MATHS

BOOKS - BHARATI BHAWAN MATHS (HINGLISH)

Some New Pattern Problems

Example

1. In the parabola $y^2 = 4x$, the ends of the double ordinate through the focus are P and Q. Let O be the vertex. Then the length of the double ordinate PQ is

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2. Find the equation of tangent to the curve $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ at the point θ

A. $s = 4a \tan \psi$

B. $s = a \cos \psi$

C. $s = a\psi$

D. $s = 4a \sin \psi$

Answer:

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3. Let ABCD be a square of side length 2 units. C2 is the circle through vertices A, B, C, D and C1 is the circle touching all the sides of the square ABCD. L is a line through A. 27. If P is a point on C1 and Q in another point on C2, then 2222 2222 PA PB PC PD QA QB QC QD +++ +++ is equal to (A) 0.75 (B) 1.25 (C) 1 (D) 0.5

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

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

C. 1

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

Answer:

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4. A circle touches the line L and the circle C_1 externally such that both the circles are on the same side of the line, then the locus of centre of the circle is :

A. part of a straight line

B. parabola

C. ellipse

D. hyperbola

Answer:

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5. Let ABCD be a square of side length 2 units. C_2 is the circle through vertices A, B, C, D and C_1 is the circle touching all the sides of the square ABCD. L is a line through A

A line M through A is drawn parallel to BD. Point S moves such that its distances from the line BD and the vertex A are equal. If locus of S cuts. M at T_2 and T_3 and AC at T_1, then area of $\Delta T_1T_2T_3$ is

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

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

C. 1

D. 2

Answer:

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6. Suppose four distinct positive numbers a_1, a_2, a_3, a_4 are in G.P. Let $b_1 = a_1, b_2 = b_1 + a_2, b_3 = b_2 + a_3$ and $b_4 = b_3 + a_4$.

Statement -1 : The numbers b_1, b_2, b_4 are neither in A.P. nor in G.P. and

Statement -2 : The numbers b_1, b_2, b_3, b_4 are in H.P.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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7. Statement-1: The curve $y = \frac{-x^2}{2} + x + 1$ s symmetric with respect to the line x = 1.

Statement -2: A parabola is symmetric about its axis.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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Exercise

1. The envelope of the family of straight lines whose sum of intercepts on the axes is 4 is

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2. The envelope of the family of tangents to the curve $y^2 = x$ is

A. $x + y^2 = 0$

B. $x^2 = y$

C. $x^2 + y = 0$

D. $y^2 - x = 0$

Answer: D

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3. The evolute of the curve $x^2 = 4y$ is

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4. The area bounded by the curve $y = f(x)$ and the lines $x = 0, y = 0$ and $x = t$, lies in the interval

A. $\frac{\frac{d^2}{dx^2}}{\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^{\frac{3}{2}}}\Bigg)$

B. $\left(\frac{\sqrt{1+\left(\frac{dy}{dx}\right)^2}}{d^2\frac{y}{dx^2}}\right)$

C. $\frac{\left(\left\{1+\left(\frac{dy}{dx}\right)^2\right)\right\}^{\frac{3}{2}}}{d^2\frac{y}{dx^2}}\Bigg)$

D. ((d^2y/dx^2)/sqrt(1+(dy/dx)^2)`

Answer:

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5. The radius of curvature of the curve $y^2 = 4x$ at the point $(1, 2)$ is

A. $4\sqrt{2}$

B. $2\sqrt{2}$

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

D. $\sqrt{2}$

Answer: A

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6. If e_1 is the eccentricity of the conic $9x^2 + 4y^2 = 36 \, and \, e_2$ is the eccentricity of the conic $9x^2 - 4y^2 = 36$ then $e12 - e22 = 2$ b. $e22 - e12 = 2$ c. $2 < 322 - 312 < 3$ d. $e22 - e12 > 3$

A. $(0, 2)$

B. $(2, 0)$

C. $(0, 3)$

D. $\left(\sqrt{3}, \left(\frac{3}{2}\right)\right)$

Answer:

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7. $\int_{-\pi/2}^{\pi/2} \sin|x| dx$ is equal to

A. $\left(\frac{\pi}{8}\right)(1+\sqrt{2})$

B. $\left(\frac{\pi}{4}\right)(1+\sqrt{2})$

C. $\frac{\pi}{8\sqrt{2}}$

D. $\frac{\pi}{4\sqrt{2}}$

Answer:

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8. $\int \frac{\sin\left(\frac{1}{x}\right)\cos^3\left(\frac{1}{x}\right)}{x^2} dx$ is equal to

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9. If $f''(x) < 0 \forall x \in (a, b)$ and $(c, f(c))$ is a point lying on the curve $y = f(x)$, where $a < c < b$ and for that value of c, $f(c)$ has a maximum then $f'(c)$ equals

A. $\frac{f(b)-f(a)}{b}-a\Big)$

B. $\frac{2}{b-a}\{f(b)-f(a)\}$

C. $2f(b)-\frac{f(a)}{2}b-a$

D. 0

Answer: D

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10. The family of parabolas with a common vertex at the origin whose foci are on the x-axis and the directrices are parallel to the y-axis can have the equation (a being a parameter)

