y - \beta z = 3$ has infinite many solution then find the value of $\alpha + \beta - \alpha\beta$

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547. A wire of length 20 is cut into two parts one is made into regular hexagon of side a and other to square . Find a if combined area of square and regular hexagon is minimum

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548. If $x^2 + y^2 + px + y(1 - p) = 0$ is the equation of circle $r \in (0, 5], q = p^2$ then number of integral value of (p,q) satisfy is

A. 16

B. 14

C. 19

D. 21

Answer: B

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549. Find $y(\pi)$ if $y(0) = 7$ and $\dfrac{dy}{dx} = 2(y - 2\sin x - 10)x + 2\cos x$

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550. If

$$y = \log_{10}x + \log_{10}x^{\frac{1}{3}} + \log_{10}x^{\frac{1}{9}} + \ldots \text{ and } \frac{2+4+6+\ldots+2y}{3+6+9+\ldots+3y} = \frac{4}{\log_{10}x}$$

then find the value of x and y

A. $x = 10^5, y = 8$

B. $x = 10^6, y = 9$

C. $x = 10^6, y = 8$

D. $x = 10^5, y = 9$

Answer: B

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551. Number of distinct real roots of equation $3x^4 + 4x^3 - 12x^2 + 4 = 0$

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552. If $A = \begin{bmatrix} 0 & 2 \\ x & -1 \end{bmatrix}$ and $A\left(A^3 + 3I\right) = 2I$ then find value of x

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553. Find the equation if $\frac{dy}{dx} + \frac{y}{x} = x^2$ passes through point (-2,2)

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554. If $y^{\frac{1}{4}} + y^{-\frac{1}{4}} = 2x$ be a curve satisfying the differential equation $\frac{d^2y}{dx^2}\left(x^2 - 1\right) + \beta x\frac{dy}{dx} + \alpha y = 0$ then ordered pair (α, β) is

A. (16,-1)

B. (-16,1)

C. (4,-1)

D. (4,1)

Answer: B

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555. A five digit number is formed by using the digit $\{1, 2, 3, 4, 5, 6\}$. Find the total number of such numbers which are divisible by 55

A. 9

B. 10

C. 11

D. 12

Answer: D

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556. Let $A = \{x : |x - 2| > 1\}, B = \left\{x : \sqrt{x^2 - 3} > 1\right\}$ and $C = \{x : |x - 4| \geq 2\}$. If the number of integeral value in $(A \cap B \cap C)' \cap Z$ (where Z is set of integers) is k, then the value of k is

A. 7

B. 8

C. 9

D. 6

Answer: B

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557. Let $\vec{A} = \hat{i} + \hat{5}j + \alpha\hat{k}, \vec{B} = \hat{i} + 3\hat{j} + \beta\hat{k}, \vec{C} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\left|\vec{B} \times \vec{C}\right| = 5\sqrt{3}$.

If $\vec{A}$ is perpendicular to $\vec{B}$ then the maxmimum value of $\left|\vec{A}\right|^2$ is

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558. $\{(p \wedge (p \rightarrow q)) \wedge (q \rightarrow r)\} \rightarrow r$ is equal to

A. $q \rightarrow \sim r$

B. $p \rightarrow \sim r$

C. fallacy

D. tautology

Answer: D

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559. The distance of the point (2,1,-3) parallel to the vector $\left(2\hat{i} + 3\hat{j} - 6\hat{k}\right)$ from the plane $2x + y + z + 8 = 0$ is

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560. If point (x,y) satisfy the relation $x^2 + 4y^2 - 4x + 3 = 0$ then

A. $x \in [1, 3], y \in \left[-\frac{1}{3}, \frac{1}{3}\right]$

B. $x \in [1, 3], y \in [1, 3]$

C. $x \in [1, 3], y \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

D. $x \in [-2, 2], y \in [-1, 1]$

Answer: C

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561. value of $\int_0^1 \cot^{-1}\left(\frac{\sqrt{1+\sin x}+\left(\sqrt{1-\sin x}\right)}{\left(\sqrt{1+\sin x}-\left(\sqrt{1-\sin x}\right)\right)}\right)dx$

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

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

C. 0

D. $\frac{1}{8}$

Answer: A

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562. If $\sin^4\theta + \cos^4\theta - \sin\theta\cos\theta = 0, x \in [0, \pi]$. then find the value of $\frac{8s}{\pi}$

(where s is the sum of the solutions of the given equation)

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563. $\lim x \to \infty \left(\sqrt{x^2 - x + 1} - ax\right) = b$ Find the value of $2(a + b)$ is

A. -3

B. -1

C. 3

D. 1

Answer: D

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564. Image of a point P(-1,2,3) in plane x+y-z-3=0 is Q and S is a point on this plane whose co-ordinates are $(3, 2, \beta)$. Then the square of length segment QS is

A. $\sqrt{18}$

B. 16

C. 17

D. 9

Answer: C

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565. Let a curve $P:(y-2)^2 = x-1$ If a tangent is drawn to the curve P at the point whose ordinate is 3 then the area between the tangent , curve and x-asis is

A. 9

B. 11

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

D. $\frac{11}{2}$

Answer: A

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566. Perpendicular tangents are drawn from an external point P to the parabola $y^2 = 16(x - 3)$ Then the locus of point P is

A. $x = 1$

B. $x = -1$

C. $x = \frac{1}{2}$

D. $x = 2$

Answer: B

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567. $(p \wedge q) \rightarrow ((r \wedge q) \wedge p)$ is a

A. Tautology

B. Contradiction

C. neither contradiction nor tautology

D. None of these

Answer: C

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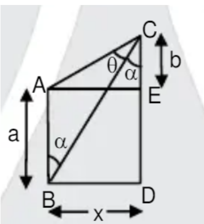
568. In the given figure ,If $\angle ACB = \theta$ and $\tan\theta = \dfrac{1}{2}$ then the relation between x , a , and b is



A. $x^2 - 2ax + ab + b^2 = 0$

B. $x^2 - 2ax + ab + a^2 = 0$

C. $x^2 + 2ax - ab + b^2 = 0$

D. $x^2 + 2ax + ab + b^2 = 0$

Answer: A

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569. There are two circles touching each other at (1,2) with equal radii 5cm and there is common tangent for these two circles $4x + 3y = 10$. The centres of 1st circle is (α, β) and centre of 2nd circle is (γ, δ). Then find $|(\alpha + \beta)(\gamma + \beta)| = ?$

A. 20

B. 40

C. 25

D. 35

Answer: B

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570.

$$\left(3x^2+4x+3\right)^2-(k+1)\left(3x^2+4x+2\right)\left(3x^2+4x+3\right)+k\left(3x^2+4x+2\right)^2=0$$

. Find 'k' for which , equation has real roots.

A. $\left(-\frac{1}{2},1\right)$

B. $\left(1,\frac{5}{2}\right]$

C. $\left(\frac{1}{2},1\right)$

D. $\left(-1,\frac{5}{2}\right]$

Answer: B

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571. Remainder when $3 \times 7^{22} + 2 \times 10^{22}$ - 44 is divisible by 18 is

A. 16

B. 3

C. 12

D. 15

Answer: D

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572. The value of $\int_0^1 \frac{\sqrt{x}dx}{(x+1)(3x+1)(x+3)}$ is

A. $\frac{\pi}{8}$ - $\frac{3\pi}{16}$

B. $\frac{\pi}{8} + \frac{3\pi}{16}$

C. $\frac{\pi}{4}$ - $\frac{3\pi}{16}$

D. 0

Answer: A

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573. When $0 < x < 1, y = \frac{1}{2}x^2 + \frac{2}{3}x^3 + \frac{3}{4}x^4 + \dots$ Then the value of e^{1-y} at $x = \frac{1}{2}$

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574. If $arg\left(z_1 - z_2\right) = \frac{\pi}{4}, z_1$ and z_2 satisfy $|z - 3| = Re(z)$ Then sum of imaginary part of $z_1 + z_2$ is

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575. A plane which passes through the intersection of the planes $\vec{r} \cdot \left(2\hat{i} + 6\hat{j} + \hat{k}\right) = 4$ and $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 6\hat{k}\right) = 2$ and also parallel to the y-axis is :

A. $2x + 11z = 0$

B. $4x + 11z = 0$

C. $x + 9z = 0$

D. $x + 11z = 0$

Answer: A

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576. $\frac{3}{1^2 2^2} + \frac{5}{2^2 3^2} + \frac{7}{3^2 4^2} + \ldots$ upto 10th term

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577. Vertex and focus of a parabola lie on x-axis and their distance from (0,0) are 's' and 'r' respectively , then find the length of LR

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578. How many words can be made by rearranging letters of VOWELS such that all consonants are not together

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579. The mean of the first 10 terms : $7 \times 8, 10 \times 10, 13 \times 12, \ldots,$

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580. A pole divided into 3:7 by a mark on it , lower part is small , this pole subtends equal angle with a point on ground at a distance 18m from pole , find the height of pole.

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581. $\lim_{x \to 0} \frac{\sin^2\left(\pi \cos^4 x\right)}{x^4}$ is equal to

A. π^2

B. $4\pi^2$

C. $2\pi^2$

D. None of these

Answer: B

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582. $I = \int_{-\frac{1}{2}}^{1} (|2x| + |x|)dx$ Find the value of 8I

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583. $\int \frac{dx}{\sqrt[4]{(x-1)^3(x+2)^5}} = ?$

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584. $e^{4x} + 2e^{3x} - e^{x} - 6 = 0$ find the number of solutions

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585. The terms independent of 'x' in the expansions of $\left(2x + \frac{1}{4x^2}\right)^{12}$ is

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586. $a_r = \left\{\cos\left(\frac{2r\pi}{9}\right) + i\sin\left(\frac{2r\pi}{9}\right)\right\}$ where $r \in \{1, 2, 3...9\}$

Find the value of $\begin{vmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$

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587. $arg\left(\frac{z - 2}{z + 2}\right) = \frac{\pi}{4}$, Find the minimum value of $\left|z - 9\sqrt{2} - 2i\right|^2$

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588. If $\left|3\vec{a}+\vec{b}\right|=\left|2\vec{a}+3\vec{b}\right|$ and angle between $\vec{a}$ and $\vec{b}$ is 60° and $\frac{\vec{a}}{8}$ is a unit vector then find the magnitude of $\vec{b}$

A. 5

B. 6

C. 8

D. 10

Answer: A

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589. Let a quadratic equation $P(x)=x^2+ax+1$ If $P(x)$ is increasing in [1,2] then minimum value of a is A and if $P(x)$ is decreasing in [1,2] then maximum value of a is B then $|A - B|$ is

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590. Let f be a non-negative function defined on the interval [0,1] . If $\int_0^x \sqrt{1-(f'(t))^2}dt = \int_0^x f(t)dt, 0 \leq x \leq 1$ and $f(0) = 0$ then the value of $\lim_{x \to 0} \int_0^x \frac{f(t)}{x^2} dt$ is

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

B. $-\frac{1}{2}$

C. 2

D. 1

Answer: A

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591. If a curve follows the diffferential equation $\frac{dy}{dx} = \frac{2^{x+y}-2^x}{2^y}$ and curve passes through the point (0,1) then the value of $y(2)$ is

A. $y = \log_2\left(1 - e^3\right)$

B. $y = \log_2\left(1 + e^3\right)$

C. $y = \log_2\left(e^3 - 1\right)$

D. $y = \log_2\left(e^{-3} + 1\right)$

Answer: B

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592. Distance of the lines $x\text{cosec}\theta + y\sec\theta = k\cot 2\theta$ and $x\sin\theta + y\cos\theta = k\sin 2\theta$ from origin is p and q respectively then

A. $4q^2 + p^2 = k^2$

B. $p^2 + q^2 = 4k^2$

C. $4p^2 + q^2 = k^2$

D. $4p^2 + q^2 = 4k^2$

Answer: C

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593. Three terms forms an increasing G.P with ratio r . If the second term of the given G.P is double then the new series are in A.P with common difference d also the 4th terms of G.P is $3r^2$ then the value of $\left(r^2 - d\right)$ is

A. $7 - 3\sqrt{3}$

B. $7 - \sqrt{3}$

C. $7 + \sqrt{3}$

D. $7 + 3\sqrt{3}$

Answer: C

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594. The value of $\operatorname{cosec} 18^\circ$ is the root of which of the following quadratic equation

A. $x^2 - 2x + 4 = 0$

B. $x^2 - 2x - 4 = 0$

C. $4x^2 - 2x + 1 = 0$

D. $4x^2 + 2x - 1 = 0$

Answer: B

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595. If $f(x) = \begin{cases} \dfrac{\log\left(\dfrac{1+\frac{x}{b}}{1-\frac{x}{a}}\right)}{x} & x < 0 \\ k & x = 0 \\ \dfrac{\cos^2 x - \sin^2 x - 1}{\sqrt{x^2+1}-1} & x > 0 \end{cases}$ is continuous at x=0 then the value of $\frac{1}{a} + \frac{1}{b} + \frac{4}{k}$ is

A. 0

B. -1

C. -5

D. 5

Answer: C

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596. If the system of equation $2x+y+z=3, x-y+z=-1$ and $x+y+az=b$ has no solution , then

A. $a=\frac{1}{3}, b\neq\frac{7}{3}$

B. $a=\frac{1}{3}, b=\frac{7}{3}$

C. $a\neq\frac{1}{3}, b=\frac{7}{3}$

D. $a\neq\frac{1}{3}, b\neq\frac{7}{3}$

Answer: A

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597. If the statement $(p * \sim q) \rightarrow \left(p \_ q\right)$ is a tautology where $*, \_ \in (\wedge, \vee)$ then correct options is

A. $* = \wedge , \_ = \vee$

B. $* = \wedge , \_ = \wedge$

C. $* = \vee , \_ = \vee$

D. $* = \vee , \_ = \wedge$

Answer: A

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598. If $S = \frac{7}{5} + \frac{9}{5^2} + \frac{13}{5^3} + \dots$ then find value of 160S

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599. How many four digit number which are divisible by neither 7 nor 3

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600. $\lim_{x \to \frac{\pi}{4}} \frac{\tan^3 x - \tan x}{\cos\left(\frac{\pi}{4} + x\right)} = \alpha$ and $\lim_{x \to 0} (\cos x)^{\cot x} = \beta$ .If α and β are the roots of equation $ax^2 + bx - 4$ then ordered pair (a,b) is

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601. If [x] denotes GIF , then value of $\pi^2 \int_0^2 \sin\left(\frac{\pi}{2}x\right)(x - [x])^{[x]} dx$

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602. $32^{\tan^2 x} + 32^{\sec^2 x} = 81$. Find number of solution if $0 \le x \le \frac{\pi}{4}$.

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603. A function defined $g \rightarrow g$ from set $1, 2, 3, 4, 5, 6....$ and it is onto then find probability that $g(3) = 2g(1)$

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604. If $\frac{z-1}{z-i}$ is purely imaginary then find the minimum value of $|z-(3+3i)|$

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605. If $\alpha + \beta + \gamma = 2\pi$ and

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

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

$(\cos\gamma)x + (\cos\alpha)y + z = 0$ then no. of solutions are

A. Unique

B. Infinite

C. No solution

D. Exactly 2

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606. The coefficient of a^7b^8in $(a+2b+4ab)^{10}=k.2^{18}$. Find k.

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607. If $\frac{a_1+a_2+\ldots.+a_{10}}{a_1+a_2+\ldots.a_p}=\frac{100}{p^2}$ and a_i is in A.P, find value of $\left(\frac{a_{11}}{a_{10}}\right)$

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608. Find number of elements in $\left\{A=\begin{bmatrix} a & b \\ 0 & d \end{bmatrix}, a, b, d \in \{-1, 0, 1\}\right.$ such that $\left.(I-A)^3=I-A^3\right\} I is 2\times 2$ identity matrix

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609. Line $\frac{x-2}{\alpha}=\frac{y-2}{-3}=\frac{z+2}{2}$ lies in $x+3y-2z+\beta=0$ then $\alpha+\beta=?$

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610. The negation of the statement $(p \vee q) \Rightarrow (q \vee r)$

A. $p \wedge q \wedge r$

B. $p \wedge q \wedge \sim r$

C. $p \wedge \sim q \wedge \sim r$

D. $\sim p \wedge q \wedge r$

Answer: C

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611. Angle between the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $x^2 + y^2 = ab, a > b.$

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612.

$$\int \frac{\sin x}{\sin^3 x + \cos^3 x} dx = \alpha \ln|1 + \tan x| + \beta \ln\left|1 - \tan x + \tan^2 x\right| + \gamma \tan^{-1}\left(\frac{2\tan^{-1} - 1}{\sqrt{3}}\right) + c$$

then find $18\left(\alpha + \beta + \gamma^2\right)$

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613. If tangent to the parabola $y^2 = 8x$ at (2,-4) also touches the circle $x^2 + y^2 = a$. then find the value of a

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614. The mean and variance of the 7 observations is 8 and 12 resp. . If two observations are 8 and 6 . find the variance of the remaining observation

A. $\frac{132}{15}$

B. $\frac{396}{25}$

C. $\frac{396}{50}$

D. $\frac{792}{25}$

Answer: B

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615. If $f(x) = \sin^{-1}\left(\frac{3x^2 + x - 1}{(x - 1)^2}\right) + \cos^{-1}\left(\frac{x - 1}{x + 1}\right)$ then the domain of $f(x)$ is

A. $\left[\frac{1}{4}, \frac{1}{2}\right]$

B. $\left[\frac{1}{4}, \frac{1}{2}\right] \cup \{0\}$

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

D. $\left(0, \frac{1}{2}\right)$

Answer: A

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616. Let $f : N \to N$ for which $f(m+n) = f(m) + f(n) \forall m, n \in N$ .If $f(6) = 18$ then the value of $f(2) \cdot f(3)$ is

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617.

