MATHS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 2

Mathematics

1. Let z_1 and z_2 be n^{th} roots of unity which subtend a right angle at the origin. Then n must be of the form

A. 4K + 1

B. 4K + 2

C. 4k+3

D. 4k

Answer: D

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2. In $(0, 2\pi)$, the total number of points where f(x)=max.{sin x, cos x, 1 - cos x} is not differentiable , are equal to

A. 3

B. 4

C. 5

D. 6

Answer: A

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3. The intergral $\int x \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)dx, (x > 0)$ is equal to

A. $-x+(1+x^2)\cot^{-1}x+c$

B. $x-(1+x^2)\cot^{-1}x+c$

C. $x-(1+x^2)\tan^{-1}x+c$

D. $-x+(1+x^2)\tan^{-1}x+c$

Answer: D

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4. The coefficient of x^n in the polynomial $(x+{}^{2n+1}C_0)(X+{}^{2n+1}C_1)(x+{}^{2n+1}C_2)\ldots\ldots(X+{}^{2n+1}C_n)$ is

A. 2^{n+1}

B. $2^{2n+1}-1$

C. 2^{2n-1}

D. 2^{2n}

Answer: D

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5. The mean of the data set comprising of 16 observations is 16. If one of the observation valued 16 is deleted and three new observations valued 3, 4 and 5 are added to the data, then the mean of the resultant data, is-

A. 14.0

B. 16.8

C. 16.0

D. 15.8

Answer: A

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6. The lines represented by the equation

$x^2 + 2\sqrt{3}xy + 3y^2 - 3x - 3\sqrt{3}y - 4 = 0$, are

A. perpendicular to each other

B. parallel

C. inclined at 45° to each other

D. None of these

Answer: B

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7. At present, a firm is manufacturing 2000 items. It is estimated that the rate of change of production P w.r.t. additional number of workers x is given by $\frac{dP}{dx} = 100 - 12\sqrt{x}$.. If the firm employs 25 more workers, then the new level of production of items is

A. 3500

B. 4500

C. 2500

D. 3000

Answer: A

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8. Let $f: R \to R$ be a periodic function such that $f(T+x) = 1$ where T is a $+\left[1 - 3f(x) + 3(f(x))^2 - (f(x))^3\right]^{\frac{1}{3}}$ fixed positive number, then period of f(x) is

A. T

B. 2T

C. 3T

D. None of these

Answer: B

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9. AB is vertical tower. The point A is on the ground and C is the middle point of AB. The part CB subtend an angle α at a point P on the ground. If $AP = nAB$, then $\tan\alpha =$

A. $n = (n^2 + 1)\tan\alpha$

B. $n = (2n^2 - 1)\tan\alpha$

C. $n^2 = (2n^2 + 1)\tan\alpha$

D. $n = (2n^2 + 1)\tan\alpha$

Answer: D

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10. If $f(x) = \begin{cases} x+1 & x > 1 \\ 0, & x = 1 \\ 7-3x, & x < 1 \end{cases}$ then f '(0) equal to

A. -1

B. -2

C. -3

D. -4

Answer: C

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11. If x = -1 and x = 2 are extreme points of f(x) = $\alpha \log|x| + \beta x^2 + x$, then

A. $\alpha = 2, \beta = -\frac{1}{2}$

B. $\alpha = 2, \beta = \frac{1}{2}$

C. $\alpha = -6, \beta = \frac{1}{2}$

D. $\alpha = -6, \beta = -\frac{1}{2}$

Answer: A

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12. If x takes negative permissible value then $\sin^{-1} x =$

A. $-\cos^{-1}\sqrt{1-x^2}$

B. $\cos^{-1}\sqrt{x^2-1}$

C. $\pi - \cos^{-1}\sqrt{1-x^2}$

D. $\cos^{-1}\sqrt{1-x^2}$

Answer: A

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13. If $f(x) = \Pi_{k=1}^{999}(x^2 - 47x + k)$. then product of all real roots of $f(x) = 0$ is

A. $550!$

B. $551!$

C. $552!$

D. $999!$

Answer: C

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14. In a certain town 25% families own a cellphone, 15% families own a scooter and 65% families own neither a cellphone nor a scooter. If 500 families own both a cellphone and scooter, then total number of families in the town is

A. 10000

B. 20000

C. 30000

D. 40000

Answer: C

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15. The number of ways of arranging 8 men and 5 women around a circular table such that no two women can sit together is

A. $8!$

B. $4!$

C. $8!4!$

D. $7! \times 8_{P_3}$

Answer: D

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16. Let $A = \begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$ be a matrix, then $|A|adj(A^{-1})$ is equal to

A. $O_{3 \times 3}$

B. $\begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$

C. I_3

D. $[-3, -3, 1), (3, 0, -2), (-1, 2, -3)]$

Answer: B

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17. If the equation $x^2 + 4 + 3\sin(ax + b) - 2x = 0$ has at least one real solution, where $a, b \in [0, 2\pi]$ then one possible value of $(a + b)$

can be equal to

A. $\frac{7\pi}{2}$

B. $\frac{5\pi}{2}$

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

D. None of these

Answer: A

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18. Fifteen coupens are numbered $1, 2, 3, \ldots 15$ respectively. Seven coupons are selected at random one at a time with replacement The Probability that the largest number appearing on a selected coupon is 9 is :

A. $\left(\frac{1}{15}\right)^7$

B. $\left(\frac{3}{5}\right)^7$

C. $\left(\frac{8}{15}\right)^7$

D. $\left(\frac{2}{5}\right)^7$

Answer: B

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19. For $x \in R, x \neq 0$ if $y(x)$ is a differentiable function such that $x\int_1^x y(t)dt = (x+1)\int_1^x ty(t)dt$, then $y(x)$ equals (where C is a constant)