A. $y^2=3ax$

B. $x^2=4ay$

C. $y^2=4a(x+2)$

D. $(y)^2=4ax$

Answer: D

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11. The orthogonal trajectory of the family of parabolas $y^2 = 4ax$ is

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

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

C. $2x^2 + y^2 = c$

D. $y^2 - x^2 = \, = c^2$

Answer: C

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12. The curve passing through the point $(1, 2)$ that cuts each member of the family of parabolas $y^2 = 4ax$ orthogonally is

A. $2x^2 + y^2 = 6$

B. $x^2 + y^2 = 5$

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

D. $y^2 - x^2 = 3$

Answer: A

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13. The general solution of the equation $\left(\frac{d^3y}{dx^3}\right) - 7\left(\frac{d^2y}{dx^2}\right) + 16\frac{dy}{dx} - 12y = 0$

A. $c_1e^{2x} + c_2e^{-2x} + c_3e^{-3x}$

B. $(c_1 + c_2x)e^{2x} + c_3e^{3x}$

C. $(c_1x + c_2)e^{-3x} + c_3e^{2x}$

D. $(A\cos x + B\sin x)e^{2x} + c_3e^{3x}$

Answer: B

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14. Find the differential equation for which the following value of y is the general solution: $y = (c_1 \cos x + c_2 \sin x)e^{-x} + c_3 e^{x}$

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15. The general solution of the equation $\frac{d^3y}{dx^3} + y = 0$ is

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16. The value of $|U|$ where $U = \begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \end{bmatrix}$

A. 3

B. -3

C. 0

D. 2

Answer: C

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17. show that matrix $A = \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 5A + 2I = 0$

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18. The sum of the elements of the product $[3, 2, 0]$ and $\begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$ is

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19. The rank of matrix $\begin{bmatrix} x & -1 & 0 \\ 0 & x & -1 \\ -1 & 0 & x \end{bmatrix}$ is 2 then value of x is:

A. 3

B. 2

C. 1

D. none of these

Answer: C

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20. One of the eigenvalues of A is where $A = \begin{bmatrix} 2 & 5 \\ 7 & 4 \end{bmatrix}$

A. 1

B. 2

C. -3

D. 3

Answer: C

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21. The denary number 43125 in the scale of 6 will be represented by

A. 353135

B. 531353

C. 515313

D. 55453

Answer: B

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22. The sum of the numbers 2053 and 412 in the scale of seven is

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23. The product of the numbers 5623 and 6 in the scale of eight is

A. 41672

B. 33738

C. 42562

D. 45262

Answer: C

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24. Which of thefollowing is true?

A. $4 = 7(\mod 5)$

B. $118 = 18(\mod 5)$

C. $110 = 93(\mod 12)$

D. $63 = 9(\mod 11)$

Answer: B

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25. Let $a = b(\mod n), a' = b'(\mod n)$ and `d, m in N. Then which of the following need not be true?

A. $a + a' = b + b'(\mod n)$

B. $aa' =$ bb' (mod n)`

C. $a^m = b^m(\mod n)$

D. $\left(\frac{a}{d}\right) \equiv \left(\frac{b}{d}\right)(\mod n)$

Answer: B

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26. If $5x = 3(\mod 7)$ then find x

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27. The value of λ for which the equation $\lambda^2 - 4\lambda + 3 + (\lambda^2 + \lambda - 2)x + 6x^2 - 5x^3 = 0$ will have two roots equal to zero is

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28. The value of (λ, μ) for which $(\lambda - \mu)x^3 - (\lambda - 2)x^2 - 3x + 7 = 0$ will have two infinite roots is

A. $(0, 0)$

B. $(2, 2)$

C. $(1, 1)$

D. $(2, 0)$

Answer: B

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29. The combined equation of asymptotes to the hyperbola $x^2 + 4xy + 3y^2 + 4x - 3y + 1 = 0$ are

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30. $17^{22} - 1$ is a multiple of

A. 16

B. 44

C. 46

D. 27

Answer: A

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31. The highest power of 7 which divides 1000 ! is

A. 164

B. 162

C. 167

D. 142

Answer: A

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32. The equation of conjugate hyperbola of $\frac{x^2}{8} - 3\frac{y^2}{8} = 1$

A. $x^2 - 3y^2 - 2x + 8 = 0$

B. $3x^2 - y^{-2} - 2y - 8 = 0$

C. $x^2 - 3y^2 - 2x + 10 = 0$

D. $x^2 - 3y^2 = -8$

Answer: D

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33. The parabola circumscribing $\triangle ABC$ and passing through the point $(4, 4)$ has the focus

A. $(0, 1)$

B. $(4, 0)$

C. $(1, 0)$

D. $(0, 4)$

Answer: C

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34. The parabola circumscribing $\triangle ABC\{(0, 0), (4, 4), (4, -4)\}$ and passing through the point $(4, 4)$ has the latus rectum

A. 4

B. 1

C. 16

D. 8

Answer: A

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35. If $A=\left(2,\left(3\frac{\sqrt{3}}{2}\right)\right)$ then coordinates of C taken mirror image along x=0 is