$\vec{a} \times \left[\left(\vec{r} - \vec{b}\right) \times \vec{a}\right] + \vec{b} \times \left[\left(\vec{r} - \vec{c}\right) \times \vec{b}\right] + \vec{c} \times \left[\left(\vec{r} - \vec{a}\right) \times \vec{c}\right] = 0$ and $\vec{a}, \vec{b}$ and are unit vector mutually perpendicular to each other then the $\vec{r}$ is :

A. $\frac{\vec{a} - \vec{b} - \vec{c}}{2}$

B. $\frac{\vec{a} - \vec{b} + \vec{c}}{2}$

C. $\frac{\vec{a} + \vec{b} + \vec{c}}{2}$

D. $\frac{\vec{a} + \vec{b} - \vec{c}}{2}$

Answer: C

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618. Distance of a point P(-2,1,2) from the line of intersection of $x + 3y - 2z + 1 = 0$ and $x - 2y + z = 0$ is

A. $2 \times \sqrt{\frac{34}{35}}$

B. $2 \times \sqrt{\frac{35}{34}}$

C. $\sqrt{\frac{35}{34}}$

D. $\sqrt{\frac{34}{35}}$

Answer: A

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619. If the line pass through the point(-3,-5) and intersect the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ at a point A and B . Then the locus of mid point of line joining A and B is

A. $4x^2 + 9y^2 + 20x + 27y = 0$

B. $9x^2 + 4y^2 + 20x + 27y = 0$

C. $4x^2 + 9y^2 + 27x + 20y = 0$

D. $9x^2 + 4y^2 + 27x + 20y = 0$

Answer: D

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620. Area enclosed by the curves $y = \sin x + \cos x$ and $y = |\cos x - \sin x|$ and the lines $x = 0$ and $x = \frac{\pi}{2}$

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621. $x^2dy + \left(y - \frac{1}{x}\right)dx = 0$ at $y(1) = 1$ then find the value of $y\left(\frac{1}{2}\right)$

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622. $\sum_{n=1}^{20} \frac{1}{a_n a_{n+1}} = \frac{4}{9}, a_1, a_2, a_3 \ldots$ are in A.P and also sum of first 21 terms of A.P is 189 then find the value of $a_6 a_{16}$

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623. The number of words with or without meaning that can be formed using all the letter of the words "FARMER" such that both R do not appear together is . .

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624. $p \wedge \sim q$ is equivalent to

A. $\sim(p \rightarrow q)$

B. $\sim(q \rightarrow p)$

C. $(q \rightarrow p)$

D. $(p \rightarrow q)$

Answer: A

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625. Find $f(x)$ which satisfies $f(x) = x + \int_0^{\frac{\pi}{2}} \sin x \cdot \cos y \cdot f(y) dy$

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626. Find the probability of selecting 2 squares in chessboard who have a side in common

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627. If $2\cos x\left(4\sin\left(\frac{\pi}{4}+x\right)\sin\left(\frac{\pi}{4}-x\right)-1\right)=1$ then for $x \in [0, \pi]$ then the number of solution s is n ,and the sum of solutions is s then find the value of (n, s)

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628. Consider 15 points $P_1, P_2, P_3, \ldots P_{15}$ on circle. Find the number of triangles formed by P_i, P_j, P_k such that $i + j + k \neq 15$

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629. Sum of coefficient of $(x + y)^n = 4096$ then find the highest coefficient

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630. If the angle between $\frac{x^2}{9} + \frac{y^2}{1} = 1$ and the circle $x^2 + y^2 = 3$ at their point of intersection in 1st quadrant is θ then find value of $\tan\theta$

A. $\sqrt{3}$

B. $\frac{1}{\sqrt{3}}$

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

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

Answer: D

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631. The area of triangle formed by the lines $2x - y + 1 = 0, 3x - y + 5 = 0$ and $2x - 5y + 11 = 0$

A. $\frac{360}{52}$

B. $\frac{361}{52}$

C. $\frac{362}{52}$

D. $\frac{363}{52}$

Answer: B

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632. If $f(x)$ is a cubic polynomial such that $f(x) = -\frac{2}{x}$ for x=2,3,4 and 5 then the value of $52 - f(10)$ is

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633. The value of $\lim_{x \to \frac{\pi}{4}} \frac{\frac{\pi}{4}\int_2^{\sec^2 x} f(x)dx}{x^2 - \frac{\pi^2}{16}}$ is

A. $2f(2)$

B. $\sqrt{2}f(2)$

C. $4f(2)$

D. $f(\sqrt{2})$

Answer: A

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634. The value of $\cos^{-1}(\cos(-6)) + \sin^{-1}(\sin 5) - \tan^{-1}(\tan 2)$ is

A. $\pi - 1$

B. $1 - \pi$

C. $3 - \pi$

D. $\pi - 3$

Answer: D

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635. If

$$f(x) = 3 + \cos^{-1}\left(\cos\left(\frac{\pi}{2} + x\right)\cos\left(\frac{\pi}{2} - x\right) + \sin\left(\frac{\pi}{2} + x\right)\sin\left(\frac{\pi}{2} - x\right)\right), x \in [0, \pi]$$

then find the minimum value of f(x) is

A. 4

B. -2

C. -3

D. 3

Answer: D

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636. Find the rang of

$$f(x) = \log_{\sqrt{5}}\left(3 + \cos\left(\frac{3\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right) - \cos\left(\frac{3\pi}{4} - x\right)\right)$$

A. $\left(0, \sqrt{5}\right)$

B. $\left[\frac{1}{\sqrt{5}}, \sqrt{5}\right]$

C. $[-2, 2]$

D. $[0, 2]$

Answer: D

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SECTION-A

1. The statement among the following that is a tautology is :

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

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

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

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

Answer: D

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2. A man on the straight line whose arithmetic mean of reciprocal of intercepts on the axes is $\frac{1}{4}$. There are 3 marbles at A (1,1) , B(2,2) , C(4,4) . Then which marble lie on its path

A. A only

B. C only

C. All the three

D. B only

Answer: D

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

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

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

C. 11x + y + 17z + 38 = 0

D. 6x – 5y + 2z + 10 = 0

Answer: C

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4. The population p(t) at time t of a certain mouse species satisfies the differential equation $\frac{dp(t)}{dt} = 0.5p(t)$ - 450 If $p(0) = 850$, then the time at which the population becomes zero is (1) $2\ln 18$ (2) $\ln 9$ (3) $\frac{1}{2}\ln 18$ (4) $\ln 18$

A. $\log_e 18$

B. $\log_e 99$

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

D. $2\log_e 18$

Answer: D

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5. The system of linear equation

$3x - 2y - kz = 10$

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

$x + 2y - z = 5m$

is in-consistent if :

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

B. $k \neq 3, m \in R$

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

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

Answer: B

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

A. discontinuous at all integral values of x except at x=1

B. Continuous only at x=1

C. continous for every real x

D. discontinuous only at x=1

Answer: C

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7. The distance of the point (1,1,9) from the point of intersection of the line $\frac{x-3}{1}=\frac{y-4}{2}=\frac{z-5}{2}$ and plane x+y+z=17

A. $2\sqrt{19}$

B. $19\sqrt{2}$

C. 38

D. $\sqrt{38}$

Answer: D

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8. Tangent is drawn to $y = x^3$ at $P\left(t, t^3\right)$, it intersects curve again at Q.Find ordinate of point which divide PQ internally in 1:2

A. $-2t^3$

B. 0

C. $-t^3$

D. $2t^3$

Answer: A

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

A. (−1, 3)

B. (3, 1)

C. (1,3)

D. (1,-3)

Answer: C

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10. Value of

$-{}^{15}C_1 + 2.\,.{}^{15}C_2 - 3.{}^{15}C_3 + \ldots\ldots - 15.{}^{15}C_{15} + {}^{15}C_1 + {}^{15}C_2 + \ldots.{}^{15}C_{14}$ is

A. $2^{16} - 1$

B. $2^{13} - 14$

C. 2^{14}

D. $2^{13} - 13$

Answer: B

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11. $f(x) = \frac{4x^3 - 3x^2}{6} - 2\sin x + (2x - 1)\cos x$, then $f(x)$ is

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

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

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

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

Answer: A

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12. Let $f: R \rightarrow R$ be fefined as f(x) = 2x -1 and $g: R - \{1\} \rightarrow R$ be defined as $g(x) = \frac{x - \frac{1}{2}}{x - 1}$ Then the composition function f(g(x)) is :

A. onto but not one-one

B. both one-one and onto

C. one-one but not onto

D. neither one-one nor onto

Answer: C

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

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

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

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

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

Answer: D

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14. A committee has to be formed from 6 Indians and 8 foreignera such that the number of Indians should be atleast two and foreigners should be double that of Indians. In how many ways can it be formed

A. 1625

B. 575

C. 560

D. 1050

Answer: A

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

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

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

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

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

Answer: C

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16. If $p, q > 0, p + q = 2$ and $p^4 + q^4 = 272$, then p and q are roots of

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

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

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

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

Answer: D

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

A. $20\sqrt{3}$

B. $25\sqrt{3}$

C. 30

D. 25

Answer: B

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18. Evaluate : $\lim_{x \to 0} \frac{\int_0^{x^2} \sin\sqrt{t}\, dt}{x^3}$

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

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

C. 0

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

Answer: A

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19. If $e^{\left(\cos^2 x + \cos^4 x + \cos^6 x + \dots \dots \dots \infty\right)\log_e 2}$ satisfies the equation $t^2 - 9t + 8 = 0$, then the value of $\frac{2\sin x}{\sin x + \sqrt{3}\cos x}\left(0 < x < \frac{\pi}{2}\right)$ is

A. $2\sqrt{3}$

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

C. $\sqrt{3}$

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

Answer: D

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20. The locus of the midpoint of the segment joining the focus to a moving point on the parabola $y^2 = 4ax$ is another parabola with directrix

$y = 0$ (b) $x = -a$ $x = 0$ (d) none of these

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

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

C. $x = 0$

D. $x = a$

Answer: C

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21. A missile fires a target . The probability of getting intercepted is $\frac{1}{3}$ and if it is not intercepted then probability of hitting the target is $\frac{3}{4}$. Three independent missiles are fired . Find the probability of all three hit.

A. $\frac{1}{27}$

B. $\frac{3}{4}$

C. $\frac{1}{8}$

D. $\frac{3}{8}$

Answer: C

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22. If $0 < \theta, \phi < \frac{\pi}{2}, x = \sum_{n=0}^{\infty} \cos^{2n}\theta, y = \sum_{n=0}^{\infty} \sin^{2n}\phi$ and $z = \sum_{n=0}^{\infty} \cos^{2n}\theta \cdot \sin^{2n}\phi$ then :

A. $xy - z = (x + y)z$

B. $xy + yz + zx = z$

C. $xyz = 4$

D. $xy + z = (x + y)z$

Answer: D

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23. $f(x+1) = f(x) + f(1), f(x), g(x) : N \rightarrow N$

$g(x)$ = any arbitrary function and $fog(x)$ is one-one

A. If fog is one-one, then g is one-one

B. If f is onto, then $f(n) = n \forall n \in N$

C. f is one-one

D. If g is onto, then fog is one-one

Answer: D

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24. The equation of the line through the point (0,1,2) and perpendicular to the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{-2}$ is :

A. $\frac{x}{3} = \frac{y-1}{4} = \frac{z-2}{3}$

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

C. $\frac{x}{3} = \frac{y-1}{4} = \frac{z-2}{-3}$

D. $\frac{x}{-3} = \frac{y-1}{4} = \frac{z-2}{3}$

Answer: D

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25. Let α be the angle between the lines whose direction cosines satisfy the equation $l + m - n = 0$and $l^2 + m^2 - n^2 = 0$ then value of $(\sin\alpha)^4 + (\cos\alpha)^4$ is

A. $\frac{3}{4}$

B. $\frac{3}{8}$

C. $\frac{5}{8}$

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

Answer: C

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26. The value of the integral

$$\int \frac{\sin\theta.\sin 2\theta\left(\sin^6\theta+\sin^4\theta+\sin^2\theta\right)\sqrt{2\sin^4\theta+3\sin^2\theta+6}}{1-\cos 2\theta}d\theta \text{ is :}$$

(where c is a constant of integration)

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

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

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

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

Answer: D

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27. The value of $\int_{-1}^{1}x^2e^{\left[x^3\right]}dx$, where [t] denotes the greatest integer $\leq t$, is :

A. $\frac{e - 1}{3e}$

B. $\frac{e + 1}{3}$

C. $\frac{e + 1}{3e}$

D. $\frac{1}{3e}$

Answer: C

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28. A man is observing, from the top of a tower, a boat speeding towards the tower from a certain point A, with uniform speed. At that point, angle of depression of the boat with the man's eye is 30° (Ignore man's height). After sailing for 20 seconds, towards the base of the tower (which is at the level of water), the boat has reached a point B, where the angle of depression is 45°. Then the time taken (in seconds) by the boat from B to reach the base of the tower is:

A. 10

B. $10\sqrt{3}$

C. $10\left(\sqrt{3}+1\right)$

D. $10\left(\sqrt{3}-1\right)$

Answer: C

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29. A tangent is drawn to the parabola $y^2 = 6x$ which is perpendicular to the line $2x + y = 1$. Which of the following points does NOT lie on it?

A. (-6, 0)

B. (4, 5)

C. (5, 4)

D. (0, 3)

Answer: C

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30. All possible values of $\theta \in [0, 2\pi]$ for which $\sin 2\theta + \tan 2\theta > 0$ lie in :

A. $\left(0, \frac{\pi}{2}\right) \cup \left(\pi, \frac{3\pi}{2}\right)$

B. $\left(0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \frac{3\pi}{4}\right) \cup \left(\pi, \frac{7\pi}{6}\right)$

C. $\left(0, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{2}, \frac{3\pi}{4}\right) \cup \left(\frac{3\pi}{2}, \frac{11\pi}{6}\right)$

D. $\left(0, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{2}, \frac{3\pi}{4}\right) \cup \left(\pi, \frac{5\pi}{4}\right) \cup \left(\frac{3}{2}, \frac{7\pi}{4}\right)$

Answer: D

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31. Let the lines $(2 - i)z = (2 + i)\bar{z}$ and $(2 + i)z + (i - 2)\bar{z} - 4i = 0$, (here $i^2 = -1$) be normal to a circle C. If the line $iz + \bar{z} + 1 + i = 0$ is tangent to this circle C, then its radius is :

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

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

C. $3\sqrt{2}$

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

Answer: D

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32. The image of the point (3, 5) in the line $x - y + 1 = 0$, lies on :

A. $(x - 2)^2 + (y - 2)^2 = 12$

B. $(x - 4)^2 + (y + 2)^2 = 16$

C. $(x - 4)^2 + (y - 4)^2 = 8$

D. $(x - 2)^2 + (y - 4)^2 = 4$

Answer: D

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33. If the cuves, $\frac{x^2}{a} + \frac{y^2}{b} = 1$ and $\frac{x^2}{c} + \frac{y^2}{d} = 1$ intersect each other at an angle of 90°, then which of the following relations is TRUE?