A. $Cx^3 e^{\frac{1}{x}}$

B. $\frac{C}{x^2}e^{-\frac{1}{x}}$

C. $\frac{C}{x}e^{-\frac{1}{x}}$

D. $\frac{C}{x^3}e^{-\frac{1}{x}}$

Answer: D

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20. If O is the origin and OP, OQ are distinct tangents to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ then the circumcentre of the triangle OPQ is

A. $(-g, -f)$

B. (g, f)

C. $(-f, -g)$

D. None of these

Answer: D

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21. The inradius of the triangle having sides 26,28,30 units is

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22. Let the sum $\sum_{n=1}^{9} \frac{1}{n(n+1)(n+2)}$ written in the rational form be $\frac{p}{q}$ (where p and q are co-prime), then the value of $\left[\frac{q-p}{10}\right]$ is (where [.] is the greatest integer function)

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23. In a ΔABC if $\angle A = \angle B = \frac{1}{2}\left(\sin^{-1}\left(\frac{\sqrt{6}+1}{2\sqrt{3}}\right) + \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)\right)$ and length of $c = 6.3^{\frac{1}{4}}$, then the area of ΔABC

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24. $\lim_{x \to 0} \frac{\sin^{-1} x - \tan^{-1} x}{x^3}$ is equal to

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25. A farmer F_1 has a land in the shape of a triangle with vertices at $P(0, 0)$, $Q(1, 1)$ and $R(2, 0)$.From this land, a neighbouring farmer F_2 takes away the region which lies between the side PQ and a curve of the form $y = x^n$, $(n > 1)$. If the area of the region taken away by the farmer F_2 is exactly $30\,\%$ of the area of ΔPQR, then the value of n is _______.

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26. If the integral

$$I = \int x^{\sin x}\left(\cos x \cdot 1nx + \frac{\sin x}{x}\right)dx, \; = (f(x))^{g(x)} + c(\forall x > 0)$$

then the range of $y = g(x)$ is (where, c is an arbitrary constant)

A. [-1,1]

B. [0,1]

C. [0,1)

D. (-1,1)

Answer: A

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27. Let P and Q are two points in the xy plane on the curve $y = x^{11} - 2x^7 + 7x^3 + 11x + 6$ such that $\overrightarrow{OP} \cdot \hat{i} = 5, \overrightarrow{OQ} \cdot \hat{i} = -5$, then the magnitude of $\overrightarrow{OP} + \overrightarrow{OQ}$ is

A. 10

B. 12

C. 14

D. 8

Answer: B

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28. If the letters of the word REGULATIONS be arranged at random, find the probability that there will be exactly four letters between the R and the E.

A. $\frac{6}{55}$

B. $\frac{3}{55}$

C. $\frac{5}{11}$

D. $\frac{6}{11}$

Answer: A

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29. If the point of intersection of the plane $4x - 5y + 2z - 6 = 0$ with the line through the origin and perpendicular to the plane $x - 2y - 4z = 4$ is P, then the distance of the point P from (1, 2,3) is

A. $\sqrt{63}$ units

B. 8 units

C. $\sqrt{65}$ units

D. $\sqrt{72}$ units

Answer: C

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30. The mean and variance of seven observations are 8 and 16 respectively. If five of these are 2,4,10,12 and 14, then find the remaining two observations.

A. 5,7

B. 3,5

C. 6,8

D. 4,2

Answer: C

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31. Let ΔABC is an isosceles trianlge with $AB = AC$. If $B = (0, a), C = (2a, 0)$ and the equation of AB is $3x - 4y + 4a = 0$, then the equation of side AC is

A. $y = 8x - 16a$

B. $3y = 4x - 8a$

C. $x = 2a$

D. $y + 8x = 16a$

Answer: C

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32. Let A (0,3) and B(0,12) be two vertices of a ΔABC where $C=(x,0)$. If the circumcircle of ΔABC touches the x-axis, then the value of cos 2θ is (where θ is angle ACB)

A. $\frac{1}{3}$

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

C. $\frac{8}{15}$

D. $\frac{7}{25}$

Answer: D

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33. Consider three statements p : person 'A' passed in mathematics exam q : Person 'A' passed in physics exam r : Person 'A' passed in chemistry exam, Then the statement ~$((\text{~}(p \Rightarrow q) \Rightarrow r)$ is equivalent to

A. Person A passed only in mathematics & physics & chemistry

B. Person A failed only in mathematics & physics & chemistry

C. Person A passed in all the three subjects mathematics & physics & chemistry

D. Person A passed in chemistry but failed in mathematics & physics.

Answer: A

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34. In equation $(Z-1)^n = Z^n = 1(\forall n \in N)$ has solution, then n can be

A. 4

B. 12

C. 15

D. 21

Answer: B

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35. The solution of the differential equation $\left(3x^2\sin\left(\frac{1}{x}\right)+y\right)dx=x\cos\left(\frac{1}{x}\right)dx-xdy$ is (where, c is an arbitrary constant)

A. $\sin\left(\frac{1}{x}\right)=xy+c$

B. $x^3\sin\left(\frac{1}{x}\right)+xy=c$

C. $x^3\sin\left(\frac{1}{x}\right)=xy+c$

D. $\sin\left(\frac{1}{x}\right)=x^3y+c$

Answer: B

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36. The quadratic equation $(1-\sin\theta)x^2+2(1-\sin\theta)x-3\sin\theta=0$ has both roots complex for all θ lying in the interval