A. $\left(-2,\frac{3\sqrt{3}}{2}\right)$

B. $\left(-2-\sqrt{6},\frac{3\sqrt{3}+1}{2\sqrt{2}}\right)$

C. $\left(-2\sqrt{3},\frac{3}{2}\right)$

D. $(0,3)$

Answer: A

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36. If the equation of the diameter AB is $x = y$ then the equation of the conjugate diameter CD will be

A. $9x + 16y = 0$

B. $x + y = 0$

C. $16x + 9y = 0$

D. $9x + 16y = 7$

Answer: B

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37. The equations of the line QR are where $Q(3, 6, 3)$, $R(18, 43, 13)$

A. $\frac{x-12}{15} = \frac{y-22}{37} = \frac{z-4}{10}$

B. $\frac{x-3}{3} = \frac{y-15}{7} = \frac{z-6}{2}$

C. $\frac{x-3}{15} = \frac{y-6}{37} = \frac{z-3}{10}$

D. $\frac{x+3}{3} = \frac{y+6}{7} = \frac{z+3}{3}$

Answer: C

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38. The distance of the centre of the sphere $x^2 + y^2 + z^2 - 2x - 4y = 0$ from the origin is

A. 5

B. $\sqrt{5}$

C. $2\sqrt{5}$

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

Answer: B

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39. The radius of the circle of intersection of the sphere $x^2 + y^2 + z^2 = 9$ by the plane $3x + 4y + 5z = 5$ is

A. $\sqrt{\frac{17}{2}}$

B. 3

C. $\sqrt{34}$

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

Answer: A

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40. The area of the sphere $x^2 + y^2 + z^2 = 25$ is

A. 75π

B. 50π

C. 100π

D. 25π

Answer: C

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41. If $P(u_i))\infty i$, where $i = 1, 2, 3, \ldots, n$then $\lim_{n \to w} P(w)$ is equal to

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

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

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

D. 1

Answer: A

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42. There are n urns each containing $(n+1)$ balls such that the i^{th} urn contains i white balls and $(n+1-i)$ red balls. Let u_i be the event of selecting i^{th} urn, $i = 1, 2, 3, \ldots, n$ and w denotes the event of getting a white balls. If $P(u_i) = c$ where c is a constant, then $P\left(\frac{u_n}{w}\right)$ is equal

A. $\frac{1}{n+1}$

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

C. $\frac{n}{n+1}$

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

Answer: B

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43. The set of values of $p \in R$ for which $x^2 + px + \frac{1}{4}(p+2) \geq 0$ for all $x \in R$ is

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44. The set of values of $p \in R$ for which the equation $x^2 + px + \frac{1}{4}(p+2) = 0$ will have real roots is

A. $[2, +\infty)$

B. $(-\infty, 2]$

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

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

Answer: D

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45. If p is chosen at random from the interval $[0, 6]$ then the probability that the roots of the equation $x^2 + px + \frac{1}{4}(p+2) = 0$ will be real is

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

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

C. $\frac{5}{7}$

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

Answer: C

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46. A bag contain 2 white balls and 1 red balls. The experiment is done 10 times. The probability that a white ball is drawn exactly 5 times is

A. $\frac{10!}{5!5!}\left(\frac{2}{3}\right)^5\left(\frac{1}{3}\right)^5$

B. $\frac{10!}{5!5!}\left(\frac{1}{3}\right)^5$

C. $\frac{10!}{(5!)^2}\left(\frac{2}{9}\right)^5$

D. $\frac{10!}{5!}\left(\frac{2}{9}\right)^5$

Answer: A

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47. A bag contain 2 white balls and 1 red balls. The experiment is done 10 times. The probability that a white ball is drawn exactly 5 times is

A. 7

B. 9

C. 8

D. 5

Answer:

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48. If $n^2 + 2n - 8$ is a prime number where $n \in N$ then n is

A. 0

B. 1

C. 2

D. ∞

Answer:

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49. If z is a complex number, then $|3z - 1| = 3|z - 2|$ represents

A. 25 and 29

B. 30 and 34

C. 35 and 39

D. 40 and 44

Answer:

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50. In Q.no. 88, if z be any point in $A \frown B \frown C$ and ω be any point satisfying $|\omega - 2 - i| < 3$. Then, $|z| - |\omega| + 3$ lies between

A. -6 and 3

B. -3 and 6

C. -6 and 6

D. -3 and 9

Answer:

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51. Which of the following is true?

A. $\left(\frac{2}{=}a\right)^2 \cdot f(1) + (2-a)^2 \cdot f''(-1) = 0$

B. $\left(\frac{2}{=}a\right)^2 \cdot f(1) + (2+a)^2 f''(-1) = 0$

C. f^'(1) f^'(-1)=(2-a)^2`

D. f^'(1) f^'(-1)=-(2+a)^2`

Answer:

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52. Which of the following is true?