A. $a + b = c + d$

B. $a - b = c - d$

C. $a - c = b + d$

D. $ab = \frac{c + d}{a + b}$

Answer: B

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34. $\lim_{n \to \infty} \left(1 + \frac{1 + \frac{1}{2} + \dots\dots\dots + \frac{1}{n}}{n^2}\right)^n$ is equal to :

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

B. 0

C. $\frac{1}{e}$

D. 1

Answer: D

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35. The coefficients a, b and c of the quadratic equation, $ax^2 + bx + c = 0$ are obtained by throwing a dice three times. The probability that this equation has equal roots is:

A. $\frac{1}{72}$

B. $\frac{5}{216}$

C. $\frac{1}{36}$

D. $\frac{1}{54}$

Answer: B

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36. The total number of positive integral solutions (x, y, z) such that xyz = 24 is :

A. 36

B. 24

C. 45

D. 30

Answer: D

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37. Integral value of k for which $x^2 - 2(3k - 1)x + 8k^2 - 7 > 0$

A. 3

B. 2

C. 0

D. 4

Answer: A

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38. If a curve passes through the origin and the slope of the tangent to it at any point (x, y) is $\frac{x^2 - 4x + y + 8}{x - 2}$, then this curve also passes through the point:

A. (5, 4)

B. (4, 5)

C. (4, 4)

D. (5, 5)

Answer: D

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39. The statement $A \rightarrow (B \rightarrow A)$ is equivalent to :

A. $A \rightarrow (A \wedge B)$

B. $A \rightarrow (A \rightarrow B)$

C. $A \rightarrow (A \leftrightarrow B)$

D. $A \rightarrow (A \vee B)$

Answer: D

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40. If Rolle's theorem holds for the function $f(x) = x^3 - ax^2 + bx - 4, x \in [1, 2]$ with $f'\left(\frac{4}{3}\right) = 0$, then ordered pair (a, b) is equal to :

A. (5, 8)

B. (-5, 8)

C. (5, -8)

D. (-5, -8)

Answer: A

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41. If the vectors $\vec{a}$ and $\vec{b}$ are mutually perpendicular, then $\vec{a} \times \left\{\vec{a} \times \left\{\vec{a} \times \left\{\vec{a} \times \vec{b}\right\}\right\}\right\}$ is equal to:

A. $\vec{0}$

B. $\frac{1}{2}\left|\vec{a}\right|^4\vec{b}$

C. $\vec{a} \times \vec{b}$

D. $\left|\vec{a}\right|^4\vec{b}$

Answer: D

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42. A fair coin is tossed fixed times. The probability of getting 7 heads is equal to probability of getting 9 heads. Then find the probability of getting 2 heads

A. $\frac{15}{2^{13}}$

B. $\frac{15}{2^{12}}$

C. $\frac{15}{2^{8}}$

D. $\frac{15}{2^{14}}$

Answer: A

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43. A is 2×2 symmetric such that trace of A^2 is 1.How many such matrices are possible with integer entries ?

A. 4

B. 1

C. 6

D. 12

Answer: A

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44. In a increasing geometric series, the sum of the second and the sixth term is $\frac{25}{2}$ and the product of the third and fifth term is 25. then , the sum of $4^{th}, 6^{th}$ and 8^{th} terms to

A. 30

B. 26

C. 35

D. 32

Answer: C

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45. The value of $\sum_{n=1}^{100} \int_{n-1}^{n} e^{x-[x]} dx =$

A. $100(e - 1)$

B. $100(1 - e)$

C. $100e$

D. $100(1 + e)$

Answer: A

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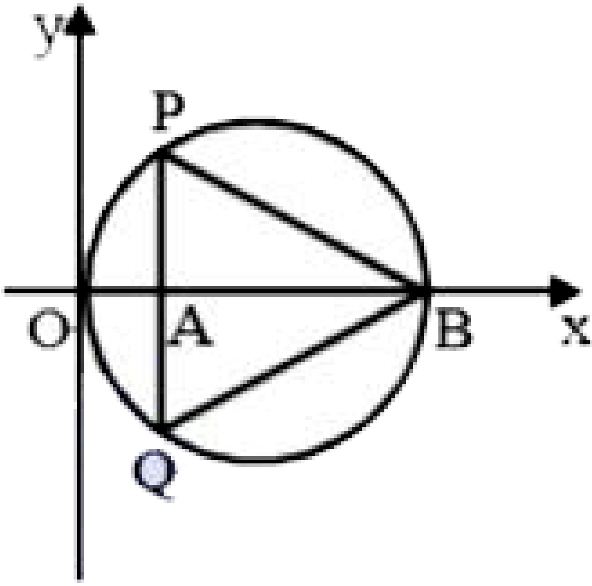
46. In the circle given below . Let OA = 1 unit , OB = 13 unit and PQ $\perp$ OB.

Then the area of the triangle PQB (in square units)is



A. $24\sqrt{2}$

B. $24\sqrt{3}$

C. $26\sqrt{3}$

D. $26\sqrt{2}$

Answer: B

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47. Sum of series $1+\frac{2}{3}+\frac{7}{3^2}+\frac{12}{3^3}+\ldots\ldots\infty$

A. $\frac{13}{4}$

B. $\frac{9}{4}$

C. $\frac{15}{4}$

D. $\frac{11}{4}$

Answer: A

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48. $\lim h \to 02\left(\frac{\sqrt{3}\sin\left(h + \frac{\pi}{6}\right) - \cos\left(h + \frac{\pi}{6}\right)}{h\left(\sqrt{3}\cosh - \sinh\right)}\right)$

A. $\frac{4}{3}$

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

C. $\frac{3}{4}$

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

Answer: A

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49. Find maximum value of term independent of "t" in

$$\left(tx^{\frac{1}{5}} + \frac{(1-x)^{\frac{1}{10}}}{t}\right)^{10}, x \in (0, 1)$$

A. $\dfrac{10!}{\sqrt{3}(5!)^2}$

B. $\dfrac{2.10!}{3\sqrt{3}(5!)^2}$

C. $\dfrac{2.10!}{2(5!)^2}$

D. $\dfrac{10!}{3(5!)^2}$

Answer: B

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50. Growth of bacteria is directly proportional to number of bacteria . At t=0 , number of bacteria = 1000 and after 2 hours population is increased by 20%. After this population becomes 2000 where $t = \frac{k}{\ln\left(\frac{6}{5}\right)}$. Find value of $\left(\frac{k}{\ln 2}\right)^2$

A. 4

B. 8

C. 2

D. 16

Answer: A

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51. If$(1, 5, 35), (7, 5, 5), (1, \lambda, 7)$ and $(2\lambda, 1, 2)$ are coplanar then the sum of all possible values of λ is

A. $\frac{39}{5}$

B. $-\frac{39}{5}$

C. $\frac{44}{5}$

D. $-\frac{44}{5}$

Answer: C

Watch Video Solution

52. $\frac{\sin^{-1}x}{a}=\frac{\cos^{-1}x}{b}=\frac{\tan^{-1}y}{c}$ value of $\cos\left(\frac{\pi c}{a+b}\right)$

A. $\frac{1-y^2}{y\sqrt{y}}$

B. $1-y^2$

C. $\frac{1-y^2}{1+y^2}$

D. $\frac{1-y^2}{2y}$

Answer: C

53. The number of seven digit integers, with sum of the digits equal to 10 and formed by using the digits 1, 2 and 3 only, is

A. 42

B. 82

C. 77

D. 35

Answer: C

54. Let f be any function defined on R and let it satisfy the condition :

$|f(x) - f(x)| \leq (x - y)^2, \forall (x, y) \in R$ if $f(0) = 1,$ then :

A. f(x) can take any value in R

B. $f(x) < 0, \ \forall x \in R$

C. $f(x) = 0, \ \forall x \in R$

D. $f(x) > 0, \ \forall x \in R$

Answer: D

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55. $y = \frac{1}{2}x^4 - 5x^3 + 18x^2 - 19x$ what will be max. value of slope at

A. (2,2)

B. (0,0)

C. (2,9)

D. $\left(3, \frac{21}{2}\right)$

Answer: A

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56. The intersection of three lines

$x - y = 0, x + 2y = 3$ and $2x + y = 6$ is a

A. right angled triangle

B. Equilateral triangle

C. Isosceles triangle

D. None of the above

Answer: C

Watch Video Solution

57. Consider the three planes

$P_1 : 3x + 15y + 21z = 9,$

$P_2 : x - 3y - z = 5,$ and

$P_3 : 2x + 10y + 14z = 5$

then , which one of the following is true ?

A. P_1 and P_2 are parallel

B. P_1 and P_3 are parallel

C. P_2 and P_3 are parallel

D. P_1, P_2 and P_3 all are parallel

Answer: B

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58. The value of $\begin{vmatrix} (a+1)(a+2) & a+2 & 1 \\ (a+2)(a+3) & a+3 & 1 \\ (a+3)(a+4) & a+4 & 1 \end{vmatrix}$ is

A. $(a+2)(a+3)(a+4)$

B. -2

C. $(a+1)(a+2)(a+3)$

D. 0

Answer: B

Watch Video Solution

59. The value of $\int_{-\pi/2}^{\pi/2} \frac{\cos^2 x}{1+3^x} dx$ is

A. $\frac{\pi}{4}$

B. 4π

C. $\frac{\pi}{2}$

D. 2π

Answer: A

Watch Video Solution

60. Let $P(x, y)$ be a point which is a constant distance from the origin. Then equivalence relation of $(1, -1)$ is

A. $S = \{(x, y) \mid x^2 + y^2 = 4\}$

B. $S = \{(x, y) \mid x^2 + y^2 = 1\}$

C. $S = \left\{(x, y) \mid x^2 + y^2 = \sqrt{2}\right\}$

D. $S = \left\{(x, y) \mid x^2 + y^2 = 2\right\}$

Answer: D

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61. For the statements p and q, consider the following compound statements :

(a) $(\sim q \wedge (p \rightarrow q)) \rightarrow \sim p$

(b) $((p \vee q) \wedge \sim p) \rightarrow q$

Then which of the following statements is correct?

A. (a) and (b) both are not tautologies.

B. (a) and (b) both are tautologies.

C. (a) is a tautology but not (b).

D. (b) is a tautology but not (a).

Answer: B

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62. Let $a, b \in R$. If the mirror image of the point P(a, 6, 9) with respect to the line $\frac{x-3}{7} = \frac{y-2}{5} = \frac{z-1}{-9}$ is (20, b, -a -9), then |a + b| is equal to :

A. 88

B. 86

C. 84

D. 90

Answer: A

Watch Video Solution

63. Equation of plane through (1,0,2) and line of intersection of planes $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 1$ and $\vec{r} \cdot \left(\hat{i} - 2\hat{j}\right) = -2$

A. $\vec{r}.\left(\hat{i} + 7\hat{j} + 3\hat{k}\right) = \frac{7}{3}$

B. $\vec{r}.\left(3\hat{i} + 7\hat{j} + 3\hat{k}\right) = 7$

C. $\vec{r}.\left(\hat{i} + 7\hat{j} + 3\hat{k}\right) = 7$

D. $\vec{r}.\left(\hat{i} - 7\hat{j} + 3\hat{k}\right) = \frac{7}{3}$

Answer: C

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64. If P is a point on the parabola $y = x^2 + 4$ which is closest to the straight line y = 4x – 1, then the co-ordinates of P are :

A. (3, 13)

B. (1,5)

C. (-2, 8)

D. (2, 8)

Answer: D

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65. The angle of elevation of a jet plane from a point A on the ground is 60°. After a flight of 20 seconds at the speed of 432 km/hour, the angle of elevation changes to 30°. If the jet plane is flying at a constant height, then its height is :

A. $1800\sqrt{3}$ m

B. $3600\sqrt{3}$ m

C. $2400\sqrt{3}$ m

D. $1200\sqrt{3}$

Answer: D

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66. If $n \geq 2$ is a positive integer, then the sum of the series ${}^{n+1}C_2 + 2\left({}^{2}C_2 + 3C_2 + 4C_2 + \dots + nC_2\right)$ is:

A. $\dfrac{n(n-1)(2n+1)}{6}$

B. $\dfrac{n(n+1)(2n+1)}{6}$

C. $\dfrac{n(2n+1)(3n+1)}{6}$

D. $\dfrac{n(n+1)^2(n+2)}{12}$

Answer: B

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67. Let $f(x) = \begin{cases} -55x & x < -5 \\ 2x^3 - 3x^2 - 120x & -5 \le x < 4 \\ 2x^3 - 3x^2 - 36x + 10 & x \ge 4 \end{cases}$

Then interval in which f(x) is monotonically increasing is

A. $(-\infty, -5) \cup (4, \infty)$

B. $(-5, \infty)$

C. $(-\infty, -5) \cup (-4, \infty)$

D. $(-5, -4) \cup (4, \infty)$

Answer: D

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68. Let f be a twice differentiable function defined on R such that f(0) = 1, f'(0) = 2 and $f'(x) \neq 0$ for all $x \in R$. If $\begin{vmatrix} f(x) & f'(x) \\ f'(x) & f''(x) \end{vmatrix} = 0$, for all $x \in R$, then the value of f(1) lies in the interval:

A. (9, 12)

B. (6, 9)

C. (0, 3)

D. (3,6)

Answer: B

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69. For which of the following curves, the line $x + \sqrt{3}y = 2\sqrt{3}$ is the tangent at the point $\left(\frac{3\sqrt{3}}{2}, \frac{1}{2}\right)$?

A. $x^2 + y^2 = 7$

B. $y^2 = \frac{1}{6\sqrt{3}}x$

C. $2x^2 - 18y^2 = 9$

D. $x^2 + 9y^2 = 9$

Answer: D

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70. The value of the integral, $\int_1^3 \left[x^2 - 2x - 2\right]dx$, where [x] denotes the greatest integer less than or equal to x, is :

A. $-\sqrt{2} - \sqrt{3} + 1$

B. $-\sqrt{2} - \sqrt{3} - 1$

C. -5

D. -4

Answer: B

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71. Evaluate $\tan\left(\frac{1}{4}\cdot\sin^{-1}\left(\frac{\sqrt{63}}{8}\right)\right)$

A. $\frac{1}{\sqrt{7}}$

B. $2\sqrt{2}-1$

C. $\sqrt{7}-1$

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

Answer: A

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72. The negative of the statement $\sim p \vee (p \wedge q)$ is

A. $\sim p \vee q$

B. $p \vee \sim q$

C. $\sim p \wedge q$

D. $p \wedge \sim q$

Answer: D

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73. A curve $y = ax^2 + bx + c$ passing through the point $(1, 2)$ has slope of tangent at orign equal to 1 , then ordered triplet (a, b, c) may be

A. $a = \frac{1}{2}, b = \frac{1}{2}, c = 1$

B. a = 1, b = 0, c= 1

C. a = 1, b = 1, c = 0

D. a = -1, b = 1, c = 1

Answer: C

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74. The area of the region : $R = \left\{(x, y) : 5x^2 \le y \le 2x^2 + 9\right\}$ is :

A. $11\sqrt{3}$ square units

B. $12\sqrt{3}$ square units

C. $9\sqrt{3}$ square units

D. $6\sqrt{3}$ square units

Answer: B

Watch Video Solution

75. Given $y = y(x)$passing through (1,2) such that $x\frac{dy}{dx} + y = bx^4$ then find b if $\int_1^2 f(x)dx = \frac{62}{5}$

A. 5

B. 10

C. $\frac{62}{5}$

D. $\frac{31}{5}$

Answer: B

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76. $f(0) = 1, f(2) = e^2, f'(x) = f'(2 - x)$, then find the value of $\int_0^2 f(x)dx$

A. $1 - e^2$

B. $1 + e^2$

C. $2\left(1 - e^2\right)$

D. $2\left(1 + e^2\right)$

Answer: B

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77. If A is symmetric matrix and B is skew symmetric matrix of order 3×3, then consider $\left(A^2B^2 - B^2A^2\right)X = 0$, where X is a matrix of unknown variable of 3×1 and O is a null matrix of 3×1, then system of linear equation has

A. no solution

B. exactly two solutions

C. infinitely many solutions

D. a unique solution

Answer: C

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78. Let a, b, c be in arithmetic progression. Let the centroid of the triangle with vertices (a, e), (2, b) and (a, b) be $\left(\frac{10}{3}, \frac{7}{3}\right)$. If α, β are the roots of the equation $ax^2 + bx + 1 = 0$, then the value of $\alpha^2 + \beta^2 - \alpha\beta$ is :

A. $\frac{71}{256}$

B. $\frac{69}{256}$

C. $-\frac{69}{256}$

D. $-\frac{71}{256}$

Answer: D

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79. For the system of linear equations :

x - 2y = 1, x - y + kz = -2, ky + 4z = 6, $k \in R$, consider the following statements :

(A) The system has unique solution if $k \neq 2, \quad k \neq -2$.

(B) The system has unique solution if k = - 2.

(C) The system has unique solution if k = 2.

(D) The system has no-solution if k = 2.

(E) The system has infinite number of solutions if $k \neq 2$.

Which of the following statements are correct?