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

B. $\left(0, \frac{3\pi}{2}\right)$

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

D. $\left(\frac{7\pi}{6}, \frac{11\pi}{6}\right)$

Answer: D

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37. The minimum value of the expression $3x+2y(\forall x, y>0)$, where $xy^2=10$, occurs when the value of y is equal to

A. $\sqrt{10}$

B. $\sqrt[3]{10}$

C. $\sqrt[3]{30}$

D. $\frac{1}{\sqrt{30}}$

Answer: C

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38. If in the expansion of $(1+x)^m(1-x)^n$ the coefficient of x and x^2 are 3 and (-6) respectively, then the value of n is-

A. 6

B. 9

C. 12

D. 24

Answer: B

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39. Number of words that can be formed with the letters of the word ALGEBRA so that all the vowels are seperated (or no two vowals come together) is

A. 720

B. 2160

C. 1440

D. 1200

Answer: A

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40. If $f(k-x)+f(x)=\sin x$, then the value of integral $I=\int_0^k f(x)dx$ is equal to

A. $\cos k$

B. $2\cos^2\left(\frac{k}{2}\right)$

C. $\sin^2\left(\frac{k}{2}\right)$

D. $\sin k$

Answer: C

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41. If the difference between the number of subsets of the sets A and B is 120 , then choose the incorrect option.

A. Maximum value of $n(A \cap B) = 3$

B. Minimum value of $n(A \cap B) = 0$

C. Maximum value of $n(A \cup B) = 21$

D. Minimum value of $n(A \cup B) = 7$

Answer: C

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42. For the function $f(x) = \sin(\pi[x]) \times \cos^{-1}([x])$, choose the correct option.

(where [.] represents the greatest integer function)

A. Domain of $f(x)$ in [-1,1]

B. Range of $f(x)$ contains exactly two elements

C. $f(x)$ is an identify function

D. $f(x)$ is a constant function

Answer: D

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43. The value of $\lim_{x \to 0} \frac{\sin x}{3}\left[\frac{5}{x}\right]$ is equal to

[where [.] represent the greatest integer function)

A. $\frac{1}{3}$

B. 0

C. $\frac{5}{3}$

D. 1

Answer: C

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44. If $y = \tan^{-1}\left(\frac{x}{1+6x^2}\right) + \tan^{-1}\left(\frac{2x-1}{2x+1}\right), (\forall x > 0)$ then $\frac{dy}{dx}$ is equal to

A. $\frac{3}{1+9x^2}$

B. $\frac{1}{1+6x^2}$

C. $\dfrac{1}{1+6x^2}+\dfrac{1}{1+x^2}$

D. $\dfrac{3}{1+6x^2}$

Answer: A

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45. If $|3x-1|, 3, |x-3|$ are the first three terms of an arithmentic progression, then the sum of the first five terms can be

A. 5

B. 10

C. 20

D. 30

Answer: A

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46. If $f(x)=\begin{cases} px+q & : x \leq 2 \\ x^2-5x+6 & : 2 < x < 3 \\ ax^2+bx+1 & : x \geq 3 \end{cases}$

is differentiable everywhere, then $|p|+|q|+\left|\frac{1}{a}\right|+\left|\frac{1}{b}\right|$ is equal to

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47. If the area bounded by $y=\left||x|^2-4|x|+3\right|$ and the x-axis from $x=1$ to $x=3$ is $\frac{p}{q}$ (where, p & q are coprime) then the value of $p+q$ is

A. 10

B. 9

C. 8

D. 7

Answer: D

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48. Let M be a square matix of order 3 whose elements are real number and $adj(adjM) = \begin{bmatrix} 36 & 0 & -4 \\ 0 & 6 & 0 \\ 0 & 3 & 6 \end{bmatrix}$, then the absolute value of $Tr(M)$ is [Here, adj P denotes adjoint matrix of P and $T_r(P)$ denotes trace of matrix P i.e., sum of all principal diagonal elements of matrix P]

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49. If common tangents of $x^2 + y^2 = r^2$ and $\frac{x^2}{16} + \frac{y^2}{9} = 1$ forms a square, then the length of diagonal of the square is

A. 9

B. 10

C. 12

D. 1

Answer: B

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50. The angular depression of the top and the foot of the chimney seen from the top of a tower on the same base level as the chimney are $\tan^{-1}\left(\frac{4}{3}\right)$ and $\tan^{-1}\left(\frac{5}{2}\right)$ respectively if the height of the tower is 150m. then the distance between the top of the chimney and the tower is

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51. Let $P_1 : 2x + y + z + 1 = 0$

$P_2 : 2x - y + z + 3 = 0$ and $P_3 : 2x + 3y + z + 5 = 0$ be three planes, then the distance of the line of intersection of planes $P_1 = 0$ and $P_2 = 0$ from the plane $P_3 = 0$ is

A. $\frac{3}{\sqrt{14}}$ units

B. $\frac{6}{\sqrt{14}}$ units

C. $\frac{3}{\sqrt{7}}$ units

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

Answer: B

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52. The parabolas $C_1 : y^2 = 4a(x - a)$ and $C_2 : y^2 = -4a(x - k)$ intersect at two distinct points A and B. If the slope of the tangent at A on C_1 is same as the slope of the normal at B on C_2, then the value of k is equal to

A. 3a

B. 2a

C. a

D. 0

Answer: A

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53. Let p, q and r be three statements, then $(p \to q) \to r$ is equivalent to

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

B. $(p \vee r) \wedge (\sim q \vee r)$

C. $(p \wedge r) \vee (q \vee r)$

D. $(p \vee r) \to r$

Answer: B

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54. Let two sides of a rectangle of area 20 sq. units are along lines $x - y = 0$ and $x + y = 2$, then the locus of the point of intersection of diagonals is a