A. $f(x)$ is decreasing in $(-1, 1)$ and has a local maximum at $x = 1$

B. $f(x)$ is increasing in (-1,1) and has a local maximum at x=1

C. $f(x)$is increasing in $(-1, 1)$ but has neither a local maximum nor a local minimum at $x = 1$

D. $f(x)$ is decreasing in $(-1, 1)$ but has neither a local maximum nor a local minimum at $x = 1$

Answer:

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53. Consider the function f : $(-\infty, \infty) \to (-\infty, \infty)$ defined by f(x) = $\dfrac{x^2 - ax + 1}{x^2 + ax + 1}, 0 < a < 2$

Let $g(x) = \int_0^{e^x} \dfrac{f'(t)}{1 + t^2}$dt

Which of the following is true ?

A. $g'(x)$ is positive on $(-\infty, 0)$ and negative on $(0, \infty)$

B. $g'(x)$ is negative on $(-\infty, 0)$ and positive on $(0, \infty)$

C. $g'(x)$ is changes sign on both $(-\infty, 0)$ and $(0, \infty)$

D. $g'(x)$ does not change sign on $(-\infty, 0)$

Answer:

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54. Consider the line

$$L1 = \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}$$
$$L2 = \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

The shortest distance between L_1 and L_2 is

A. $\frac{1}{\sqrt{99}}\left(\overrightarrow{-} I + 7\vec{j} + 7\vec{k}\right)$

B. $\frac{1}{5\sqrt{3}}\left(\overrightarrow{-} I - 7\vec{j} + 5\vec{k}\right)$

C. $\frac{1}{5}(\sqrt{3})\left(\overrightarrow{-} I + 7\vec{j} + 5\vec{k}\right)$

D. $\frac{1}{\sqrt{99}}\left(7\vec{i} - 7\vec{j} - \vec{k}\right)$

Answer:

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55. Consider the line

$$L1 = \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}$$
$$L2 = \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

The shortest distance between L_1 and L_2 is

A. 0

B. $\frac{17}{\sqrt{3}}$

C. $\frac{41}{5}\sqrt{3}$

D. $\frac{17}{5\sqrt{3}}$

Answer: D

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56. cosider the lines,

$$L1 = \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+2}{2}$$
$$L2 = \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

The distance of the point $(1, 1, 1)$ from the plane passing through the point $(-1, -2, -1)$ and whose normal is perpendicular to both the lines L_1 and L_2 is

A. $\frac{2}{\sqrt{75}}$

B. $\frac{7}{\sqrt{75}}$

C. $\frac{13}{\sqrt{75}}$

D. $\frac{23}{\sqrt{75}}$

Answer: C

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57. Consider the function defined implicitly by the equation $y^3 - 3y + x = 0$ on various intervals in the real line. If $x \in (-\infty, -2) \cup (2, \infty)$, the equation implicitly defines a unique real-valued defferentiable function $y = f(x)$. If $x \in (-2, 2)$, the equation implicitly defines a unique real-valud diferentiable function $y - g(x)$ satisfying $g_0 = 0$.

If $f(-10\sqrt{2}) = 2\sqrt{2}$, then $f(-10\sqrt{2})$ is equal to

A. $4\frac{\sqrt{2}}{7^3}\cdot 3^2$

B. $4\frac{\sqrt{2}}{7^3}\cdot 3^3$

C. $4\frac{\sqrt{2}}{7^3}\cdot 3$

D. $-4\frac{\sqrt{2}}{7^3}\cdot 3$

Answer:

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58. The area of the region bounded by the curve $y = f(x)$, x-axis, and the lines $x = a$ and $x = b$ where $-\infty < a < b < -2$ is

A.

$$\int_a^b \frac{x}{3\{(f(x))^2 - 1\}}dx + b\,f(b) - a\,f(a)$$

B.

$$\int_a^b \frac{x}{3\{(f(x))^2 - 1\}}dx + b\,f(b) - a\,f(a)$$

C.

$$\int_a^b \frac{x}{3\{(f(x))^2 - 1\}} dx - b f(b) + a f(a)$$

D.

$$\int_a^b \frac{x}{3\{(f(x))^2 - 1\}} dx - b f(b) + a f(a)$$

Answer: A

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59. $\int_{-1}^{1} g'(x) dx =$

A. $2g(-1)$

B. $g(1) - g(-1)$

C. $-2g(1)$

D. $2g(1)$

Answer: B

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60. The equation of the circle C with center at $\left(\sqrt{3}, 1\right)$ is

A. $\left(x - 2\sqrt{3}\right)^2 + (y - 1)^2 = 1$

B. $\left(x - 2\sqrt{3}\right)^2 + \left(y + \frac{1}{2}\right)^2 = 1$

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

D. $\left(x - \sqrt{3}\right)^2 + (y - 1)^2 = 1$

Answer: D

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61. The number of 2 x 2 matrices A such that all entries are either 1 or 0 is

A. 12

B. 6

C. 9

D. 16

Answer: D

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62. Let A be the set of all 3×3 symmetric matrices all of whose either 0 or 1. Five of these entries are 1 and four of them are 0.

The number of matrices A in A for which the system of linear equations

$$A\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

has a unique solution is

A. less than 4

B. atleast 4 but less than 7

C. atleast 7 but less than 10

D. at least 10

Answer:

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63. Let A be the set of all 3×3 symmetric matrices all of whose either 0 or 1. Five of these entries are 1 and four of them are 0.