A. (C) and (D) only

B. (B) and (E) only

C. (A) and (E) only

D. (A) and (D) only

Answer: D

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80. The probability that two randomly selected subsets of the set {1, 2, 3, 4, 5} have exactly two elements in their intersection, is :

A. $\frac{65}{2^7}$

B. $\frac{65}{2^8}$

C. $\frac{135}{2^9}$

D. $\frac{35}{2^7}$

Answer: C

Watch Video Solution

81. Let $\hat{i} + y\hat{j} + z\hat{k}$ and $x\hat{i} - \hat{j} + \hat{k}$ are parallel then unit vector parallel to $x\hat{i} + y\hat{j} + z\hat{k}$

A. $\frac{1}{\sqrt{2}}\left(-\hat{j} + \hat{k}\right)$

B. $\frac{1}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$

C. $\frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

D. $\frac{1}{\sqrt{3}}\left(\hat{i} - \hat{j} - \hat{k}\right)$

Answer: D

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82. Let A = {1,2,3,.....10} and $f: A \rightarrow A$ be defined as

$$f(k) = \begin{cases} k+1 & \text{if k is odd} \\ k & \text{if k is even} \end{cases}$$

Then the number of possible functions g:$A \rightarrow A$ such that gof=f is

A. 10^5

B. ${}^{10}C_5$

C. 5^5

D. $5!$

Answer: A

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83. Let $f: R \rightarrow R$ be defined as $f(x) = \begin{cases} 2\sin\left(-\frac{\pi x}{2}\right), & \text{if } x < -1 \\ \left|ax^2 + x + b\right|, & \text{if } -1 \leq x \leq 1 \\ \sin(\pi x), & \text{if } x > 1 \end{cases}$

If f(x) is continuous on R , then a+b equals

A. -3

B. -1

C. 3

D. 1

Answer: B

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84. $f(x) = \int_1^x \frac{\ln t}{1+t} dt, f(e) + f\left(\frac{1}{e}\right) =$

A. 1

B. -1

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

D. 0

Answer: C

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85. The prime factorization of a number 'n' is given as $n = 2^x \times 3^y \times 5^z, y + z = 5$ and $y^{-1} + z^{-1} = \frac{5}{6}$. Find out the odd divisors of n including 1

A. 11

B. 6

C. 6x

D. 12

Answer: D

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86. Let $f(x) = \sin^{-1}x$ and $g(x) = \frac{x^2 - x - 2}{2x^2 - x - 6}$. If $g(2) = \lim_{x \to 2} g(x)$ then the domain of the function fog is

A. $(-\infty, -2] \cup \left[-\frac{3}{2}, \infty\right)$

B. $(-\infty, -2] \cup [-1, \infty)$

C. $(-\infty, -2] \cup \left[-\frac{4}{3}, \infty\right)$

D. $(-\infty, -1] \cup [2, \infty)$

Answer: C

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87. The triangle of maximum area that can be inscribed in a given circle of radius 'r' is

A. An isoscles triangle with base equal to 2r

B. An equilateral of height $\frac{2r}{3}$

C. an equilateral trianlge having each of its side of length $\sqrt{3}r$

D. `A right angle triangle having two of its sides of length 2r and r.

Answer: C

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88. Let L be a line obtained from the intersection of two planes x+2y+z = 6 and y+2z=4 . If point $P(\alpha, \beta, \gamma)$ is the foot of perpendicular from (3,2,1) on L then the value of $21(\alpha+\beta+\gamma)$ equals .

A. 142

B. 68

C. 136

D. 102

Answer: D

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89. Let

$F_1(A, B, C) = (A \wedge \sim B) \vee [\sim C \wedge (A \vee B)] \vee \sim A$ and $F_2(A, B) = (A \vee B) \vee (B \rightarrow$

be two logical expressions. Then :

A. F_1 and F_2 both are tautologies

B. F_1 is tautology but F_2 is not a tautology

C. F_1 is not tautology but F_2 is a tautology

D. Both F_1 and F_2 are not talutogies

Answer: C

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90. The slope of the tangent to curve is $\frac{xy^2 + y}{x}$ and it intersects the line $x + 2y = 4$ at $x = -2$. $If(3, y)$ lies on the curve then y is

A. $\frac{18}{35}$

B. $-\frac{4}{3}$

C. $-\frac{18}{19}$

D. $-\frac{18}{11}$

Answer: C

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91. Locus of the mid-point of the line joining (3,2) and point on $\left(x^2 + y^2 = 1\right)$ is a circle of radius r . Find r

A. 1

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

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

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

Answer: B

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92. Consider the following system of equations :

$x + 2y - 3z = a$

$2x + 6y - 11z = b$

$x - 2y + 7z = c,$

where a, b and c are real constant. Then the system of eqations :

A. has a unique solution when 5a=2b+c

B. has infinite number of solutions when 5a=2b+c

C. has no solution for all a, b and c

D. has a unique solutions for all a,b and c

Answer: B

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93. If $0 < a, b < 1$ and $\tan^{-1}a + \tan^{-1}b = \frac{\pi}{4}$, then the value of $(a+b) - \left(\frac{a^2+b^2}{2}\right) + \left(\frac{a^3+b^3}{3}\right) - \left(\frac{a^4+b^4}{4}\right) + \ldots$ is :

A. $\log_e 2$

B. $e^2 - 1$

C. e

D. $\log_e\left(\frac{e}{2}\right)$

Answer: A

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94. The sum of the series $\sum_{n=1}^{\infty} \frac{n^2 + 6n + 10}{(2n + 1)!}$ is equal to

A. $\frac{41}{8}e + \frac{19}{8}e^{-1} - 10$

B. $\frac{41}{8}e - \frac{19}{8}e^{-1} - 10$

C. $\frac{41}{8}e + \frac{19}{8}e^{-1} + 10$

D. $-\frac{41}{8}e + \frac{19}{8}e^{-1} - 10$

Answer: B

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95. $f(x)$ is differentiable function at $x = a$ such that $f'(a) = 2, f(a) = 4$. Find

$$\lim_{x \to a} \frac{xf(a) - af(x)}{x - a}$$

A. 2a+4

B. 4-2a

C. 2a-4

D. a+4

Answer: B

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96. Let $A(1, 4)$ and $B(1, -5)$ be two points let p be the point on $(x-1)^2 + (y-1)^2 = 1$. Find maximum value of $(PA)^2 + (PB)^2$

A. a straight line

B. a hyperbole

C. an ellipse

D. a parabola

Answer: A

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97. Mirror image of point $(1, 3, 5)$ w.r.t plane $4x - 5y + 2z = 8$ is (α, β, γ) then $5(\alpha + \beta + \gamma)$

A. 47

B. 43

C. 39

D. 41

Answer: A

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98. $f(x) = \int_0^x e^t f(t)dt + e^x, f(x)$ is a differentiable function on $x \in R$ then $f(x) =$

A. $2e^{\left(e^x - 1\right)} - 1$

B. e^{e^x} - 1

C. $2e^x$ - 1

D. $e^{\left(e^x - 1\right)}$

Answer: A

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99. If A_1 is area between the curve $y = \sin x, y = \cos x$ and y-axis in 1st quadrant and A_2 is area between $y = \sin x, y = \cos x$ x=$\frac{\pi}{2}$ and x-axis in 1st quadrant . Then find $\frac{A_2}{A_1}$

A. $A_1 : A_2 = 1 : \sqrt{2}$ and $A_1 + A_2 = 1$

B. $A_1 = A_2$ and $A_1 + A_2 = \sqrt{2}$

C. $2A_1 = A_2$ and $A_1 + A_2 = 1 + \sqrt{2}$

D. $A_1 : A_2 = 1 : 2$ and $A_1 + A_2 = 1$

Answer: A

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100. A seven digit number is formed using digits 3,3,4,4,4,5,5. The probability, that number so formed is divisble by 2, is:

A. $\frac{6}{7}$

B. $\frac{1}{7}$

C. $\frac{3}{7}$

D. $\frac{4}{7}$

Answer: C

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SECTION-B

1. If the least and the largest real values of α, for which the equation $z + \alpha|z-1| + 2i = 0$ (z $\in$ C and 1 =$\sqrt{-1}$) has a solution, are p and q

respectively, then $4\left(p^2+q^2\right)$ is equal to ____

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

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

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

and $C=\{9k+l:K\in N\}$ for some $l(0<l<9)$ if the sum of all the elements of the set $A\cap(B\cup C)$ is 274×400 , then l is equal to ______.

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4. Let a matrix M of order 3×3 has elements from the set {0,1,2}. How many matrices are possible whose sum of diagonal elements is 7 of matrix $M^T \cdot M$

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5. v37

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6. Find the minimum value of α where $\dfrac{4}{\sin x} + \dfrac{1}{1 - \sin x} = \alpha$

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7. $\lim_{x \to \infty} \tan\left\{\sum_{r=1}^{n} \tan^{-1}\left(\dfrac{1}{1 + r + r^2}\right)\right\}$ is equal to ______.

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8. Let three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}, \vec{a}.\vec{c} = 7$ and $\vec{b}$ is perpendicular to $\vec{c}$, where $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{k}$, then the value of $2\left|\vec{a} + \vec{b} + \vec{c}\right|^2$ is _______.

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9. Of the three independent events E_1, E_2 and E_3, the probability that only E_1 occurs is α, only E_2 occurs is β and only E_3 occurs is γ. Let the probability p that none of events E_1, E_2 and E_3 occurs satisfy the equations $(\alpha - 2\beta), p = \alpha\beta$ and $(\beta - 3\gamma)p = 2\beta\gamma$. All the given probabilities are assumed to lie in the interval $(0, 1)$. Then, $\dfrac{probabilityofourrenceofE_1}{probabilityofourrenceofE_3}$ is equal to

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10. Let $P = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$, where $\alpha \in R$. Suppose $Q = [q_{ij}]$ is a matrix satisfying $PQ = KI_3$ for some non - zero $K \in R$. If $q_{23} = -\frac{K}{8}$ and $|Q| = \frac{1}{2}$, then $\alpha^2 + k^2$ is equal to _______.

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11. If $p(x)$ is a polynomial of degree 6 with coefficient of x^6 equal to 1 . If extreme value occur at x=1 and x=-1 , $\lim_{x \to o} \left(\frac{f(x)}{x^3}\right) = 1$ then $5f(2) =$

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12. The number of points, at which the function $f(x) = |2x + 1| - 3|x + 2| + |x^2 + x - 2|, x \in R$ is not differentiable, is ______.

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13. The graphs of sine and cosine functions, intersect each other at a number of points and between two consecutive points of intersection, the two graphs enclose the same area A. Then A^4 is equal to _____.

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14. Let $A_1, A_2, A_3,$ .... be squares such that for each $n \geq 1$, the length of the side of A_n equals the length of diagonal of A_{n+1}. If the length of A_1 is 12 cm, then the smallest value of n for which area of A_n is less than one, is _____.

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15. Let $A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$, where x, y and z are real numbers such that $x + y + z > 0$ and $xyz = 2$. If $A^2 = I_3$, then the value of $x^3 + y^3 + z^3$ is________.

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16. A = $\begin{bmatrix} 0 & -\tan\frac{\theta}{2} \\ \tan\frac{\theta}{2} & 0 \end{bmatrix}$ and $(I + A)(I - A)^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$. Find $13\left(a^2 + b^2\right)$

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17. Find the total number of number lying between 100 and 1000 formed using 1 , 2 , 3 , 4 , 5 and divisible by either 3 or 5

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18. Let $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}, \vec{b} = \hat{i} - \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}$ and $\vec{r} \cdot \vec{b} = 0$, then $\vec{r} \cdot \vec{a}$ is equal to ______.

Watch Video Solution

19. If the system of equations

$kx + y + 2z = 1$

$3x - y - 2z = 2$

$-2x - 2y - 4z = 3$

has infinitely many solutions, then k is equal to _______.

Watch Video Solution

20. The locus of the point of intersection of the lines $(\sqrt{3})kx + ky - 4\sqrt{3} = 0$ and $\sqrt{3}x - y - 4(\sqrt{3})k = 0$ is a conic, whose eccentricity is __________.

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21. The difference between degree and order of a differential equation that represents the family of curves given by $y^2 = a\left(x + \frac{\sqrt{a}}{2}\right), a > 0$ is

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22. The number of integral values of 'k' for which the equation 3sinx + 4 cosx = k + 1 has a solution, k $\in$ R is

Watch Video Solution

23. Find no. of solutions $\log_2(x - 3) = \log_4(x - 1)$

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24. The sum of 162^{nd} power of the root of the equation $x^3 - 2x^2 + 2x - 1 = 0$ is

Watch Video Solution

25. Let $m, n \in N$ and $gcd(2, n) = 1.$ if

$$30\binom{30}{0} + \binom{30}{1} + \dots + 2\binom{30}{28} + 1\binom{30}{29} = n.2^m$$

then n+m is equal to

(here $\begin{pmatrix} n \\ k \end{pmatrix} = {}^nC_K$)

Watch Video Solution

26. If $y = y(x)$ is the solution of the equation $e^{\sin y}\cos y\frac{dy}{dx} + e^{\sin y}\cos x = \cos x, y(0) = 0,$ then $1 + y\left(\frac{\pi}{6}\right) + \frac{\sqrt{3}}{2}y\left(\frac{\pi}{3}\right) + \frac{1}{\sqrt{2}}y\left(\frac{\pi}{4}\right)$ is equal to

Watch Video Solution

27. Let $(\lambda, 2, 1)$ be a point on the plane which passes through the point $(4, -2, 2)$. If the plane is perpendicular to the line joining the points $(-2, -21, 29)$ and $(-1, -16, 23)$, then $\left(\frac{\lambda}{11}\right)^2 - \frac{4\lambda}{11} - 4$ is equal to

Watch Video Solution

28. The area bounded by the lines $y = ||x - 1| - 2|$ and x axis is

Watch Video Solution

29. The value of the integral $\int_0^{\pi} |\sin 2x| dx$ is

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30. If $\sqrt{3}\left(\cos^2 x\right) = \left(\sqrt{3} - 1\right)\cos x + 1,$ the numbers of solution of the given equation when $x \in \left[0, \frac{\pi}{2}\right]$ is

Watch Video Solution

31. For integers n and r, let $\binom{n}{r} = \begin{cases} {}^nC_r & \text{if } n \geq r \geq 0 \\ 0 & \text{otherwise} \end{cases}$. The maximum value of k for which the sum $\sum_{i=0}^{k} \binom{10}{i}\binom{15}{k-i} + \sum_{i=0}^{k+1} \binom{12}{i}\binom{13}{k+1-i}$ exists, is equal to ________.

Watch Video Solution

32. Let λ be an interger. If the shortest distance between the lines $x - \lambda = 2y - 1 = -2z$ and $x = y + 2\lambda = z - \lambda$ is $\frac{\sqrt{7}}{2\sqrt{2}}$, then the value of $|\lambda|$ is _______ .

Watch Video Solution

33. If $a + \alpha = 1, b + \beta = 2$ and $af(n) + \alpha f\left(\frac{1}{n}\right) = bn + \frac{\beta}{n}$, then find the value of $\frac{f(n) + f\left(\frac{1}{n}\right)}{n + \frac{1}{n}}$

Watch Video Solution

34. Let a point P be such that its distance from the point (5, 0) is thrice the distance of P from the point (-5, 0). If the locus of the point P is a circle of radius r, then $4r^2$ is equal to ______ .

Watch Video Solution

35. If the area of the triangle formed by the positive x-axis, the normal and the tangent to the circle $(x - 2)^2 + (y - 3)^2 = 25$ at the point (5, 7) is A, then 24A is equal to _______ .

Watch Video Solution

36. The variance of 10 natural numbers 1,1,1,1 ... k is less then 10 . Find maximum value of k

Watch Video Solution

37. Sum of first four terms of GP is $\frac{65}{12}$, sum of their reciprocals is $\frac{65}{18}$ .Product of their first 3 terms is 1 and if 3rd term is α then find 2α

Watch Video Solution

38. $S_1, S_2, \ldots, S_{10}$ are 10 students , in how many ways they can be divided in 3 groups A,B and C such that all groups have atleast one student and C has maximum 3 students.

Watch Video Solution

39. Let $i = \sqrt{-1}$. If $\frac{\left(-1 + i\sqrt{3}\right)^{21}}{(1 - i)^{24}} + \frac{\left(1 + i\sqrt{3}\right)^{21}}{(1 + i)^{24}} = k$, and n = [|k|] be the greatest integral part of |k|. Then $\sum_{j=0}^{n+5} (j + 5)^2 - \sum_{j=0}^{n+5} (j + 5)$ is equal to ______ .