A. pair of ellipse

B. pair of straight lines

C. pair of hyperbola having eccentricity 2 and $\frac{2}{\sqrt{3}}$

D. pair of hyperbola each having eccentricity $\sqrt{2}$

Answer: D

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55. Let $2\vec{a} = \vec{b} \times \vec{c} + 2\vec{b}$ where $\vec{a}, \vec{b}$ and $\vec{c}$ are three unit vectors, then sum of all possible values of $\left|3\vec{a} + 4\vec{b} + 5\vec{c}\right|$ is

A. 10

B. 12

C. 14

D. 16

Answer: C

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56. If $f(1+x)=f(1-x)(\forall x\in R)$, then the value of the integral

$$I=\int_{-7}^{9}\frac{f(x)}{f(x)+f(2-x)}dx \text{ is}$$

A. 0

B. 2

C. 8

D. 10

Answer: C

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57. If $f(x)$ is a real valued function such that

$f(x+6)-f(x+3)+f(x)=0, \ \forall x \in R$, then period of $f(x)$ is

A. 6

B. 12

C. 18

D. 24

Answer: C

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58. The value of $\lim_{x \to 0} \dfrac{\tan^2 3x}{\sqrt{5}-\sqrt{4+\sec x}}$ is equal to

A. $2\sqrt{5}$

B. $-9\sqrt{5}$

C. $9\sqrt{5}$

D. $-36\sqrt{5}$

Answer: D

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59. If $-\pi < \theta < \pi$, the equation

$$(\cos 3\theta + 1)x^2 + 2(\cos 2\theta - 1)x + (1 - 2\cos\theta) = 0$$

has more than two roots for

A. no value of θ

B. one value of θ

C. two value of θ

D. all value of θ

Answer: A

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60. If $In(2x^2 - 5), In(x^2 - 1)$ and $In(x^2 - 3)$ are the first three terms of an arithmetic progression, then its fourth term is

A. In 8 - In 3

B. In 3 - In 8

C. In 24

D. 2 In 6

Answer: A

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61. Image of line $\frac{x-2}{3}=\frac{y-1}{1}=\frac{z-1}{-4}$ in the plane $x+y+z=7$ is

A. $\frac{x-4}{1}=\frac{y-3}{1}=\frac{z-3}{1}$

B. $\frac{x-3}{1}=\frac{y-4}{1}=\frac{z-3}{1}$

C. $\frac{x-4}{3}=\frac{y-3}{1}=\frac{z-3}{-4}$

D. $\frac{x-3}{1}=\frac{y-4}{1}=\frac{z-3}{-4}$

Answer: C

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62. If $\pi<\theta<\frac{3\pi}{2}$ and $\cos\theta=-\frac{3}{5}$, then $\tan\left(\frac{\theta}{4}\right)$ is equal to

A. $\frac{\sqrt{5}-1}{2}$

B. $\frac{\sqrt{5}+1}{2}$

C. $\frac{-\sqrt{5}-1}{4}$

D. $\frac{-\sqrt{5}+1}{4}$

Answer: B

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63. If the value of integral

$$\int\left(x+\sqrt{x^2-1}\right)^2 dx = ax^3 - x + b\left(x^2-1\right)^{\frac{1}{b}}, + C$$

(where, C is the constant of integration), then $a \times b$ is equal to

A. 1

B. $\frac{4}{9}$

C. 2

D. $\frac{9}{4}$

Answer: B

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64. The range of the function $\sin^{-1}\left(\frac{x^2}{1+x^2}\right)$ is

A. $[-\pi/2, \pi/2]$

B. $[0, \pi/2)$

C. $(0, \pi/2]$

D. $(-\pi/2, \pi/2)$

Answer: B

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65. The solution of the differential equation $\frac{1}{x^2}\left(\frac{dy}{dx}\right)^2 + 6 = \left(\frac{5}{x}\right)\frac{dy}{dx}$ is $y = \lambda x^2 + c$ (where, c is an arbitary constant). The sum of all the possible value of λ is

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

B. $\frac{5}{2}$

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

D. 2

Answer: B

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66. The number of tangents with positive slope that can be drawn from the origin to the curve $y = \sin x$ is

A. 0

B. 2

C. 4

D. infinitely many

Answer: D

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67. A complex number z is said to be unimodular if . Suppose z_1 and z_2 are complex numbers such that $\frac{z_1 - 2z_2}{2 - z_1 z_2}$ is unimodular and z_2 is not unimodular. Then the point z_1 lies on a : (1) straight line parallel to x-axis (2) straight line parallel to y-axis (3) circle of radius 2 (4) circle of radius $\sqrt{2}$

A. circle of radius $\sqrt{2}$

B. straight line parallel to x-axis

C. straight line parallel to y-axis

D. circle of radius 2

Answer: D

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68. Equation of the straight line which meets the circle $x^2 + y^2 = 8$ at two points where these points are at a distance of 2 units from the point A(2, 2) is

A. $x + y = 2$

B. $x + y = 3$

C. $x + y = 1$

D. $x + y = 0$

Answer: B

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69. $If x_1, x_2, \ldots . x_n$ are n observations such that $\sum_{i=1}^{n} (x_i)^2 = 400$ and $\sum_{i=1}^{n} x_i = 100$ then possible values of n among the following is

A. 18

B. 20

C. 24

D. 27

Answer: D

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70. If the system of equation $x - 2y + 5z = 3$

$2x - y + z = 1$ and $11x - 7y + pz = q$ has infinitely many solution, then

A. $p + q = 2$

B. $p + q = 10$

C. $p - q = 2$

D. $p - q = 5$

Answer: C

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71. A term of randomly chosen from the expansion of $\left(\sqrt[6]{4}+\frac{1}{\sqrt[4]{5}}\right)^{20}$.