The number of matrices A in A for which the system of linear equations

$$A\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

is inconsistent is

A. 0

B. more than 2

C. 2

D. 1

Answer:

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64. A fair die is tossed repeatedly until a 6 is obtained. Let X denote the number of tosses required.

The probability that $X = 3$ equals

A. $\frac{25}{216}$

B. $\frac{25}{36}$

C. $\frac{5}{36}$

D. $\frac{125}{216}$

Answer:

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65. A fair die is tossed repeated until a six is obtained. Let X denote the number of tosses required.

The probability that $X \geq 3$ is

A. $\frac{125}{216}$

B. $\frac{25}{216}$

C. $\frac{5}{36}$

D. $\frac{25}{36}$

Answer:

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66. A fair die is tossed repeatedly until a six obtained. Let X denote the number of tosses required.

The conditional probability that $X \geq 6$ given $X > 3$ equals

A. $\frac{125}{216}$

B. $\frac{25}{216}$

C. $\frac{5}{36}$

D. $\frac{25}{36}$

Answer:

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67. Equation of the common tangent to the circle $x^2 + y^2 = 50$ and the parabola $y^2 = 40x$ can be

A. $2x - \sqrt{5}y - 20 =$

B. $2x - \sqrt{5}y + 4 =$

C. $x^2 + y^2 + 24x - 12 = 0$

D. $x^2 + y^2 - 24x - 12 = 0$

Answer:

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68. If the events A and B are mutually exclusive events such that P(A) = $\dfrac{3x+1}{3}$ and P(B) = $\dfrac{1-x}{4}$, then the set of possible real values of x lies in the interval

A. $\left(-\frac{1}{4}, \frac{1}{4}\right)$

B. $\left(11, -\frac{3}{4}\right)$

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

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

Answer:

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69. Let s be the sum of all distinct real roots of f(x) and let $t = \mod(s)$

The area bounded by the curve $y = f(x)$ and the lines $x = 0, y = 0$ and $x = t$, lies in the interval

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

B. $\left(\frac{21}{64}, 11, 16\right)$

C. $(9, 10)$

D. $\left(0, \frac{21}{64}\right)$

Answer: A

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70. Tangents are drawn from the point P(3,4) to be the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ touching the ellipse at A and B . Then the coordinates of A and B are.

A. $(3, 0)$ and $(0, 2)$

B. $\left(-\frac{8}{5}, 2\frac{\sqrt{161}}{15}\right)$ and $\left(-\frac{9}{5}, \frac{8}{5}\right)$

C. $\left(-\frac{8}{5}, 2\frac{\sqrt{161}}{15}\right)$ and $(0, 2)$

D. $(3, 0)$ and $\left(-\frac{9}{5}, \frac{8}{5}\right)$

Answer: D

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71. The tangents are drawn from the point $P(3, 4)$ to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ touching the ellipse at points A and B. The orthocenter of the triangle PAB is

A. $\left(5, \frac{8}{7}\right)$

B. $\left(\frac{7}{5}, \frac{25}{8}\right)$

C. $\left(\frac{11}{5}, \frac{8}{5}\right)$

D. $\left(\frac{8}{25}, \frac{7}{5}\right)$

Answer: C

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72. Tangents are drawn from the point P(3,4) to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ touching the ellipse at the point A and B then the equation of the locus of the point whose distances from the point P and the line AB are equal, is

A. $9x^2 + y^2 - 6xy - 54x - 62y + 241 = 0$

B. $x^2 + 9y^2 + 6xy - 54x + 62y - 241 = 0$

C. $9x^2 + 9y^2 - 6xy - 54x - 62y - 241 = 0$

D. $x^2 + y^2 - 2xy + 27x + 31y - 120 = 0$

Answer: A

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73. Match the following (more than one may match with the same).

(A) $\int_0^{\pi/2} (\sin x)^{\cos x} \cdot \{\cos x \cot x - \log(\sin x)^{\sin x}\} dx$ (p) 1

(B) Area bounded by $-4y^2 = x$ and $x - 1 = -5y^2$ (q) 0

(C) Cosine of the angle of intersection of curves $y = 3^{x-1} \log x$ and $y = x^x - 1$ is (r) $6 \log 2$

(D) $\lim_{x \to \infty} \frac{\left(\int_0^x e^{x^2} dx\right)^2}{\int_0^x e^{2x^2} dx}$ is equal to (s) $\frac{4}{3}$

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74. Match the following (more than one may match with the same).

Normals are drawn at points P, Q and R lying on the parabola $y^2 = 4x$ and they intersect at $(3, 0)$. Then,

(A) Area of ΔPQR	(p) 2
(B) Circumradius of ΔPQR	(q) $\frac{5}{2}$
(C) Centroid of ΔPQR	(r) $\left(\frac{5}{2}, 0\right)$
(D) Circumcentre of ΔPQR	(s) $\left(\frac{2}{3}, 0\right)$

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75. Let $aandb$ be the roots of the equation $x^2 - 10cx - 11d = 0$ and those of $x^2 - 10ax - 11b = 0arec, \cdot\cdot$ then find the value of $a + b + c + \ddot{w}hena \neq b \neq c \neq \cdot\cdot$

A.