Watch Video Solution

40. The number of the real roots of the equation $(x+1)^2 + |x-5| = \frac{27}{4}$ is

______ .

Watch Video Solution

41. IF $z(z \in C)$ satisfy $|z+5| \leq 5$ and $z(1+i) + \bar{z}(1-i) \geq -10$.If the maximum value of $|z+1|^2$ is $\alpha + \sqrt{2}\beta$ then find $\alpha + \beta$

Watch Video Solution

42. Let the normals at all the points on a given curve pass through a fixed point (a,b). If the curve passes through (3,-3) and $\left(4, -2\sqrt{2}\right)$, and given that $a - 2\sqrt{2}b = 3$, then $\left(a^2 + b^2 + ab\right)$ is equal to ______

Watch Video Solution

43. $P_n = \alpha^n + \beta^n, \alpha + \beta = 1, \alpha \cdot \beta = -1, P_{n-1} = 11, P_{n+1} = 29, thenP_n^2 =$

Watch Video Solution

Watch Video Solution

44. If $I_{m,n} = \int_0^1 x^{m-1}(1-x)^{n-1}dx$ for $m, n \geq 1$ and $\int_0^1 \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}dx = \alpha I_{m,n}, \alpha \in R$ then α equals _____

Watch Video Solution

45. If the arithmetic mean and geometric mean of the p^{th} and q^{th} terms of the sequence -16,8,-4,2,... satisfy the equation $4x^2 - 9x + 5 = 0$, then p+q is equal to ______

Watch Video Solution

46. The total number of 4-digit number whose greatest common divisor with 18 is 3, is ______

Watch Video Solution

47. Let L be a common tangent line to the curves $4x^2 + 9y^2 = 36$ and $(2x)^2 + (2y)^2 = 31$. Then the square of the slope of the line L is ________

Watch Video Solution

48. If all the zeros of polynomial function $f(x) = 2x^5 + 5x^4 + 10x^3 + 10x^2 + 10x + 10$ lies in $(a, a + 1)$ where $a \in I$ then find $|a|$

Watch Video Solution

49. Let $X_1, X_2, \ldots, X_{18}$ be eighteen observations such that $\sum_{i=1}^{18}\left(X_i - \alpha\right) = 36$ and $\sum_{i=1}^{18}\left(X_i - \beta\right)^2 = 90$, where α and β are distinct real number. If the standard deviation of these observations is 1 then the value of $|\alpha - \beta|$ is ______

Watch Video Solution

50. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & -1 \end{bmatrix}$ and $A^{20} + \alpha A^{19} + \beta A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Find the value of $(\alpha + \beta)$

Watch Video Solution

(SECTION - A)

1. If A is 3×3 matrix and $|A| = 4$. Operation $R_2 \rightarrow 2R_2 + 5R_3$ is applied on 2A to get new matrix B .Find $|B|$

A. 16

B. 80

C. 128

D. 64

Answer: D

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2. $\int \frac{e^{3\log_e(2x)} + 5e^{2\log_e(2x)}}{e^{4\log_e(x)} + 5e^{3\log_e(x)} - 7e^{2\log_e(x)}} \cdot dx, x > 0$

A. $\log_e\left|x^2 + 5x - 7\right| + c$

B. $4\log_e\left|x^2 + 5x - 7\right| + c$

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

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

Answer: B

Watch Video Solution

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

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

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

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

D. 0

Answer: B

Watch Video Solution

4. If $z^2 + \alpha z + \beta$ has one root $1 - 2i$, then find the value of $\alpha - \beta(\alpha, \beta, \in R)$

A. -3

B. -7

C. 7

D. 3

Answer: B

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5. If a hyperbola passes through the focus of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and its transverse and conjugate gate axis coincides with the major and minor axis of the ellipse, and product of their eccentricities is 1, then

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

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

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

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

Answer: B

Watch Video Solution

6. If $\cos x + \cos y - \cos(x + y) = \frac{3}{2}$, then

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

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

C. $\dfrac{\sqrt{3}}{2}$

D. $\dfrac{1 - \sqrt{3}}{2}$

Answer: B

Watch Video Solution

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

A. $\sqrt{\dfrac{2}{7}}$

B. $\sqrt{\dfrac{2}{3}}$

C. $\sqrt{\dfrac{2}{11}}$

D. $\sqrt{\dfrac{2}{5}}$

Answer: C

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

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

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

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

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

Answer: C

Watch Video Solution

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

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

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

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

D. $\frac{75}{56}$

Answer: B

Watch Video Solution

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

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

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

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

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

Answer: D

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

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

B. If you will earn money, you will work

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

D. To earn money, you need to work

Answer: C

Watch Video Solution

12. Let $f(x) = \dfrac{5^x}{5^x + 5}$ Then find the value of

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

A. $\dfrac{19}{2}$

B. $\dfrac{49}{2}$

C. $\dfrac{29}{2}$

D. $\dfrac{39}{2}$

Answer: D

Watch Video Solution

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

A. 4

B. 2

C. 3

D. 1

Answer: D

Watch Video Solution

14. Minimum value at $a^{ax} + a^{1-ax}; a > 0$ and $x \in R$, is

A. $2a$

B. $2\sqrt{a}$

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

D. $a + 1$

Answer: B

Watch Video Solution

15. $I_n = \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \left(\cot^n x\right) dx$, then :

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

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

C. $I_2 + I_4, \left(I_3 + I_5\right)^2, I_4 + I_6$ are in G.P.

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

Answer: D

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16. $\lim N \to \infty \left[\dfrac{1}{n} + \dfrac{n}{(n+1)^2} + \dfrac{n}{(n+2)^2} + \ldots + \dfrac{n}{(2n-1)^2}\right]$

A. $\dfrac{1}{2}$

B. 1

C. $\dfrac{1}{3}$

D. $\dfrac{1}{4}$

Answer: A

Watch Video Solution

17. A number is selected from 4 digit numbers of the form 5n+2 where n belongs to N containing exactly one digit as 7 . Find the probability that number when divided by 5 leaves remainder 2.

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

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

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

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

Answer: C

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18. If α and β be root of $x^2 - 6x - 2 = 0$ with $\alpha > \beta$ if $a_n = \alpha^n - \beta^n$ for $n \geq 1$ then the value of $\frac{a_{10} - 2a_8}{3a_9}$

A. 2

B. 1

C. 4

D. 3

Answer: A

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19. Set A contain 3 elements , set B contain 5 elements , number of one-one function from $A \rightarrow B$ is "x" and number of one-one functions from $A \rightarrow A \times B$ is "y" then relation between x and y

A. $y = 273x$

B. $2y = 91x$

C. $y = 91x$

D. $2y = 273x$

Answer: B

Watch Video Solution

20. The following system of linear equations

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

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

$x - y + 4z = 8$

A. has a solution (α, β, γ) satisfying $\alpha + \beta^2 + \gamma^3 = 12$

B. has infinitely many solutions

C. does not have any solution

D. has a unique solution

Answer: D

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(SECTION - B)

1. Total number of two digit number n What is the value of n such that $\left(3^n + 7^n\right)$ is divisible by 10

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

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

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

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4. When x is divided by 4 leaves remainder 3 then $(2022 + x)^{2022}$ is divisided by 8 , remainder is

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

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

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7. $\lim_{x \to 0} \dfrac{ax - \left(e^{4x} - 1\right)}{ax\left(e^{4x} - 1\right)} = b$ .Find a-2b

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

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9. $I = \int_{-2}^{2} \left|3x^2 - 3x - 6\right| dx$. Find the value of I

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

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

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

Then the coordinate(s) of the point(s) on l_2 at a distance of $\sqrt{17}$ from the point of intersection of l and l_1 is (are) (a, b, c) then $18(a+b+c)$ is equal to

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MATHEMATICS (SECTION A)

1. The number of elements in the set $\{x \in R : (|x| - 3)|x+4| = 6\}$ is equal to : then 'a' must be greater then :

A. $-\frac{1}{2}$

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

C. 1

D. -1

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2. A card from a pack 52 cards is lost. From the remaining cards , two cards are drawn and are found to be speades. Find the probability that missing card is also a spade.

A. $\frac{52}{867}$

B. $\frac{22}{425}$

C. $\frac{39}{50}$

D. $\frac{3}{4}$

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3. The locus of the midpoints of the chord of the circle, $x^2 + y^2 = 25$ which is tangent to the hyperbola, $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is :

A. $\left(x^2 + y^2\right)^2 - 16x^2 + 9y^2 = 0$

B. $\left(x^2 + y^2\right)^2 - 9x^2 + 144y^2 = 0$

C. $\left(x^2+y^2\right)^2-9x^2+16y^2=0$

D. $\left(x^2+y^2\right)^2-9x^2-16y^2=0$

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4. The number of elements in the set $\{x \in R : (|x|-3)|x+4|=6\}$ is equal to :

A. 3

B. 1

C. 4

D. 2

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5. Consider three observations a, b and c such that b=a+c. If the standard deviation of a+2, b+2, c+2 is d, then which of the following is true ?

A. $b^2 = 3\left(a^2 + c^2\right) + 9d^2$

B. $b^2 = \left(a^2 + c^2\right) - 9d^2$

C. $b^2 = \left(a^2 + c^2 + d^2\right)$

D. $b^2 = a^2 + c^2 + 3d^2$

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6. Let a vector $a\hat{i} + \beta\hat{j}$ be obtained by rotating the vector $\sqrt{3}\hat{i} + \hat{j}$ by an angle 45° about the origin in counterclockwise direction in the first quadrant. Then the area of triangle having vertices (α, β), $(0, \beta)$ and $(0, 0)$ is equal to:

A. 1

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

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

D. $2\sqrt{2}$

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7. $LetA = \begin{bmatrix} i & -i \\ -i & i \end{bmatrix}, i\sqrt{-i}$ Then, the system of linear equations $A^8\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ 64 \end{bmatrix}$ has:

A. No solution

B. Exactly two solutions

C. Infinitely many solutions

D. A unique solution

Watch Video Solution

8. The number of roots of the equation,

$$(81)^{\sin^2 x} + (81)^{\cos^2 x} x = 30$$

in the interval $[0, \pi]$ is equal to :

A. 3

B. 4

C. 8

D. 2

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9. Let the functions $f: R \rightarrow R$ and $g: R \rightarrow R$ be defined as :

$$f(x) = \begin{cases} x + 2 & x < 0 \\ x^2 & x > 0 \end{cases} \text{ and } g(x) = \begin{cases} x^3 & x < 1 \\ 3x - 2 & x > 1 \end{cases}$$

Then, the number of points in R where (fog)(x) is NOT differentiable is equal to :

A. 0

B. 3

C. 2

D. 1

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10. If y=yır) is the solution of the differential equation, $\frac{dy}{dx} + 2y\tan x = \sin x, y\left(\frac{\pi}{3}\right) = 0$, then the maximum value of the function y(x) over R is equal to :

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

B. - $\frac{15}{4}$

C. 8

D. $\frac{1}{8}$

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11. Let a complex number $z|z| = 1,.$ satisfy $\log_{\frac{1}{\sqrt{2}}}\left(\frac{|z| + 11}{(|z| - 1)^2}\right) \leq 2.$ Then, the largest value of |z| is equal to ________

A. 8

B. 6

C. 7

D. 5

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12. $LetS_K = \sum_{r=1}^{k} \tan^{-1}\left(\frac{6^r}{2^{2r+1} + 3^{2r+1}}\right).$ Then $\lim k \to \infty S_k$ is equal to :

A. $\frac{\pi}{2}$

B. $\tan^{-1}(3)$

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

D. $\cot^{-1}\left(\frac{3}{2}\right)$

Watch Video Solution

13. The range of a R for which the function

$f(x) = (4a - 3)\left(x + \log_e 5\right) + 2(a - 7)\cot\left(\frac{x}{2}\right)\sin^2\left(\frac{x}{2}\right), x \neq 2n\pi, n \in N$ has

critical points, is :

A. $[1, \infty)$

B. $\left[-\frac{4}{3}, 2\right]$

C. $(-3, 1)$

D. $(-\infty, -1]$

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14. If $\log_{10}\sin x + \log_{10}\cos x = -1$ and $\log_{10}(\sin x + \cos x) = \dfrac{(\log_{10}n)n - 1}{2}$

then the value of n is __________

A. 9

B. 20

C. 12

D. 16

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15. If for

$x \in \left(0, \dfrac{\pi}{2}\right)$, $\log_{10}\sin x + \log_{10}\cos x = -1$ and $\log_{10}(\sin x + \cos x) = \dfrac{1}{2}\left(\log_{10}n - 1\right)$

then the value of n is equal to :

A. 1

B. 12

C. 2^{n-1}

D. n

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16. Let the position vectors of two points P and Q be $3\hat{i} - \hat{j} + 2\hat{k}$ and $\hat{i} + 2\hat{j} - 4\hat{k}$, respectively. Let Rand 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 :

A. $\sqrt{5}$

B. $\sqrt{171}$

C. $\sqrt{227}$

D. $\sqrt{482}$

Watch Video Solution

17. If for $a > 0$, the feet of perpendiculars from the points A(a, - 2a, 3) and B(0,4,5) on the plane lx +my+nz=0 are points c(0, -a, -1) and D respectively, then the length of line segment CD is equal to :

A. $\sqrt{55}$

B. $\sqrt{41}$

C. $\sqrt{66}$

D. $\sqrt{31}$

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18. Let P be a plane lx+my+nz=0 containing the line, $\frac{1-x}{1}=\frac{y+4}{2}=\frac{z+2}{3}$.

If plane P divides the line segment AB joining points A(-3, -6, 1) and B(2, 4,

-3) in ratio k: 1 then the value of k is equal to:

A. 3

B. 4

C. 1.5

D. 2

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19. If n is the number of irrational terms in the expansion of $\left(3^{1/4}+5^{1/8}\right)^{60}$, then (n-1) is divisible by :

A. 8

B. 26

C. 30

D. 7

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20. Which of the following Boolean expression is a tautology ?

A. $(p \wedge q) \wedge (p \rightarrow q)$

B. $(p \wedge q) \vee (p \vee q)$

C. $(p \wedge q) \rightarrow (p \rightarrow q)$

D. $(p \wedge q) \vee (p \rightarrow q)$

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21. The system of equations $kx + y + z = 1, x + ky + z = k$ and $x + y + zk = k^2$ has no solution if k is equal to :

A. -1

B. 1

C. -2

D. 0

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22. If the fourth term in the expansion of $\left(x+x^{\log_2 x}\right)^7$ is 4480 , then the value of x where $x \in N$ is equal to :

A. 4

B. 2

C. 1

D. 3

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23. If the Boolean expression $(p \Rightarrow q) \Leftrightarrow (\sim q * p)$ is a tautology, then the Boolean expression $p * (\sim q)$ is equivalent to :

A. $q \Rightarrow p$

B. $p \Rightarrow q$

C. $p \Rightarrow \sim q$

D. $\sim q \Rightarrow p$

Watch Video Solution

24. Which of the following is true for y(x) that satisfies the differential equation $\frac{dy}{dx} = xy - 1 + x - y, y(0) = 0$:

A. $y(1) = e^{\frac{1}{2}} - e^{-\frac{1}{2}}$

B. $y(1) = e^{\frac{1}{2}} - 1$

C. $y(1) = e^{-\frac{1}{2}} - 1$

D. $y(1) = 1$

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25. Choose the incorrect statement about the two circles whose equations are given below :

$x^2 + y^2 - 10x - 10y + 41 = 0$ and

$x^2 + y^2 - 16x - 10y + 80 = 0$

A. Distance between two centres is the average of radii of both the circles

B. Circles have two intersection points.

C. Both circles' centres lie inside regio of one another.

D. Both circles pass through the centre of each other.

Watch Video Solution

26. If $A = \begin{pmatrix} 0 & \sin\alpha \\ \sin\alpha & 0 \end{pmatrix}$ and det $\left(A^2 - \frac{1}{2}I\right) = 0$, then a possible value of α is :

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{4}$

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27. If $\cot^{-1}(\alpha) = \cot^{-1}(2) + \cot^{-1}(8) + \cot^{-1}(18) + \cot^{-1}(32) + \ldots\ldots\ldots\ldots$ upto 100 terms , then α is :

A. 1.00

B. 1.01

C. 1.03

D. 1.02

Watch Video Solution

28. Two dices are rolled. If both dices have six faces numbered 1,2,3,5,7 and 11, then the probability that the sum of the numbers on the top faces is less than or equal to 8 is :

A. $\frac{4}{9}$

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

C. $\frac{17}{36}$

D. $\frac{5}{12}$

Watch Video Solution

29. In a triangle PQR, the co-ordinates of the points P and Q are $(-2, 4)$ and $(4, -2)$ respectively. If the equation of the perpendicular bisector of PR is $2x - y + 2 = 0$, then the centre of the circumcircle of the ΔPQR is :

A. $(1, 4)$

B. $(-2, -2)$

C. $(0, 2)$

D. $(-1, 0)$

Watch Video Solution

30. Which of the following statements is incorrect for the function $g(\alpha)$ for $x \in R$ sucth that $g(\alpha) = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin^{\alpha}x}{\cos^{\alpha}x + \sin^{\alpha}x} dx$

A. $g(\alpha)$ is a strictly increasing function

B. $g(\alpha)$ is an even function

C. $g(\alpha)$ is a strictly decreasing function

D. $g(\alpha)$ has an inflection point at $\alpha = -\frac{1}{2}$

Watch Video Solution

31. What is the inverse of the function $y = 5^{\log x}$?

A. $x = y^{\frac{1}{\log 5}}$

B. $x = y^{\log 5}$

C. $x = 5^{\frac{1}{\log y}}$

D. $x = 5^{\log y}$

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32. Team 'A' consists of 7 boys and n girls and Team 'B' has 4 boys and 6 girls. If a total of 52 single matches can be arranged between these two teams when a boy plays against a boy and a girl plays against a girl, then n is equal to :

A. 6

B. 5

C. 4

D. 2

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33. Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\vec{b} = 7\hat{i} + \hat{j} - 6\hat{k}$. If $\vec{r} \times \vec{a} = \vec{r} \times \vec{b}$, $\vec{r}.\left(\hat{i} + 2\hat{j} + \hat{k}\right) = -3$, then $\vec{r}.\left(2\hat{i} - 3\hat{j} + \hat{k}\right)$ is equal to :