If the probability that it is a rational term is P, then 420P is euqal to

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72. If a tangent of slope 2 of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{1}=1$ passes through the point $(-2, 0)$, then the value of a^2 is equal to

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73. The number obtained after dividing the number formed by the last three digits of 17^{256} by 100 is

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74. The area (in sq. units) bounded by $y = 2 - |x - 2|$ and the x-axis is

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75. Let $y = x^3 - 6x^2 + 9x + 1$ be an equation of a curve, then the x-intercept of the tangent to this curve whose slope is least, is

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76. Two intersecting lines lying in plane P_1 have equations $\frac{x-1}{1} = \frac{y-3}{2} = \frac{z-4}{3}$ and $\frac{x-1}{2} = \frac{y-3}{3} = \frac{z-4}{1}$. If the equation of plane P_2 is $7x - 5y + z - 6 = 0$, then the distance between planes P_1 and P_2 is

A. $\frac{11}{5\sqrt{3}}$

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

C. $\frac{1}{\sqrt{3}}$

D. $\frac{7}{5\sqrt{3}}$

Answer: B

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77. If t is real and $\lambda = \frac{t^2 - 3t + 4}{t^2 + 3t + 4}$ then find number of the solution of the systems of equation $3x - y + 4z = 0, x + 2y - 3z = -2.6x + 5y + \lambda z = -3$ for a particular value of λ.

A. a unique solution

B. infinite solutions

C. no solution

D. 2 solutions

Answer: A

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78. The solution of the differential equation $2ydx + xdy = 2x\sqrt{y}dx$ is

(where, C is an arbitrary constant)

A. $x\sqrt{y} = x + C$

B. $x\sqrt{y} = \frac{x^2}{2} + C$

C. $\frac{x}{\sqrt{y}} = x + C$

D. $xy = C$

Answer: B

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79. The mean and variance of 10 observation are found to be 10 and 4 respectively. On rechecking it was found that an observation 8 was incorrect. If it is replaced by 18, then the correct variance is

A. 7

B. 8

C. 9

D. $\frac{55}{6}$

Answer: C

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80. The sum of the series

$3+8+16+27+41$.............. upto 20 terms is equal to

A. 4230

B. 4430

C. 4330

D. 4500

Answer: B

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81. The greatest integer less than or equal to $\left(\sqrt{2}+1\right)^{6}$ is

A. 196

B. 197

C. 198

D. 199

Answer: B

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82. If $\cos x - \sin x = -\frac{5}{4}$, where $\frac{\pi}{2} < x < \frac{3\pi}{4}$, then $\cot\left(\frac{x}{2}\right)$ is equal to

A. $\frac{4-\sqrt{7}}{9}$

B. 8

C. -8

D. $\frac{4+\sqrt{7}}{9}$

Answer: D

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83. In ΔPQR, the equation of the internal angle bisector of angle Q is y = x and the equation of side PR is $3x - y = 2$. If coordinates of P are (3, 2) and $2PQ = RQ$, then the coordinates of Q are

A. (3, 3)

B. (7, 7)

C. $(-2, -2)$

D. (5, 5)

Answer: B

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84. Let the lines l_1 and l_2 be normals to $y^2 = 4x$ and tangents to $x^2 = -12y$ (where l_1 and l_2 are not x - axis). The absolute value of the difference of slopes of l_1 and l_2 is

A. 3

B. 2

C. 1

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

Answer: C

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85. The value of $\lim_{x \to \infty} \frac{(\ln x)^2}{2 + 3x^2}$ is equal to

A. $\frac{1}{3}$

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

C. 1

D. 0

Answer: D

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86. The value of $\lim_{n \to \infty} \Sigma_{r=1}^{n} \left(\frac{2r}{n^2}\right) e^{\frac{r^2}{n^2}}$ is equal to

A. e

B. 2e

C. $e - 2$

D. $e - 1$

Answer: D

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87. The direction cosines l, m and n of two lines are connected by the relations $l + m + n = 0$ and $lm = 0$, then the angle between the lines is

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

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

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

D. 0

Answer: A

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88. The function $f(x) = x^3 - ax$ has a local minimum at $x = k$, where $k \geq 2$, then a possible value of a is

A. 9

B. 11

C. 13

D. 8

Answer: C

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89. Let two circles having radii r_1 and r_2 are orthogonal to each other. If the length of their common chord is k times the square root of harmonic mean between the squares of their radii, then k^4 is equal to

A. 13

B. 7

C. 4

D. 2

Answer: C

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90. The value of $\int_0^{\frac{\pi}{2}} (\cos 2x \cos 2^2 x \cos 2^3 x \cos 2^4 x) dx$ is equal to

A. 0

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

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

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

Answer: A

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91. Let A be a matrix of order 3×3 such that $|A| = 3$. Let $B = 3A^{-1}$ and $C = \frac{adjA}{2}$, then the value of $|A^2B^3C^4|$ is

A. $\frac{3^{16}}{2^{12}}$

B. $\left(\frac{3}{2}\right)^{12}$

C. $\frac{3^{10}}{2^8}$

D. $\frac{3^{12}}{2^{14}}$

Answer: A

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92. Let

$$\left(\hat{p} \times \overrightarrow{q}\right) \times \hat{p} + \left(\hat{p}. \overrightarrow{q}\right)\overrightarrow{q} = (x^2 + y^2)\overrightarrow{q} + (14 - 4x - 6y)\hat{p}$$

where $\hat{p}$ and $\overrightarrow{q}$ are non - collinear vectors $\hat{p}$ is a unit vector) and x, y are scalars, then the value of $x^2 + y^2$ is equal to