B.

C.

D.

Answer:

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76. Complete the following statements.

If $a_n = \frac{3}{4} - \left(\frac{3}{4}\right)^2 + \left(\frac{3}{4}\right)^3 - \ldots + (-1)^{n-1} \cdot \left(\frac{3}{4}\right)^n$ and $b_n = 1 - a_n$ then the smallest natural number n_0, such that $b_n > a_n Vntn > n_0$ is

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77. If f(x) is a twice differentiable function such that f(a)=0, f(b)=2, f(c)=-1,f(d)=2, f(e)=0 where a < b < c < d e, then the minimum number of zeroes of $g(x) = f'(x)^2 + f''(x)f(x)$ in the interval [a, e] is

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78. Consider the planes $3x - 6y - 2z = 15 and 2x + y - 2z = 5.$

Statement 1:The parametric equations of the line intersection of the given planes are $x = 3 + 14t, y = 2t, z = 15t\cdot$ Statement 2: The vector $14\hat{i} + 2\hat{j} + 15\hat{k}$ is parallel to the line of intersection of the given planes.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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79. Let the vectors $\overrightarrow{PQ}, \overrightarrow{QR}, \overrightarrow{RS}, \overrightarrow{ST}, \overrightarrow{TU}$ and $\overrightarrow{UP}$ represent the sides of a regular hexagon.

Statement I:$\overrightarrow{PQ} \times \left(\overrightarrow{RS} + \overrightarrow{ST}\right) \neq \vec{0}$

Statement II: $\overrightarrow{PQ} \times \overrightarrow{RS} = \vec{0}$ and $\overrightarrow{PQ} \times \overrightarrow{RS} = \vec{0}$ and $\overrightarrow{PQ} \times \overrightarrow{ST} \neq \vec{0}$

For the following question, choose the correct answer from the codes (A), (B) , (C) and (D) defined as follows:

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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80. Tangents are drawn from the point (17, 7) to the circle $x^2 + y^2 = 169$, Statement I The tangents are mutually perpendicular Statement, lls The locus of the points frorn which mutually perpendicular tangents can be drawn to the given circle is $x^2 + y^2 = 338$ (a) Statement I is correct, Statement II is correct; Statement II is a correct explanation for Statementl (b(Statement I is correct, Statement I| is correct Statement II is not a correct explanation for Statementl (c)Statement I is correct, Statement II is incorrect (d) Statement I is incorrect, Statement II is correct

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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81. The lines $L_1 : y - x = 0$ and $L_2 : 2x + y = 0$ intersect the line $L_3 : y + 2 = 0$ at P and Q respectively . The bisectors of the acute angle between L_1 and L_2 intersect L_3 at R .

Statement 1 : The ratio PR : RQ equals $2\sqrt{2} : \sqrt{5}$

Statement - 2 : In any triangle , bisector of an angle divides the triangle into two similar triangles .

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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82. Let C be the locus of a point the sum of whose distances from the points $S(\sqrt{3}, 0)$ and $S'(-\sqrt{3}, 0)$ is 4.

Statement-1: The curve C cuts off intercept $2\sqrt{3}$ from the line 2y-1=0

Statement-2: The equation of the centre C is $x^2 + 8y^2 = 5$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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83. Let F(x) be an indefinite integral of $\sin^2 x$

Statement I The function F(x) satisfies $F(x+\pi) = F(x)$ for all real x.

Because

Statement II $\sin^2(x+\pi) = \sin^2 x,$ for all real x.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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84. let $f(x) = 2 + \cos x$ for all real x Statement 1: For each real t, there exists a pointc in $[t, t + \pi]$ such that $f'(c) = 0$ Because statement 2: $f(t) = f(t + 2\pi)$ for each real t

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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85. Assertion- Reason Type Question:

STATEMENT -1: $1 \cdot 3 \cdot 5 \cdot \ldots \cdot (2n - 1) > n^n, n \in N$ because

STATEMENT -2: the sum of the first n natural numbers is equal to n^2.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is False

Answer: D

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86. Let $(1+x)^{36} = a_0 + a_1 x + a_2 x^2 + \dots + a_{36} x^{36}$. Then

Statememt-1: $a_0 + a_3 + a_6 + \dots + a_{36} = \frac{2}{3}(2^{36} + 1)$

Statement-2: $a_0 + a_2 + a_4 + \dots + a_{36} = 2^{35}$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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87. The vlaue of $\dfrac{(5050)\int_0^1 \left(1-x^{50}\right)^{100} dx}{\int_0^1 \left(1-x^{50}\right)^{100} dx}$, is

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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88. In $!ABC$ it is given that a:b:c = cos A:cos B:cos C

Statement-1: $!ABC$ is equilateral.