A. 13

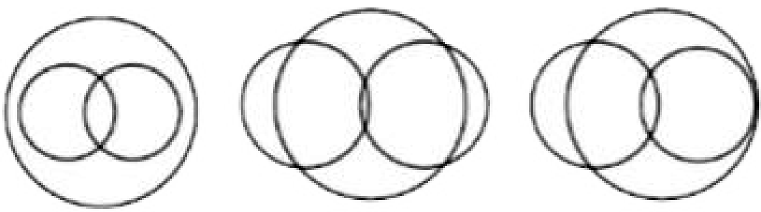
B. 10

C. 12

D. 8

Watch Video Solution

34. In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statement ?



P Q R

A. P and Q

B. None of these

C. Q and R

D. P and R

Watch Video Solution

35. The value of $4+\dfrac{1}{5+\dfrac{1}{4+\dfrac{1}{5+\dfrac{1}{4+\ldots.\infty}}}}$ is

A. $2+\dfrac{4}{\sqrt{5}}\sqrt{30}$

B. $5+\dfrac{2}{5}\sqrt{30}$

C. $4+\dfrac{4}{\sqrt{5}}\sqrt{30}$

D. $2+\dfrac{2}{5}\sqrt{30}$

Watch Video Solution

36. Area of the triangle formed by the complex number z, iz and z+iz is

____

A. $\dfrac{1}{2}|z||iz|^2$

B. 1

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

D. $\frac{1}{2}|z|^2$

Watch Video Solution

37. The sum of possible values of x for $\tan^{-1}(x+1)+\cot^{-1}\left(\frac{1}{x-1}\right)=\tan^{-1}\left(\frac{8}{31}\right)$ is :

A. $-\frac{31}{4}$

B. $-\frac{32}{4}$

C. $-\frac{30}{4}$

D. $-\frac{33}{4}$

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38. The equation of the plane which contains the y-axis and passes through the point (1,2,3) is :

A. $x + 3z = 0$

B. $3x - z = 0$

C. $3x + z = 6$

D. $x + 3z = 10$

Watch Video Solution

39. The line $2x - y + 1 = 0$ is tangent to the circle at the point (2, 5) and the center of the circle lies on $x - 2y = 4$. The radius of the circle is

A. $3\sqrt{5}$

B. $4\sqrt{5}$

C. $5\sqrt{4}$

D. $5\sqrt{3}$

Watch Video Solution

40. The value of $\lim_{x \to 0^+} \frac{\cos^{-1}\left(x - [x]^2\right) . \sin^{-1}\left(x - [x]^2\right)}{x - x^3}$, where [x] denotes the greatest integer $\leq x$ is :

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. 0

D. π

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41. Let $f: R - \{3\} \rightarrow R - \{1\}$ be defined by f(x) $= \dfrac{x - 2}{x - 3}$

Let $g: R \rightarrow R$ be given as g(x)=2x-3. Then, the sum of all the values of x for which $f^{-1}(x) + g^{-1}(x) = \dfrac{13}{2}$ is equal to

A. 2

B. 7

C. 3

D. 5

Watch Video Solution

42. Let $f: R \rightarrow R$ be a function defined as

$$f(x) = \begin{cases} \dfrac{\sin(a+1)x + \sin 2x}{2x} & \text{if } x < 0 \\ b & \text{if } x = 0 \\ \dfrac{\sqrt{x + bx^3} - \sqrt{x}}{bx^{\frac{5}{2}}} & \text{if } x > 0 \end{cases}$$

If f is continuous at x=0 then the value of a+b is equal to :

A. -3

B. -2

C. $-\frac{3}{2}$

D. $-\frac{5}{2}$

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43. Let S_1 be the sum of first 2n terms of an arithmetic progression. Let S_2 be the sum first 4n terms of the same arithmeti progression. If $\left(S_2 - S_1\right)$ is 1000, then the sum of the first 6n term of the arithmetic progression is equal to :

A. 3000

B. 5000

C. 1000

D. 7000

Watch Video Solution

44. Let in a series of 2n observations, half of them are equal to a and remaining half are equal to -a. Also by adding a b in each of these observation, the mean and standard deviation of a new set become 5 and 20 respectively. Then the value of $a^2 + b^2$ is equal to :

A. 650

B. 425

C. 925

D. 250

Watch Video Solution

45. Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors perpendicular to each other and $|\vec{a}| = |\vec{b}|$. If $|\vec{a} \times \vec{b}| = |\vec{a}|$, then the angle between the vectors $\left(\vec{a} + \vec{b} + \left(\vec{a} \times \vec{b}\right)\right)$ and $\vec{a}$ is equal to :

A. $\sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$

B. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

D. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Watch Video Solution

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

A. 2

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

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

D. 4

Watch Video Solution

47. Consider a hyperbola $H : x^2 - 2y^2 = 4$. Let the tangent at a point $P\left(4, \sqrt{6}\right)$ meet the x-axis at Q and latus rectum at $R\left(x_1, y_1\right), x_1 > 0$. If F is a focus of H which is nearer to the point P, then the area of $\triangle QFR$ is equal to

A. $4\sqrt{6} - 1$

B. $\sqrt{6} - 1$

C. $\frac{7}{\sqrt{6}} - 2$

D. $4\sqrt{6}$

Watch Video Solution

48. Let $g(x) = \int_0^x f(t)dt$, where f is continuous function in [0,3] such that $\frac{1}{3} \leq f(t) \leq 1$ for all $t \in [0, 1]$ and $0 \leq f(t) \leq \frac{1}{2}$ for all $t \in (1, 3]$. The largest possible interval in which g(3) lies is:

A. $\left[-1, -\frac{1}{2}\right]$

B. [1,3]

C. $\left[\frac{1}{3}, 2\right]$

D. $\left[-\frac{3}{2}, -1\right]$

Watch Video Solution

49. Let the centroid of an equilateral triangle ABC be at the origin. Let one of the sides of equilateral triangle be along the straight line x+y=3. If

R and r be the radius of circumcircle and incircle respectively of $\triangle ABC$,

then (R+r) is equal to :

A. $2\sqrt{2}$

B. $7\sqrt{2}$

C. $\frac{9}{\sqrt{2}}$

D. $3\sqrt{2}$

Watch Video Solution

50. In a triangle ABC, if $\left|\overrightarrow{BC}\right| = 8, \left|\overrightarrow{CA}\right| = 7, \left|\overrightarrow{AB}\right| = 10$, then the projection

of the $\overrightarrow{AB}$ on $\overrightarrow{AC}$ is equal to :

A. $\frac{127}{20}$

B. $\frac{25}{4}$

C. $\frac{85}{14}$

D. $\frac{115}{16}$

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51. Let the system of linear equations

$4x + \lambda y + 2z = 0$

$2x - y + z = 0$

$\mu x + 2y + 3z = 0, \lambda, \mu \in R$

has a non-trivial solution. Then which of the following is true?

A. $\lambda = 3, \mu \in R$

B. $\lambda = 2, \mu \in R$

C. $\mu = -6, \lambda \in R$

D. $\mu = 6, \lambda \in R$

Watch Video Solution

52. If $15\sin^4\alpha + 10\cos^4\alpha = 6$, some $\alpha \in R$, then the value of $27\sec^6\alpha + 8\cos ec^6\alpha$ is equal to

A. 250

B. 400

C. 350

D. 500

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53. Let a tangent be drawn to the ellipse $\frac{x^2}{27} + y^2 = 1$ at $\left(3\sqrt{3}\cos\theta, \sin\theta\right)$, where $\theta \in \left(0, \frac{\pi}{2}\right)$. Then the value of θ such that the sum of intercepts on axes made by this tangent is minimum is equal to :

A. $\frac{\pi}{6}$

B. $\frac{\pi}{8}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{3}$

Watch Video Solution

54. The area bounded by the curve $4y^2 = x^2(4 - x)(x - 2)$ is equal to :

A. $\frac{3\pi}{8}$

B. $\frac{3\pi}{2}$

C. $\frac{\pi}{8}$

D. $\frac{\pi}{16}$

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55. Define a relation R over a class of $n \times n$ real matrices A and B as ARB iff there exists a non-singular matrix P such that $A = P^{-1}BP$

Then which of the following is true?

A. R is symmetric, transitive but not reflexive

B. R is reflexive, transitive but not symmetric

C. R is an equivalence relation

D. R is reflecxive, symmetric but not transitive

Watch Video Solution

56. Let in a Binomial distribution, consisting of 5 independent trials, probalitiies of exactly 1 and 2 sucesses be 0.4096 and 0.2048 resepectively. Then the probability of getting exactly 3 sucesses is equal to :

A. $\frac{40}{243}$

B. $\frac{32}{625}$

C. $\frac{128}{625}$

D. $\frac{80}{243}$

Watch Video Solution

57. Let $S_1 : x^2 + y^2 = 9$ and $S_2 : (x - 2)^2 + y^2 = 1$. Then the locus of centre of a variable circle S which touches S_1 internally and S_2 externally always passes through the points:

A. $\left(2, \pm \frac{3}{2}\right)$

B. $\left(0, \pm \sqrt{3}\right)$

C. $(1, \pm 2)$

D. $\left(\frac{1}{2}, \pm \frac{\sqrt{5}}{2}\right)$

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58. A pole stands vertically inside a triangular park ABC. Let the angle of elevation of the top of the pole from corner of the park be $\frac{\pi}{3}$. If the radius of the circumcircle of $\triangle ABC$ is 2. then the height of the pole is equal to :

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

B. $\frac{1}{\sqrt{3}}$

C. $\sqrt{3}$

D. $2\sqrt{3}$

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59. If P and Q are two statements, then which of the following compound statement is a tautology?

A. $(P \Rightarrow Q) \wedge \sim Q) \Rightarrow Q$

B. $(P \Rightarrow Q) \wedge \sim Q) \Rightarrow P$

C. $(P \Rightarrow Q) \wedge \sim Q) \Rightarrow (P \wedge Q)$

D. $(P \Rightarrow Q) \wedge \sim Q) \Rightarrow \sim P$

Watch Video Solution

60. Let y=y(x) be the solution of the differential equation

$\frac{dy}{dx} = (y+1)\left((y+1)e^{\frac{x^2}{2}} - x\right), 0 < x < 2.1,$ with y(2)=0. Then the value of $\frac{dy}{dx}$

at x=1 is equal to .

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

B. $\frac{5e^{\frac{1}{2}}}{\left(e^2+1\right)^2}$

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

D. $\dfrac{e^{\frac{5}{2}}}{\left(1+e^{2}\right)^{2}}$

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MATHEMATICS (SECTION B)

1. The total number of 3×3 matrices A having entries from the set $\{0, 1, 2, 3\}$ such that the sum of all the diagonal entries A^TA is 9, is equal to ________

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2. Let $F:(0, 2) \rightarrow R$ be defined as $f(x) = \log_2\left(1 + \tan\left(\frac{\pi x}{4}\right)\right)$.

Then $\lim_{n \to \infty} \frac{2}{n}\left(f\left(\frac{1}{n}\right) + f\left(\frac{2}{n}\right) + \ldots + f(1)\right)$ is equal to

Watch Video Solution

3. Let ABCD be a square of side of unit length. Let a circle C_1 centered at A with unit radius is drawn. Another circle C_2 which touches C_1 and the lines AD and AB are tangent to it, is also drawn. Let a tangent line from the point to the circle C_2 meet the side AB at E. If the length of EB is $\alpha + \sqrt{3}\beta$, where α, β are integers, then $\alpha + \beta$ is equal to ______

Watch Video Solution

4. Let the curve y=y(x) be the solution of the differential equation, $\frac{dy}{dx} = 2(x+1)$. If the numerical value of area bounded by the curve y=y(x) and x-axis is $\frac{4\sqrt{8}}{3}$, then the value of y(1) is equal to ______

Watch Video Solution

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

Watch Video Solution

6. Let $f: R \rightarrow R$ be continuous function such that $f(x) + f(x+1) = 2$, for all $x \in R$. $If I_1 \int_0^8 f(x)dx$ and $I_2 = \int_{-1}^{3} f(x)dx$, then the value of $I_2 + 2I_2$ is equal to ________

Watch Video Solution

7. Consider an arithmetic series and a geometric series having four initial terms from the set {11, 8, 21, 16, 26, 32, 4}. If the last terms of these series are the maximum possible four digit numbers, then the number of common terms in these two series is equal to _______________

Watch Video Solution

8. Let

$$P = \begin{bmatrix} -30 & 20 & 56 \\ 90 & 140 & 112 \\ 120 & 60 & 14 \end{bmatrix} \text{ and } A = \begin{bmatrix} 2 & 7 & \omega^2 \\ -1 & -\omega & 1 \\ 0 & -\omega & -\omega + 1 \end{bmatrix} where \omega = \frac{-1 + \sqrt{3}}{2}, \text{ and } I_3$$

be the identity matrix of order 3. If the determinate of the matrix $\left(P^{-1}AP - I_3\right)^2$ is $a\omega^2$, then the value of α is equal to________.

Watch Video Solution

9. If the normal to the curve $y(x) = \int_0^2 \left(2t^2 - 15t + 10\right)$ dt at a point (a,b) is parallel to the line $x + 3y = 5, a > 1$, then the value of $|a + 6b|$ is equal to

____

Watch Video Solution

10. If $\lim_{x \to 0} \dfrac{ae^x - b\cos x + ce^{-x}}{x\sin x} = 2$, then $a + b + c$ is equal to

____

Watch Video Solution

11. If [.] represents the greatest integer function, then the value of

$$\left|\int_0^{\sqrt{\frac{\pi}{2}}}\left[\left[x^2\right] - \cos x\right]dx\right|$$ is ____________

Watch Video Solution

12. The maximum value of z in the following equation $z = 6xy + y^2$, where $3x + 4y \le 100$ and $4x + 3y \le 75$ for $x \ge 0$ and $y \ge 0$ is ____________

Watch Video Solution

13. The minimum distance between any two points P_1 and P_2 while considering point P_1 on one circle and point P_2 on the other circle for the given circles equations

$x^2 + y^2 - 10x - 10y + 41 = 0$

$x^2 + y^2 - 24x - 10y + 160 = 0$ is __________ .

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14. If $A = \begin{bmatrix} 2 & 3 \\ 0 & -1 \end{bmatrix}$, then the value of $\det\left(A^4\right) \mid \det\left(A^{10} - Adj(2A)\right)^{10}\Big)$ is equal to ________________.

Watch Video Solution

15. If the function $f(x) = \dfrac{\cos(\sin x) - \cos x}{x^4}$ is continuous at each point in its domain and $f(0) = \dfrac{1}{K}$, then k is ________________.

Watch Video Solution

16. If $f(x) = \sin\left(\cos^{-1}\left(\dfrac{1 - 2^{2x}}{1 + 2^{2x}}\right)\right)$ and its fist derivative with respect to x is $-\dfrac{b}{a}\log_e 2$ when x = 1, where a and b are integers, then the minimum value of $\left|a^2 - b^2\right|$ is ________________.

Watch Video Solution

17. If the eqution of the plane passing through the line of intersection of planes $2x - 7y + 4z - 3 = 0, 3x - 5y + 4z + 11 = 0$ and the point (-2,1,3) at $ax + by + cz - 7 = 0$, then the value of $2a + b + c - 7$ is ____________.

Watch Video Solution

18. If $(2021)^{3762}$ is divided by 17, then the remainder is ____________.

Watch Video Solution

19. If $\vec{a} = \alpha\hat{i} + \beta\hat{j} + 3\hat{k}$,

$\vec{b} = -\beta\hat{i} - \alpha\hat{j} - \hat{k}$ and

$\vec{c} = \hat{i} - 2\hat{j} - \hat{k}$

such that $\vec{a}.\vec{b} = 1$ and $\vec{b}.\vec{c} = -3$ then $\frac{1}{3}\left(\left(\vec{a} \times \vec{b}\right).\vec{c}\right)$ is equal to ________.

Watch Video Solution

20. Of the three independent event E_1, E_2 and E_3, the probability that only E_1 occurs is α, only E_2 occurs is β and only E_3 occurs is γ. If the probavvility p that none of events E_1, E_2 or E_3 occurs satisfy the equations $(\alpha - 2\beta)p = \alpha\beta$ and $(\beta - 3\gamma)p = 2\beta\gamma$. All the given probabilities are assumed to lie in the interval (0, 1). Then, $\frac{\text{probability of occurrence of } E_1}{\text{probability of occurrence of } E_3}$ is equal to

Watch Video Solution

21. Let P be a plane containing the line $\frac{x-1}{3} = \frac{y+6}{4} = \frac{z+5}{2}$ and parallel to the line $\frac{x-3}{4} = \frac{y-2}{-3} = \frac{z+5}{7}$. If the point $(1, -1, \alpha)$ lies on the plane P, then the value of $|5\alpha|$ is equal to ....

Watch Video Solution

22. If $\sum_{r=1}^{10} r!\left(r^3 + 6r^2 + 2r + 5\right) = \alpha(11!)$, then the value of α is equal to ....

Watch Video Solution

23. Let the miror image of the point (1,3,a) with respect to the plane $\vec{r}\left(2\hat{i} - \hat{j} + \hat{k}\right) - b = 0$ be (-3,5,2). Then the value of |a+b| is equal to ....

Watch Video Solution

24. Let y=y(x) be the solution of the differential equation $xdy - ydx = \sqrt{x^2 - y^2}dx, x \geq 1,$ with y(1)=0. If the area bounded by the lin x=1, $x = e^{\pi}, y = 0$ and $y = y(x)$ is $\alpha e^{2\pi} + \beta,$ then the value of $10(\alpha + \beta)$ is equal to ....