A. 10

B. 11

C. 12

D. 13

Answer: D

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93. If p and q are two statements, then which of the following statement is a tautology

A. $p \Rightarrow (p \vee {\sim}q)$

B. $(p \vee q) \Rightarrow p$

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

D. $p \Leftrightarrow (p \Rightarrow q)$

Answer: A

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94. In an equilateral triangle ABC, equation of the sides BC is $x + y - 2 = 0$ and the centroid of ΔABC is (0, 0). If points A, B and C are in anticlockwise order, then the equation of side AC is

A. $(y + 2) = (2 - \sqrt{3})(x + 2)$

B. $(y+2)=(2+\sqrt{3})(x+2)$

C. $(y+1)=(2+\sqrt{3})(x+1)$

D. $x+2=0$

Answer: B

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95. The minimum distance between the curves $y=\tan x, \forall x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ and $\left(x-2-\frac{\pi}{4}\right)^2+y^2=1$ is

A. $\sqrt{2}-1$

B. $\sqrt{5}-1$

C. $\sqrt{5}+1$

D. 2

Answer: B

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96. A fair die is thrown n number of times. If the probability of always getting a number greater than the previous number is $\frac{5}{54}$, then the value of n is equal to $(n \leq 6)$.

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97. How many 4 letter words can be formed from the word "MATHEMATICS" ?

A. 2500

B. 2454

C. 2400

D. 2254

Answer: B

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98. If $f(x)=\begin{cases}(1+|\sin x|)^{\frac{p}{|\sin x|}} & , -\frac{\pi}{6}<x<0 \\ q & : x=0 \\ e^{\tan 3x \cdot \cot 5x} & : 0<x<\frac{\pi}{6}\end{cases}$ is continuous at x = 0, then the value of $2p+10\ln q$ is equal to

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99. If $f(x)=\sin x, g(x)=\cos x$ and $h(x)=\cos(\cos x)$, then the integral $I=\int f(g(x)).\, f(x).\, h(x)dx$ simplifies to $-\lambda\sin^2(\cos x)+C$ (where, C is the constant of integration). The value of λ is equal to

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100. If numerically greatest term in the expansion of $(3-5x)^{11}$, where $x=\frac{1}{5}$, is 729λ, then the value of $\frac{\lambda}{150}$ is

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101. If a tower subtends equal angles at four points P, Q , R and S that lie in a plane containing the foot of the tower , the which fo the following statements is always true (here, the tower is perpendicular to the plane containing the points P, Q,R,S)

A. $\angle PQS = \angle PRS$

B. $\angle PQR + \angle PSR = 180^\circ$

C. $\angle PQS = 90^\circ \Rightarrow \angle PRS = 90^\circ$

D. $(PQ)(RS) + (PS)(RQ) = (PR)(QS)$

Answer: C

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102. The values of λ for which one root of the equation $x^2 + (1 - 2\lambda)x + (\lambda^2 - \lambda - 2) = 0$ is greater than 3 and the other smaller than 2 are given by

A. $2 < \lambda < 5$

B. $1 < \lambda < 4$

C. $1 < \lambda < 5$

D. $2 < \lambda < 4$

Answer: D

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103. Let a function $f: (2, \infty) \to [0, \infty)$ defined as $f(x) = \dfrac{|x-3|}{|x-2|}$, then f is

A. injective & surjective

B. not injective but surjective

C. injective but not surjective

D. neither injective nor surjective

Answer: B

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104. Let n be a positive integer and a complex number with unit modulus is a solution of the equation $Z^n + Z + 1 = 0$, then the value of n can be

A. 87

B. 97

C. 104

D. 222

Answer: C

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105. The value of $\lim_{x \to 0} \frac{e^{-\left(\frac{x^2}{2}\right)} - \cos x}{x^3 \tan x}$ is equal to

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

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

C. $\frac{1}{12}$

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

Answer: C

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106. The value of $\int \frac{(x-4)}{x^2\sqrt{x-2}}$ dx is equal to (where , C is the constant of integration)

A. $2x\sqrt{x-2}+C$

B. $-\frac{2}{x}\sqrt{x-2}+C$

C. $\frac{\sqrt{x-2}}{x}+C$

D. $\frac{x}{\sqrt{x-2}}+C$

Answer: B

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107. The equation of the curve passing through the point (1,1) and satisfying the differential equation $\frac{dy}{dx}=\frac{x+2y-3}{y-2x+1}$ is

A. $x^2-4xy-y^2+6x+2y-4=0$

B. $x^2+4xy-y^2-6x+2y+4=0$

C. $x^2+4xy-y^2-6x-2y+4=0$

D. $x^2+4xy+y^2-6x-2y-4=0$

Answer: C

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108. Five different games are to be distributed among 4 children randomly. The probability that each child get at least one game is

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

B. $\frac{15}{64}$

C. $\frac{21}{64}$

D. $\frac{17}{632}$

Answer: B

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109. Let the focus S of the parabola $y^2 = 8x$ lies on the focal chord PQ of the same parabola . If PS = 6 , then the square of the slope of the chord PQ is

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

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

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

D. $\frac{9}{4}$

Answer: B

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110. If $p \to (q \vee r)$ is false, then the truth values of p,q,r are respectively

A. TFF

B. FFF

C. FTT

D. TTF

Answer: A

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111. $\frac{5}{3^2 7^2}+\frac{9}{7^2 11^2}+\frac{13}{11^2 15^2}+\ldots.\infty$