Statement-2: cosA

$$= \frac{b^2 + c^2 - a^2}{2bc}, \cos B = \frac{c^2 + a^2 - b^2}{2ac}, \cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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89. Let $H_1, H_2, \ldots, H_n$ be mutually exclusive events with $P(H_i) > 0, i = 1, 2, \ldots\ldots\ldots n.$ Let E be any other event with $0 < P(E)$

Statement I $P(H_i \mid E) > P(E \mid H_i. P(H_i)$ for $i = 1, 2, \ldots\ldots, n$

statement II $\sum_{i=1}^{n} P(H_i) = 1$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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90. Let $A and B$ b e two independent events. Statement 1: If $(A) = 0.3 and P(A \cup B) = 0.8, then P(B)$ is 2/7. Statement 2: $P(E) = 1 - P(E), where E$ is any event.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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91. The equations of two straight lines are

$$\frac{x-1}{2}=\frac{y+3}{1}=\frac{z-2}{-3} \text{ and } \frac{x-2}{1}=\frac{y-1}{-3}=\frac{z+3}{2}$$

Statement 1: The given lines are coplanar.

Statement 2: The equations

$2r - s = 1$

$r + 3s = 4$

$3r + 2s = 5$

are consistent.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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92. Assertion- Reason Type Question:

Let $I_n = \int_0^{\pi/4} \tan^n x\, dx$, where $n \in N$.

STATEMENT-1: $\int_0^{\pi/4} \tan^4 x\, dx = \frac{3\pi - 8}{12}$.

because

STATEMENT-2: $I_n + I_{n-2} = \frac{1}{n-1}$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

93. Statement-1: The cubic equation $4x^3 - 15x^2 + 14x - 5 = 0$ has a root in the internal (2, 3).

Statement-2: If f(x) is a polynomial equation which has two real roots $\alpha, \beta(\alpha < \beta)$, then f(x) = 0 will have a root $\gamma sucht\hat{}$alpha lt gamma lt beta`.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

94. Consider, $L_1 : 2x + 3y + p - 3 = 0$, $L_2 : 2x + 3y + p + 3 = 0$, where p is a real number, and $C : x^2 + y^2 + 6x - 10y + 30 = 0$

Statement-I : If line L_1 is a chord of circle C, then line L_2 is not always a diameter of circle C.

and

Statement-II : If line L_1 is a diameter of circle C, then line L_2 is not a chord of circle C.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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95. Let a,b,c,p,q be the real numbers. Suppose α, β are the roots of the equation $x^2 + px + q = 0$ and $\alpha, \frac{\beta}{2}$ are the roots of the equation $ax^2 + bx + c = 0$ where $\beta^2 \notin \{-1, 0, 1\}$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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96. For the following question, choose the correct answer from the codes (a),(b),(c) and (d) follows

Let a solution y=y(x) of the differential equation $x\sqrt{x^2-1}dy - y\sqrt{y^2-1}dx = 0$ satisfy y(2)=$\frac{2}{\sqrt{3}}$

Statement I y(x) = sec $\left(\sec^{-1}x - \frac{\pi}{6}\right)$ and

Statement II y(x) is given by $\frac{1}{2} = \frac{2\sqrt{3}}{x} - \sqrt{1-\frac{1}{x^2}}$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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97. Consider three planes $P_1 : x - y + z = 1, P_2 : x + y - z = -1, P_3, x - 3y + 3z = 2$ Let

L_1, L_2, L_3 be the lines of intersection of the planes P_2 and P_3 and $P-1, P_1$ and P_2, respectively.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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98. Consider the system of equations

x-2y+3z=-1

-x+y-2z=k

x-3y+4z=1

Statement -1 The system of equation has no solutions for $k \neq 3$.

statement -2 The determinant $\begin{vmatrix} 1 & 3 & -1 \\ -1 & -2 & k \\ 1 & 4 & 1 \end{vmatrix} \neq 0$, for $\quad k \neq 3$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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99. Consider the system of equations ax + by = 0; cx + dy = 0, where $a, b, c, d \in \{0, 1\}$)STATEMENT-1: The probability that the system of equations has a unique solution is 3/8 STATEMENT-2: The probability that the system of equations has a solution is 1

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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100. Let f and g be real valued functions defined on interval $(-1, 1)$ such that $g(x)$ is continuous, $g(0) \neq 0$, $g'(0) = 0$, $g(0) \neq 0$, and $f(x) = g(x)\sin x$. Statement-1 : $(\text{Lim})_{x \to 0}[g(x)\cot x - g(0)\text{c o s e c}x] = f(0)$ and Statement-2 : $f'(0) = g(0)$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statemcnt-2 is True, Statement-2 is Not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer:

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101. Match the integrals in Column I with the values in Column II and indicate your answer by darkening the apporpriate bubbles in the 4×4

matrix.

Column I	Column II
(A) $\int_{-1}^{1} \frac{dx}{1+x^2}$	(p) $\frac{1}{2}\log\left(\frac{2}{3}\right)$
(B) $\int_{0}^{1} \frac{dx}{\sqrt{1-x^2}}$	(q) $2\log\left(\frac{2}{3}\right)$
(C) $\int_{2}^{3} \frac{dx}{1-x^2}$	(r) $\frac{\pi}{3}$
(D) $\int_{1}^{2} \frac{dx}{x\sqrt{x^2-1}}$	(s) $\frac{\pi}{2}$

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102. In the following $[x]$ denotes the greatest integer less than for equal to x. Match the functions in Column I with the properties in Column II and indicate your answer by darkening the appropriate bubles in the 4×4

matrix.