Watch Video Solution

25. Let P(x) be a real polynomial of degree 3 which vanishes at x=-3. Let P(x) have local minima at x=1, local maximum at x=-1 and $\int^{1} -1P(x)dx = -18,$ then the sum of all the coefficients of the polynomical P(x) is equal to........

Watch Video Solution

26. Let I be an identity matrix of order 2×2 and $P = \begin{bmatrix} 2 & -1 \\ 5 & -3 \end{bmatrix}$. Then the value of $n \in N$ for which $P^n = 5I - 8P$ is equal to ....

Watch Video Solution

27. The term independent of x in the expansion of

$$\left[\frac{x+1}{x^{\frac{2}{3}} - x^{\frac{1}{3}} + 1} - \frac{x-1}{x - x^{\frac{1}{2}}}\right]^{10}, x \neq 1 \text{ is equal to..........}$$

Watch Video Solution

28. If f(x) and g(x) are two polynomials such that the polynomial $P(x) = f\left(x^3\right) + g\left(x^3\right)$ is divisible by $x^2 + x + 1$, then P(1) is equal to ....

Watch Video Solution

29. Let $f:R \rightarrow R$ satisfy the equation $f(x+y)=f(x)$, f(y) for all $x, y \in R$ and $f(x) \neq 0$ for any $x \in R$. If the function f is differentiable at x=0 and f'(0)=3, then $\lim_{h \rightarrow 0}\frac{1}{h}(f(h)-1)$ is equal to

Watch Video Solution

30. Let ${}^{n}C_{r}$ denote the binomial coefficient of x^{r} in the expansion of $(1+x)^{n}$. If $\sum_{k=0}^{10}\left(2^{2}+3k\right){}^{n}C_{k}=\alpha 3^{10}+\beta . 2^{10}, \alpha, \beta \in R$ then $\alpha+\beta$ is equal to..........

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MATHEMATICS SECTION A

1. $\frac{1}{3^{2}-1}+\frac{1}{5^{2}-1}+\frac{1}{7^{2}-1}+\ldots\ldots+\frac{1}{(201)^{2}-1}$ is equal to

A. $\frac{99}{400}$

B. $\frac{25}{101}$

C. $\frac{101}{408}$

D. $\frac{101}{404}$

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2. The values of x in $(0, \pi)$ satisfying the equation.

$$\begin{vmatrix} 1+\sin^2 x & \sin^2 x & \sin^2 x \\ \cos^2 x & 1+\cos^2 x & \cos^2 x \\ 4\sin 2x & 4\sin 2x & 1+4\sin 2x \end{vmatrix} = 0, \text{ are}$$

A. $\frac{\pi}{12}, \frac{\pi}{6}$

B. $\frac{7\pi}{12}, \frac{11\pi}{12}$

C. $\frac{5\pi}{12}, \frac{7\pi}{12}$

D. $\frac{\pi}{6}, \frac{5\pi}{6}$

Watch Video Solution

3. If $f(x) = \begin{cases} \frac{1}{|x|} & |x| \geq 1 \\ ax^2 + b & |x| < 1 \end{cases}$ is differentiable at every point of the domain,then the values of a and b are respectively :

A. $\frac{1}{2}, -\frac{3}{2}$

B. $\frac{5}{2}, -\frac{3}{2}$

C. $\frac{1}{2}, \frac{1}{2}$

D. $-\frac{1}{2}, \frac{3}{2}$

Watch Video Solution

4. The integral $\int \frac{(2x-1)\cos\sqrt{(2x-1)^2+5}}{\sqrt{4x^2-4x+6}}dx$ is equal to :(where c is constant of integration)

A. $\frac{1}{2}\sin\sqrt{(2x+1)^2+5}$ +c

B. $\frac{1}{2}\sin\sqrt{(2x - 1)^2 + 5} + c$

C. $\frac{1}{2}\cos\sqrt{(2x - 1)^2 + 5} + c$

D. $\frac{1}{2}\cos\sqrt{(2x + 1)^2 + 5} + c$

Watch Video Solution

5. Choose the correct statement about two circles whose equations are given below :

$x^2 + y^2 - 10x - 10y + 41 = 0$

$x^2 + y^2 - 22x - 22y + 137 = 0$

A. circles have two meeting points

B. circles have no meeting point

C. circles have same centre

D. circles have only one meeting point

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6. The equation of one of the straight lines which passes through the point (1,3) and makes an angle $\tan^{-1}\left(\sqrt{2}\right)$ with the straight line, $y + 1 = 3\sqrt{2}x$ is :

A. $4\sqrt{2}x + 5y - \left(15 + 4\sqrt{2}\right) = 0$

B. $4\sqrt{2}x - 5y - 4\sqrt{2} = 0$

C. $5\sqrt{2}x - 4y - \left(15 + 4\sqrt{2}\right) = 0$

D. $4\sqrt{2}x - 5y - \left(15 + 4\sqrt{2}\right) = 0$

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7. The number of integral values of m so the abscissa of point of intersection of lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is :

A. 1

B. 3

C. 2

D. 0

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8. Let α, β, γ are the real roots of the equation $x^3 + ax^2 + bx + c = 0(a, b, c \in Randa \neq 0)$. If the system of equations $(\in u, v, andw)$ given by $\alpha u + \beta v + \gamma w = 0$ $\beta u + \gamma v + \alpha w = 0$ $\gamma u + \alpha v + \beta w = 0$ has non-trivial solutions then the value of a^2/b is _______.

A. 0

B. 3

C. 5

D. 1

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9. The real valued function $f(x) = \frac{\operatorname{cosec}^{-1}x}{\sqrt{x - [x]}}$, where [x] denotes the greatest integer less than or equal to x, is definde for all x belonging to :

A. all reals except integers

B. all integers except 0,-1,1

C. all reals except the interval [-1,1]

D. all non-integers except the interval [-1,1]

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10. The value of

$$3+\cfrac{1}{4+\cfrac{1}{3+\cfrac{1}{4+\cfrac{1}{3+\ldots\ldots\infty}}}}$$

is equal to

A. $4+\sqrt{3}$

B. $3+2\sqrt{3}$

C. $1.5+\sqrt{3}$

D. $2+\sqrt{3}$

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11. Let $A+2B=\begin{bmatrix}1 & 2 & 0\\ 6 & -1 & 3\\ -5 & 3 & 1\end{bmatrix}$ and $2A-B=\begin{bmatrix}2 & -1 & 5\\ 2 & -1 & 6\\ 0 & 1 & 2\end{bmatrix}$, then find $tr(A)-tr(B)$.

A. 1

B. 3

C. 0

D. 2

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12. If $\lim_{x \to 0}\dfrac{\sin^{-1}x-\tan^{-1}x}{3x^3}$ is equal to L, then the value of (6L+1) is :

A. 6

B. $\dfrac{1}{6}$

C. 2

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

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13. A vector $\vec{a}$ has components 3p and 1 with rrespect to a rectangular cartesian system. This system is rotated through a certain angle about the origin in the counter clockwise sense. If, with respect to new system, $\vec{a}$ has components p+1 and $\sqrt{10}$ then a value of p is equal to :

A. -1

B. $\frac{4}{5}$

C. 1

D. $-\frac{5}{4}$

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14. If α, β are natural numbers such that $100^{\alpha} - 199\beta = (100)(100) + (99)(101) + (98)(102) + \ldots. + (1)(199)$, then the slope of the line passing through (α, β) and origin is :

A. 540

B. 550

C. 510

D. 530

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15. If the equation $a|z|^2 + \bar{\alpha}z + \alpha\bar{z} + d = 0$ represents a circle where a, d are real constants, then which of the following condition is correct ?

A. $|\alpha|^2 - ad > 0$ and $a \in R - \{0\}$

B. $|\alpha|^2 - ad \neq 0$

C. $|\alpha|^2 - ad \geq 0$ and $a \in R$

D. $\alpha = 0, a, d \in R^+$

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16. The differential equation satisfied by the system of parabolas $y^2 = 4a(x + a)$ is :

A. $y\left(\frac{dy}{dx}\right) + 2x\left(\frac{dy}{dx}\right) + y = 0$

B. $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) + y = 0$

C. $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) - y = 0$

D. $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$

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17. Let

$\left(1 + x + 2x^2\right)^{20} = a_0 + a_1 x + a_2 x^2 + \ldots. + a_{40} x^{40}$. Then, $a_1 + a_3 + a_5 \ldots. + a_{37}$

is equal to :

A. $2^{20}\left(2^{20} + 21\right)$

B. $2^{19}\left(2^{20} + 21\right)$

C. $2^{20}\left(2^{20} - 21\right)$

D. $2^{20}\left(2^{20} - 21\right)$

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18. The sum of all the 4-digit distinct numbers that can be formed with the digits 1,2,2 and3 is :

A. 22264

B. 122234

C. 26664

D. 122664

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19. If the functions are defined as $f(x) = \sqrt{x}$ and $g(x) = \sqrt{1 - x}$, then what is the common domain of the following functions : $f + g, f/g, g/f, f - g$ where $(f \pm g)(x) = f(x) \pm g(x), (f/g)(x) = \dfrac{f(x)}{g(x)}$

A. $0 \leq x < 1$

B. $0 \leq x \leq 1$

C. $0 < x < 1$

D. $0 < x \leq 1$

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20. For the four circles M, N, O and P, following four equations are given :

Circle M : $x^2 + y^2 = 1$

Circle N : $x^2 + y^2 - 2x = 0$

Circle O : $x^2 + y^2 - 2x - 2y + 1 = 0$

Circle P : $x^2 + y^2 - 2y = 0$

If the centre of circle M is joined with centre of the circle N, further centre of circle N is joined with centre of the circle O, centre of circle O is joined with the centre of circle P and lastly, centre of circle P is joined with centre of circle M, then these lines form the sides of a :

A. Square

B. Rectangle

C. Rhombus

D. Parallelogram

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21. If x, y, z are in arithmetic progression with common difference d, $x \neq 3d$, and the determinant of the matrix $\begin{bmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{bmatrix}$ is zero, then the value of K^2 is:

A. 6

B. 72

C. 36

D. 12

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22. Tha value of the limit $\lim \theta \rightarrow 0 \frac{\tan\left(\pi\cos^2\theta\right)}{\sin\left(2\pi\sin^2\theta\right)}$ is equal to :

A. $-\frac{1}{2}$

B. $-\frac{1}{4}$

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

D. 0

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23. Let S_1, S_2 and S_3 be three sets defined as

$S_1 = \left\{z \in \mathbb{C} : |z - 1| \leq \sqrt{2}\right\}$

$S_2 = \{z \in \mathbb{C} : Re((1 - i)z) \geq 1\}$

$S_3 = \{z \in \mathbb{C} : Im(z) \leq 1\}$

Then the set $S_1 \cap S_2 \cap S_3$

A. has exactly three elements

B. is a singleton

C. has infinitely many elements

D. has exactly two elements

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24. Let L be a tangent line to the parabola $y^2 = 4x - 20$ at (6, 2). If L is also a tangent to the ellipse

$\frac{x^2}{2} + \frac{y^2}{b} = 1$, then the value of b is equal to :

A. 20

B. 16

C. 11

D. 14

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25. Let the tangent to the circle $x^2 + y^2 = 25$ at the point R(3, 4) meet x-axis and y-axis at points P and Q, respectively. If r is the radius of the circle passing through the origin O and having centre at the incentre of the triangle OPQ, then r^2 is equal to :

A. $\frac{625}{72}$

B. $\frac{125}{72}$

C. $\frac{585}{66}$

D. $\frac{529}{64}$

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26. If the sides AB, BC and CA of a triangle ABC have 3, 5 and 6 interior points respectively, then the total number of triangles that can be constructed using these points as vertices, is equal to :

A. 240

B. 333

C. 360

D. 364

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27. Let O be the origin. Let $\overrightarrow{OP} = x\hat{i} + y\hat{i} - \hat{k}$ and $\overrightarrow{OQ} = -\hat{i} + 2\hat{j} + 3x\hat{k}, xy \in R, x > 0,$ be such that $\left|\overrightarrow{PQ}\right| = \sqrt{20}$ and the vector $\overrightarrow{OP}$ is perpendicular to $\overrightarrow{OQ}$. If $\overrightarrow{OR} = 3\hat{i} + z\hat{j} - 7\hat{k}, z \in R$, is coplanar with $\overrightarrow{OP}$ and $\overrightarrow{OQ}$, then the value of $x^2 + y^2 + z^2$ is equal to :

A. 1

B. 7

C. 9

D. 2

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28. If the curve $y = y(x)$ is the solution of the differential equation $2\left(x^2 + x^{5/4}\right)dy - y\left(x + x^{1/4}\right)dx = 2x^{9/4}dx, x > 0$ which passes through the point $\left(1, 1 - \frac{4}{3}\log_e 2\right)$, then the value of y(16) is equal to :

A. $4\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$

B. $\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$

C. $4\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$

D. $\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$

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29. The value of $\lim_{n \to \infty} \frac{[r] + [2r] + \dots + [nr]}{n^2}$,

where r is a non-zero real number and [r] denotes the greatest integer less than or equal to r, is equal to :

A. $\frac{r}{2}$

B. 0

C. 2r

D. r

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30. Let $y = y(x)$ be the solution of the differential equation $\cos x(3\sin x + \cos x + 3)dy = (1 + y\sin(3\sin x + \cos x + 3))dx, 0 \leq x \leq \frac{\pi}{2}, y(0) = 0$. Then, $y\left(\frac{\pi}{3}\right)$ is equal to :

A. $2\log_e\left(\frac{2\sqrt{3} + 9}{6}\right)$

B. $2\log_e\left(\frac{3\sqrt{3} - 8}{4}\right)$

C. $2\log_e\left(\frac{\sqrt{3} + 7}{2}\right)$

D. $2\log_e\left(\frac{2\sqrt{3}+10}{11}\right)$

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31. If the Boolean expression $(p \wedge q) \otimes (p \oplus q)$ is a tautology ,then $\otimes$ and $\oplus$ are respectively given by :

A. $\wedge$, $\vee$

B. $\wedge$, $\rightarrow$

C. $\rightarrow$, $\rightarrow$

D. $\vee$, $\rightarrow$

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32. The number of solutions of the equation $\sin^{-1}\left[x^2+\frac{1}{3}\right]+\cos^{-1}\left[x^2-\frac{2}{3}\right]=x^2$, for $x \in [-1, 1]$, and $[x]$ denotes the greatest less than or equal to x, is :

A. 4

B. 2

C. Infinite

D. 0

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33. 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 α, β, γ are integers and [x] denotes the greatest integer less than or equal to x, then the value of $\alpha+\beta+\gamma$ is equal to :

A. 0

B. 25

C. 20

D. 10

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34. Consider the function $f: R \rightarrow R$ defined by

$$f(x) = \begin{cases} \left(2 - \sin\left(\frac{1}{x}\right)\right)|x| & , \quad x \neq 0 \\ 0 & , \quad x = 0 \end{cases}$$

.Then f is :

A. monotonic on $(0, \infty)$ only

B. monotonic on $(-\infty, 0)$ only

C. not monotonic on $(-\infty, 0)$ and $(0, \infty)$

D. monotonic on $(-\infty, 0) \cup (0, \infty)$

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35. The number of solutions of the equation $x + 2\tan x = \frac{\pi}{2}$ in the interval $[0, 2\pi]$ is:

A. 5

B. 2

C. 4

D. 3

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36. Let $f: R \rightarrow R$ be defined as $f(x) = e^{-x}\sin x$. If $F:[0, 1] \rightarrow R$ is a differentiable function such that $F(x) = \int_0^x f(t)dt$, then the vlaue of $\int_0^1 (F'(x) + f(x))e^x dx$ lies in the interval

A. $\left[\frac{330}{360}, \frac{331}{360}\right]$

B. $\left[\frac{327}{360}, \frac{329}{360}\right]$

C. $\left[\frac{335}{360}, \frac{336}{360}\right]$

D. $\left[\frac{331}{360}, \frac{334}{360}\right]$

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37. The value of $\sum_{r=0}^{6}\left({}^{6}C_{r}\cdot{}^{6}C_{6-4}\right)$ is equal to:

A. 924

B. 1024

C. 1324

D. 1124

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38. Let a computer program generate only the digits 0 and 1 to form a string of binary numbers with probability of occurrence of 0 at even places be $\frac{1}{2}$ and probability of occurrence of 0 at the odd place be $\frac{1}{3}$. Then the probability that '10' is followed by '01' is equal to :

A. $\frac{1}{18}$

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

C. $\frac{1}{9}$

D. $\frac{1}{6}$

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39. Two tangents are drawn from a point P to the circle $x^2 + y^2 - 2x - 4y + 4 = 0$, such that the angle between these tangents is $\tan^{-1}\left(\frac{12}{5}\right)$, where $\tan^{-1}\left(\frac{12}{5}\right) \in (0, \pi)$. If the centre of the circle is denoted by C and these tangents touch the circle at points A and B, then the ratio of the areas of ΔPAB and ΔCAB is :

A. $9:4$

B. $3:1$

C. $2:1$

D. $11:4$

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40. If the equation of plane passing through the mirror image of a point (2,3,1) with respect to line $\frac{x+1}{2} = \frac{y-3}{1} = \frac{z+2}{-1}$ and containing the line $\frac{x-2}{3} = \frac{1-y}{2} = \frac{z+1}{1}$ is $\alpha x + \beta y + \gamma z = 24$, then $\alpha + \beta + \gamma$ is equal to :

A. 21

B. 18

C. 19

D. 20

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MATHEMATICS SECTION B

1. Let the plane $ax + by + cz + d = 0$ bisect the line joining the points (4, -3,1) and (2, 3, -5) at the right anglesI If a, b, c, d are integers, then the minimum value of $\left(a^2 + b^2 + c^2 + d^2\right)$ is______.