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

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

C. $\frac{1}{54}$

D. $\frac{1}{72}$

Answer: D

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112. If $13^{99} - 19^{93}$ is divided by 162, then the remainder is

A. 3

B. 6

C. 5

D. 0

Answer: D

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113. The $\int_0^{\pi/2} sgn\left(\sin^2 x - \sin x + \frac{1}{2}\right)$ dx is equal to , (where , sgn (x) denotes the sigum function of x)

A. 0

B. 1

C. π

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

Answer: D

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114. If $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{a} . \vec{b} = 2$ and $\vec{a} \times \vec{b} = 2\hat{i} - \hat{k}$, then $\vec{b}$ is

A. $\left(\hat{i} - 2\hat{j} + \hat{k}\right)$

B. $\left(4\hat{i} - 4\hat{j} + 2\hat{k}\right)$

C. $\frac{1}{2}\left(3\hat{i} + 7\hat{j} + 9\hat{k}\right)$

D. $\frac{1}{29}\left(7\hat{i} - 4\hat{j} + 14\hat{k}\right)$

Answer: D

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115. Equation of the plane passing through the point of intersection of lines $\frac{x-1}{3} = \frac{y-2}{1} = \frac{z-3}{2} \& \frac{x-3}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ and perpendicular to the line $\frac{x+5}{2} = \frac{y-3}{3} = \frac{z+1}{1}$ is

A. $2x + 3y + z + 7 = 0$

B. $2x - 3y - z + 22 = 0$

C. $2x + 3y + z - 22 = 0$

D. $2x + 3y + z + 13 = 0$

Answer: C

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116. The equation of the tangent to the parabola $y^2 = 4x$ whose slope is positive and which also touches $x^2 + y^2 = \frac{1}{2}$ is

A. y = x + 1

B. y = 2x + 1

C. x + y = 2

D. $y = 4x + \frac{1}{2}$

Answer: A

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117. If A is 2×2 matrix such that $A\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$ and $A^2\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, then trace of A is (where the trace of the matrix is the sum of all principal diagonal elements of the matrix)

A. 1

B. 0

C. 2

D. 5

Answer: A

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118. consider the planes $P_1 : 2x - y + z = 6$ and $P_2 : x + 2y - z = 4$ having normal $\overrightarrow{N}_1$ and $\overrightarrow{N}_2$ respectively . The distance of the origin from the plane passing through the point (1,1,1) and whose normal is perpendicular to N_1 and N_2 is

A. $\frac{7}{\sqrt{5}}$ units

B. $\sqrt{\frac{7}{5}}$ units

C. $\sqrt{\frac{3}{5}}$ units

D. $\frac{14}{\sqrt{35}}$ units

Answer: B

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119. Let $I_1 = \int_0^{\frac{\pi}{2}} \frac{dt}{1+t^6}$ and $I_2 = \int_0^{\frac{\pi}{2}} \frac{x \cos x dx}{1+(x \sin x + \cos x)^6}$, then

A. $2I_1 = I_2$

B. $I_1 = 2I_2$

C. $I_1 = I_2$

D. $I_1 = I_2 = 0$

Answer: C

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120. A wire of length 28 cm is bent to form a circular sector , then the radius (in cm) of the circular sector such that the area of the circular sector is maximum is equal to

A. 5

B. 6

C. 7

D. 8

Answer: C

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121. Let $x^2 + y^2 = r^2$ and $xy = 1$ intersect at $A\&B$ in first quadrant, If $AB = \sqrt{14}$ then find the value of r.

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122. If $f(x) = \left\{\frac{a + b\cos x + c\sin x}{x^2}, , x > 0\right), (9, , x \geq 0)\}$ is continuous at x = 0 , then the value of $\frac{|a| + |b|}{5}$ is

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123. Let p and q be the length of two chords of a circle which subtend angles 36° and 60° respectively at the centre of the circle . Then , the angle (in radian) subtended by the chord of length p + q at the centre of the circle is (use $\pi = 3.1$)

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124. Let $a_r = r^4C_r, b_r = (4-r)^4C_r, A_r = \begin{bmatrix} a_r & 2 \\ 3 & b_r \end{bmatrix}$ and $A = \sum_{r=0}^{4} A_r$ then the value of |A| is equal to

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125. The product of all the values of $|\lambda|$, such that the lines $x + 2y - 3 = 0, 3x - y - 1 = 0$ and $\lambda x + y - 2 = 0$ cannot form a triangle, is equal to

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Maths

1. The integral value of m for which the quadratic equation $(2m-3)x^2 - 4x + 2m - 3 = 0$ has both the roots negative is given by

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2. Let from a point A (h,k) chord of contacts are drawn to the ellipse $x^2 + 2y^2 = 6$ such that all these chords touch the ellipse $x^2 + 4y^2 = 4$, then locus of the point A is

A. $4x^2 + 9y^2 = 36$

B. $x^2 + y^2 = 4$

C. $x^2 - y^2 = 9$

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

Answer: D

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3. If $y(x)$ is the solution of the differential equation $\frac{dy}{dx} = -2x(y-1)$ with $y(0) = 1$, then $\lim_{x \to \infty} y(x)$ equals

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4. $\int \frac{\sin^2 x \cdot \sec^2 x + 2\tan x \cdot \sin^{-1} x \cdot \sqrt{1-x^2}}{\sqrt{1-x^2}(1+\tan^2 x)} dx$