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2. The mean age of 25 teachers in a school is 40 yearsI A teacher retires at the age of 60 years and a new teacher is appointed in his placeI If the mean age of the teachers in this school now is 39 years, then the age (in years) of the newly appointed teacher is______ .

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3. The number of times the digit 3 will be written when listing the integers from 1 to 1000 is____ .

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4. A square ABCD has all its vertices on the curve $x^2y^2 = 1$. The midpoints of its sides also lie on the same curve. Then, the square of area of ABCD is _______ .

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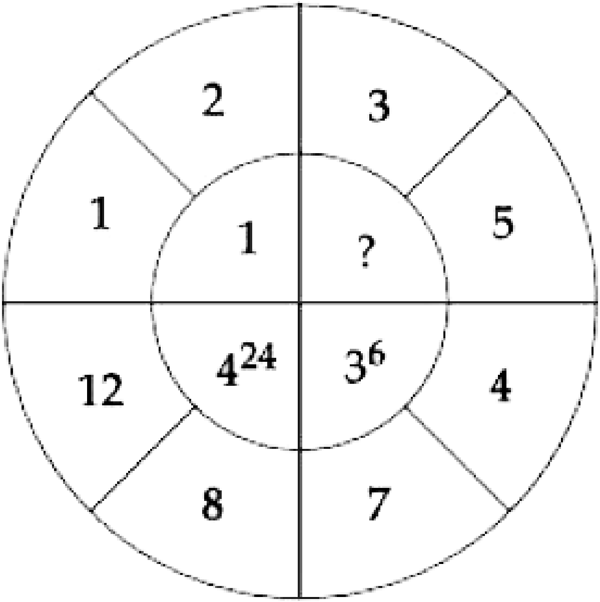
5. The missing value in the following figurs is _____ .



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6. The equation of the planes parallel to the plane $x - 2y + 2z - 3 = 0$ which are at unit distance from the point (1, 2, 3) is $ax + by + cz + d = 0$. If $(b - d) = K(c - a)$, then the positive value of K is ______ .

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7. The number of sotutions of the equation $|\cot x| = \cot x + \dfrac{1}{\sin x}$ in the interval $[0, 2\pi]$ is _____ .

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

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9. Let z_1, z_2 be the roots of the equation $z^2 + az + 12 = 0$ and z_1, z_2 form an equilateral triangle with origin. Then, the value of $|a|$ is _______ .

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

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11. Let the coefficients of third, fuurth and fifth terms in the expansion of $\left(x + \frac{a}{x^2}\right)^n, x \neq 0$ be in the ratio 12:8:3. Then the term independent of x in the expansion, is equal to ______.

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12. Let $\vec{x}$ be a vector in the plane containing vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$. If the vector $\vec{x}$ is perpendicular to $\left(3\hat{i} + 2\hat{j} - \hat{k}\right)$ and its projection on $\vec{a}$ is $\frac{17\sqrt{6}}{2}$, then the value of $|\vec{x}|^2$ is equal to ________.

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13. Let $I_n = \int_1^e x^{19}(\log|x|)^n dx$, where $n \in N$. If $(20)I_{10} = \alpha I_9 + \beta I_8$, for natural numbers α and β, then $\alpha - \beta$ equals to _______.

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14. Let $\tan\alpha$, $\tan\beta$ and $\tan\gamma$, $\alpha, \beta, \gamma \neq \frac{(2n-1)\pi}{2}$, $n \in N$ be the slopes of three line segments OA, OB and OC, respectively, where O is origin. If circumcentre of ΔABC coincides with origin and its orthocontre lies on y-axis, then the value of $\left(\frac{\cos 3\alpha + \cos 3\beta + \cos 3\gamma}{\cos\alpha\cos\beta\cos\gamma}\right)^2$ is equal to ________.

Watch Video Solution

15. Let $f : [-3, 1] \to R$ be given as

$$f(x) = \begin{cases} \min\left\{(x+6), x^2\right\}, & -3 \le x \le 0 \\ \max\left\{\sqrt{x}, x^2\right\}, & 0 \le x \le 1 \end{cases}.$$

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

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16. If $1, \log_{10}(4^x - 2)$ and $\log_{10}\left(4^x + \frac{18}{5}\right)$ are in arithmetic progression for a real number x, then the value of the determinant

$$\begin{vmatrix} 2\left(x - \frac{1}{2}\right) & x - 1 & x^2 \\ 1 & 0 & x \\ x & 1 & 0 \end{vmatrix}$$ is equal to:

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17. Let P be an arbitrary point having sum of the squares of the distances from the planes $x + y + z = 0$, $lx - nz = 0$ and $x - 2y + z = 0$, equal to 9. If the locus of the point P is$x^2 + y^2 + z^2 = 9$, then the value of $l - n$ is equal to ________.

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18. Consider a set of 3n numbers having variance 4. In this set, the mean of first 2n numbers is 6 and the mean of the remaining n numbers is 3. A new set is constructed by adding 1 into each of first 2n numbers, and subtracting 1 from each of the remaining n numbers. If the variance of the new set is k, then 9k is equal to ________.

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19. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $B = \begin{bmatrix} \alpha \\ \beta \end{bmatrix} \neq \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ such that AB = B and $a + d = 2021$, then the value of $ad - bc$ is equal to ________ .

Watch Video Solution

20. Let $f : [-1, 1] \rightarrow R$ be defined as $f(x) = ax^2 + bx + c$ for all $x \in [-1, 1]$, where $a, b, c \in R$ such that $f(-1) = 2, f'(-1) = 1$ and for $x \in (-1, 1)$ the maximum value of $f''(x)$ is $\frac{1}{2}$. If $f(x) \leq \alpha, x \in [-1, 1]$, then the least value of α is equal to ________.

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Mathematic section A

1. Let C be the locus of the mirror image of a point on the parabola $y^2 = 4x$ with respect to the line y=x. Then the equation of tangent to C at P(2, 1) is :

A. x-y=1

B. 2x+y=5

C. x+3y=5

D. x+2y=4

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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 $\vec{r} \times \vec{a} = \vec{b} \times \vec{r}$, $\vec{r}.\left(\alpha\hat{i} + 2\hat{j} + \hat{k}\right) = 3$ and $\vec{r}.\left(2\hat{i} + 5\hat{j} - \alpha\hat{k}\right) = -1$, $a \in R$, then the value of $\alpha + \left|\vec{r}\right|^2$ is equal to :

A. 15

B. 11

C. 9

D. 13

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3. Let (x,y,z) be an arbitrary point lying on a plane P which passes through the points (42,0,0), (0,42,0) and (0,0,42), then the value of the expression

$$3 + \frac{x - 11}{(y - 19)^2(z - 12)^2} + \frac{y - 19}{(x - 11)^2(z - 12)^2} + \frac{z - 12}{(x - 11)^2(y - 19)^2} - \frac{x + y + z}{14(x - 11)(y - 19)(}$$

is equal to :

A. 0

B. 39

C. 3

D. -45

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4. Let f be a real valued function, defined on $R - \{-1, 1\}$ and given by

$$f(x) = 3\log_e\left|\frac{x-1}{x+1}\right| - \frac{2}{x-1}$$

Then in which of the following intervals, function f(x) is increasing ?

A. $\left(-1, \frac{1}{2}\right]$

B. $(-\infty, -1) \cup \left(\left[\frac{1}{2}, \infty\right) - \{1\}\right)$

C. $(-\infty, \infty) - \{-1, 1\}$

D. $\left(-\infty, \frac{1}{2}\right] - \{-1\}$

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5. Let A denote the event that a 6-digit integer formed by 0, 1, 2, 3, 4, 5, 6 without repetitions, be divisible by 3. Then probability of event A is equal to :

A. $\frac{9}{56}$

B. $\frac{11}{27}$

C. $\frac{4}{9}$

D. $\frac{3}{7}$

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6. Let C, be the curve obtained by the solution of differential equation $\frac{dy}{dx} + (\tan x)y = \sin x, 0 \le x \le \frac{\pi}{3}$, with y(0)=0, then $y\left(\frac{\pi}{4}\right)$ equal to :

A. $\log_e 2$

B. $\frac{1}{4}\log_e 2$

C. $\frac{1}{2}\log_e 2$

D. $\left(\frac{1}{2\sqrt{2}}\right)\log_e 2$

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7. The least value of $|z|$ where z is complex number which satisfies the inequality exp $\left(\frac{(|z| + 3)(|z| - 1)}{|z| + 1|}\log_e 2\right) > \log_{\sqrt{2}}\left|5\sqrt{7} + 9i\right|, i = \sqrt{-1}$ is equal to :

A. 8

B. $\sqrt{5}$

C. 2

D. 3

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8. Let C_1 be the curve obtained by the solution of differential equation $2xy\frac{dy}{dx} = y^2 - x^2, x > 0$ Let the curve C_2 be the solution of $\frac{2xy}{x^2 - y^2} = \frac{dy}{dx}$. If both the curves pass through (1, 1), then the area enclosed by the curves C_1 and C_2 is equal to :

A. $\frac{\pi}{2} - 1$

B. $\frac{\pi}{4} + 1$

C. $\pi - 1$

D. $\pi + 1$

Watch Video Solution

9. 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 :

A. $\frac{4}{15}$

B. 1

C. 3

D. 2

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10. Let $f: S \to S$ where $S = (0, \infty)$ be a twice differentiable function such that $f(x+1) = f(x)$. 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 :

A. $\frac{197}{144}$

B. $\frac{187}{144}$

C. 1

D. $\frac{205}{144}$

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11. Let the lengths of intercepts on x-axis and y-axis made by the circle $x^2 + y^2 + ax + 2ay + c = 0, (a < 0)$ be $2\sqrt{2}$ and $2\sqrt{5}$, respectively. Then the shortest distance from origin to a tangent to this circle which is perpendicular to the line x+2y=0 is equal to :

A. $\sqrt{7}$

B. $\sqrt{6}$

C. $\sqrt{10}$

D. $\sqrt{11}$

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12. Given that the inverse trigonometric functions take principal values only. Then, the number of real values of x which satisfy $\sin^{-1}\left(\frac{3x}{5}\right) + \sin^{-1}\left(\frac{4x}{5}\right) = \sin^{-1}x$ is equal to :

A. 1

B. 0

C. 3

D. 2

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13. If the foot of the perpendicular from point (4, 3,8) on the line $L_1 : \frac{x-a}{l} = \frac{y-2}{3} = \frac{z-b}{4}, l \neq 0$ (3,5,7) then the shortest distance between the line L_1 and line $L_2 : \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ is equal to :

A. $\frac{1}{\sqrt{3}}$

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

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

D. $\frac{1}{\sqrt{6}}$

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14. Let $A = (1, 2, 3, 4, 5, \ldots, 30)$ and $\cong$ be an equivalence relation on $A \times A$, defined by (a,b) $\cong$ (c,d)` if and only if ad=bc. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair (4,3) is equal to :

A. 8

B. 5

C. 7

D. 6

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15. Consider a rectangle ABCD having 5, 7, 6, 9 points in the interior of the line segments AB, CD, BC, DA respectively. Let α be the number of triangles having these points from different sides as vertices and β be the number of quadrilaterals having these points from different sides as vertices. Then (β - α) is equal to :

A. 795

B. 1173

C. 717

D. 1890

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16. Let $P(x) = x^2 + bx + c$ be a quadratic polynomial with real coefficients such that $\int_0^1 P(x)dx = 1$ and P(x) leaves remainder 5 when it is divided by (x

- 2). Then the value of 9(b + c) is equal to:

A. 15

B. 7

C. 9

D. 11

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17. Consider the integral $I = \int_0^{10} \frac{[x]e^{[x]}}{e^{x-1}} dx$, where [x] denotes the greatest integer less than or equal to x. Then the value of I is equal to :

A. 45 (e-1)

B. 45(e+1)

C. 9(e+1)

D. (e-1)

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18. Let $\alpha \in R$ be such that the function

$$f(x) = \begin{cases} \dfrac{\cos^{-1}\left(1 - \{x\}^2\right)\sin^{-1}(1 - \{x\})}{\{x\} - \{x\}^3}, & x \neq 0 \\ \alpha & x = 0 \end{cases}$$ is continuous at =0 where

$[x] = x - \{x\}$. $\{x\}$ is the greatest integer less than or equal to x. The :

A. $\alpha = 0$

B. $\alpha = \dfrac{\pi}{4}$

C. no such α exists

D. $\alpha = \dfrac{\pi}{\sqrt{2}}$

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19. The maximum value of $f(x) = \begin{vmatrix} \sin^2 x & 1+\cos^2 x & \cos 2x \\ 1+\sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & \sin 2x \end{vmatrix}, x \in R$ is :

A. $\sqrt{5}$

B. $\frac{3}{4}$

C. $\sqrt{7}$

D. 5

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20. If the points of intersections of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the circle $x^2 + y^2 = 4b, b > 4$ lie on the curve $y^2 = 3x^2$, then b is equal to :

A. 12

B. 5

C. 6

D. 10

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Mathematic section B

1. If the distance of the point (1,-2,3) from the plane $x + 2y - 3z + 10 = 0$ measured parallel to the line, $\frac{x - 1}{3} = \frac{2 - y}{m} = \frac{z + 3}{1}$ is $\sqrt{\frac{7}{2}}$ then the value of $|m|$ is equal to ....

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2. Let $\frac{1}{16}$ a and b in G.P $\frac{1}{a}, \frac{1}{b}$ 6 be in A.P., where $a, b > 0$. Then 72(a+b) is equal to ______

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3. Consider the statistics of two sets of observations as follows:

	Size	Mean	Variance
Observation I	10	2	2
Observation II	n	3	1

If the variance of the combined set of these two observations is $\frac{17}{9}$ then the value of n is equal to....

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4. For real numbers α, β, γ and δ, if

$$\int \frac{\left(x^2 - 1\right) + \tan^{-1}\left(\frac{x^2+1}{x}\right)}{\left(x^4 + 3x^2 + 1\right)\tan^{-1}\left(\frac{x^2+1}{x}\right)}dx$$

$$= \alpha\log_e\left(\tan^{-1}\left(\frac{x^2 + 1}{x}\right)\right) + \beta\tan^{-1}\left(\frac{\gamma\left(x^2 - 1\right)}{x}\right) + \delta\tan\left(\frac{x^2 + 1}{x}\right) + C$$

where is an arbitrary constant, then the value of $10(\alpha + \beta\gamma + \delta)$ is equal to........

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5. Let

$S_n x = \log_{a1/2} x + \log_{a1/3} x + \log_{a1/6} x + \log_{a1/11} x + \log_{a1/18} x + \log_{a1/27} + \ldots .$

up to n-terms.

Where $a > 1$. If $S_{24}(x) = 1093$ and $S_{12} = 265$ then value of a is equl to....

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6. Let $f : R \rightarrow R$ and $g, R \rightarrow R$ be defined as

$$f(x) = \begin{cases} x + a, & x < 0 \\ |x - 1|, & x \geq 0 \end{cases} \text{ and } g = \begin{cases} x + 1, & x < 0 \\ (x - 1)^2 + b, & x > 0 \end{cases}$$

where a, b are non-negative real numbers. If $(gof)(x)$ is continuous for all $x \in R$, then $a + b$ is equal to......

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7. ΔABC the lengths of sides AC and AB are 12 cm and 5 cm, respectively. If the area of ΔABC is 30 cm2 and R and r are respectively the radii of circumcircle and incircle of ΔABC then the value of 2R+r (in cm) is equal to......

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8. Let $\vec{r}$ be a vector perpendicular to the vertors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. If $\vec{c}.\left(\hat{i} + \hat{j} + 3\hat{k}\right) = 8$ then the value of $\vec{c}.\left(\vec{a} \times \vec{b}\right)$ is equal to...

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9. Let $A = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$ be two 2×1 matricews with real entires such that $A = XB$, where $x = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & -1 \\ 1 & k \end{bmatrix}$, and $k \in R$. If $a_1^2 + a_2^2 = \frac{2}{3}\left(b_1^2 + b_2^2\right)$ and $\left(k^2 + 1\right)b_2^2 \neq -2b_1b_2$ then the value of k is.....

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10. Let n be a positive intgeger Let

$$A = \sum_{k=0}^{n} (-1)^{k\,n}C_k\left[\left(\frac{1}{2}\right)^k + \left(\frac{3}{4}\right)^k + \left(\frac{7}{8}\right)^k + \left(\frac{15}{16}\right) + \left(\frac{31}{32}\right)^k\right]$$

If $63A = 1 - \dfrac{1}{2^{30}}$ then n is equal to ......

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