A. $(\sin^{-1} x)(\cos^2 x) + C$

B. $(\sin^{-1} x)(\sin^2 x) + C$

C. $(\cos^{-1} x)(\sin^2 x) + C$

D. $-\sin^{-1} x(\sin^2 x) + C$

Answer: B

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5. The value of $\lim_{x \to 0} \frac{x \cot(4x)}{\tan^2(3x)\cot^2(6x)}$ is equal to

A. 0

B. 4

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

D. 1

Answer: D

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6. If n objects are arrange in a row, then the number of ways of selecting three of these objects so that no two of them are next to each other is

A. $.^{n-3}C_3$

B. $.^{n-3}C_2$

C. $.^{n-2}C_2$

D. $.^{n-2}C_3$

Answer: D

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7. Solve $\sin^{-1}(1-x) - 2s \in^{-1} x = \frac{\pi}{2}$

A. 0

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

C. $0, \frac{1}{2}$

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

Answer: A

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8. If 1 , a, b and 4 are in harmonic progression , then the value of a + b is equal to

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

B. $\frac{10}{3}$

C. $\frac{3}{10}$

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

Answer: B

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9. fractional part of $\frac{2^{78}}{31}$ is:

A. $\frac{2}{31}$

B. $\frac{4}{31}$

C. $\frac{6}{31}$

D. $\frac{8}{31}$

Answer: D

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10. Let f (x) = 10 - |x-5| , $x \in R$, then the set of all values of x at which f (f(x)) is not differentiable is

A. {0,5,10}

B. {5,10}

C. {0,5,10,15}

D. {5,10,15}

Answer: A

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11. If two tangents drawn from the point P (h,k) to the parabola $y^2 = 8x$ are such that the slope of one of the tangent is 3 times the slope of the other , then the locus of point P is

A. $3y^2 = 16x$

B. $3y^2 = 8x$

C. $y^2 = 32x$

D. $3y^2 = 32x$

Answer: D

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12. If $I_1 = \int_{1-x}^{k} x \sin\{x(1-x)\} dx$ and $I_2 = \int_{1-x}^{k} \sin\{x(1-x)\} dx$,

then

A. 2

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

C. 1

D. $\frac{1}{3}$

Answer: B

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13. Let A is a matrix of order 3×3 defined as $A = [a_{ij}] 3 \times 3$, where $a_{ij} = \lim_{x \to 0} \frac{1 - \cos(ix)}{\sin(ix)\tan(jx)} (\forall 1 \leq i, j, \leq 3)$, then A^2 is equal to

A. A

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

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

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

Answer: B

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14. If

$$\left[\left(\vec{a}+2\vec{b}+3\vec{c}\right)\times\left(\vec{b}+2\vec{c}+3\vec{a}\right)\right],.\left(\vec{c}+2\vec{a}+3\vec{b}\right)\right]=54$$

where $\vec{a}$, $\vec{b}$ and $\vec{c}$ are 3 non - coplanar vectors, then the values of $\begin{vmatrix}\vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c}\\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c}\\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c}\end{vmatrix}$ is equal to

A. 9

B. 3

C. 6

D. 12

Answer: A

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15. Let A be the point (1,2,3) and B be a point on the line $\frac{x-1}{-2}=\frac{y+1}{3}=\frac{z-5}{4}=k$ Then value of k such that line AB is perpendicular to the plane $4x+9y-18z=6$ is

A. $-\frac{2}{5}$

B. $\frac{1}{5}$

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

D. no such value of k is possible

Answer: C

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16. Let the circumcentre of ΔABC is S (-1,0) and the midpoints of sides AB and AC are E(1,-2) and F(-2,1) respectively , then the equation of the circumcircle of ΔABC us

A. $(x+1)^2 + y^2 = 5$

B. $(x+1)^2 + y^2 = 10$

C. $(x+1)^2 + y^2 = 15$

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

Answer: B

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17. If p and q are two statements , then which of the following statements is not equivalent to $p \Leftrightarrow (p \Rightarrow q)$?

A. $p \wedge q$

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

C. $(p \Rightarrow q) \Leftrightarrow q$

D. $(-p \Rightarrow q) \wedge (p \vee {\sim}q)$

Answer: D

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18. Let $F(n) = (\sin 1) \times (\sin 2) \times .... \sin(n), \forall \mathrm{n} \in \mathrm{N}$ then number of elements in the set $A = \{f(1), f(2), ..., f(6)\}$ that are positive are

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19. $a, b, c, \in N$ and $d = \begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$, then the least positive value of D is

A. 4

B. 6

C. 3

D. 8

Answer: A

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20. $F: R \rightarrow R, F(x) = \lambda x + \sin x$ is onto if λ is an element of the set P and f (x) is one- one if λ is an element of the set Q, then (given , λ is a real number)

A. P = Q

B. $P \subset Q$

C. $P - Q = \{0\}$

D. $Q \subset P$

Answer: D

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21. Consider circles $C_1 \& C_2$ touching both the axes and passing through (4,4) , then the product of radii of these circles is

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22. If P (z) is a variable point in the complex plane such that IM $\left(-\frac{1}{z}\right)=\frac{1}{4}$, then the value of the perimeter of the locus of P (z) is (use $\pi=3.14$)

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23. The probability of India winning a test match against Australia is $\frac{1}{4}$. Assuming the matches to be independent events , the probability that in a 7 match series India's second win occurs at 4^{th} test is P , then 256 P is equal to

A. 15

B. 12

C. 27

D. 40

Answer: C

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24. The number of solutions of the equation $|\cot x| = \cot x + \text{cosec} x$ in $[0, 10\pi]$ is /are

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25. If α is the only real root of $x^3 + bx^2 + cx + 1 = 0 (b < c)$, then the value of $|[\alpha]|$ is (where,[.] represents the greatest integer function)

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