Column I	Column II
(A) $x\|x\|$	(p) continuous in (–1, 1)
(B) $\sqrt{\|x\|}$	(q) differentiable in (–1, 1)
(C) $x+\|x\|$	(r) strictly increasing in (–1, 1)
(D) $\|x-1\|+\|x+1\|$	(s) not differentiable at least at one point in (–1, 1)

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103. Match the statement in Column I with the properties in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix.

Column I	Column II
(A) Two intersecting circles	(p) have a common tangent
(B) Two mutually external circles	(q) have a common normal
(C) Two circles, one strictly inside the other	(r) do not have a common tangent
(D) Two branches of a hyperbola	(s) do not have a common normal

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104. Consider the following linear equations

$ax + by + cz = 0, bx + cy + az = 0, cx + ay + bz = 0. Matchthestateme$

$\propto riatebu \leq s \in the$

4 xx 4` matrix given in the ORS.

Column I	Column II
(A) $a + b + c \neq 0$ and $a^2 + b^2 + c^2 = ab + bc + ca$	(p) the equations represent planes meeting only at a single point.
(B) $a + b + c = 0$ and $a^2 + b^2 + c^2 \neq ab + bc + ca$	(q) the equations represent the line $x = y = z$.
(C) $a + b + c \neq 0$ and $a^2 + b^2 + c^2 \neq ab + bc + ca$	(r) the equations represent identical planes.
(D) $a + b + c = 0$ and $a^2 + b^2 + c^2 = ab + bc + ca$	(s) the equations represent the whole of the three dimensional space.

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105. Let (x, y) be such that $\sin_{-1}(ax) + \cos^{-1}(y) + \cos^{-1}(bxy) = \frac{\pi}{2}$

Match the statement in Column I with the properties in Column II and

indicate your answer by darkening the appropriate bubbles in the 4×4

matrix.

Column I	Column II
(A) If $a = 1$ and $b = 0$ then (x, y)	(p) lies on the circle $x^2 + y^2 = 1$
(B) If $a = 1$ and $b = 1$ then (x, y)	(q) lies on $(x^2 - 1)(y^2 - 1) = 0$
(C) If $a = 1$ and $b = 2$ then (x, y)	(r) lies on $y = x$
(D) If $a = 2$ and $b = 2$ then (x, y)	(s) lies on $(4x^2 - 1)(y^2 - 1) = 0$

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106. Let $f(x) = \dfrac{x^2 - 6x + 5}{x^2 - 5x + 6}$ Match the statement in Column I with the properties in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix.

Column I	Column II
(A) If $-1 < x < 1$ then $f(x)$ satisfies	(p) $0 < f(x) < 1$
(B) If $1 < x < 2$ then $f(x)$ satisfies	(q) $f(x) < 0$
(C) If $3 < x < 5$ then $f(x)$ satisfies	(r) $f(x) > 0$
(D) If $x > 5$ then $f(x)$ satisfies	(s) $f(x) < 1$

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107. Consider the lines give by

$L_1 : x + 3y - 5 = 0,\ L_2 : 3x - ky - 1 = 0,\ L_3 : 5x + 2y - 12 = 0$

Column I	Column II
(A) L_1, L_2, L_3 are concurrent, if	(p) $k = -9$
(B) One of L_1, L_2, L_3 is parallel to at least one of the other two, if	(q) $k = -6/5$
(C) L_1, L_2, L_3 form a triangle, if	(r) $k = 5/6$
(D) L_1, L_2, L_3 do not form a triangle, if	(s) $k = 5$

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108. Consider all possible permulations of letter of the word ENDEANOEL.

`

Column I	Column II
(A) The number of permutations containing the word ENDEA is	(p) 5!
(B) The number of permutations in which the letter E occurs in the first and the last positions is	(q) 2 (5!)
(C) The number of permutations in which none of the letters D, L, N occurs in the last five position	(r) 7 (5!)
(D) The number of permutations in which the letters A, E, O occur only in odd positions is	(s) 21 (5!)

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109. `

Column I	Column II
(A) The minimum positive value of $\frac{x^2+2x+4}{x+2}$, $x \in R$ is	(p) 0
(B) Let A and B be 3×3 matrices of real numbers, where A is symmetric, B is skew-symmetric and $(A+B)(A-B) = (A-B)(A+B)$. If $(AB)^T = (-1)^K AB$, where $(AB)^T$ is the transpose of AB then the possible values of k are	(q) 1
(C) Let $a = \log_3 \log_3 2$. An integer k satisfying $1 < 2^{-k+3^{-a}} < 2$, must be less than	(r) 2
(D) If $\sin\theta = \cos\varphi$, then the possible values of $\frac{1}{\pi}\left(\theta \pm \varphi - \frac{\pi}{2}\right)$ are	(s) 3

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110. Match the statements/expressions given in Column I with the values given in Column II. `

Column I	Column II
(A) Root (s) of the equation $2\sin^2\theta + \sin^2 2\theta = 2$	(p) $\pi/6$
(B) Points of discontinuity of $f(x) = \left[\frac{6x}{\pi}\right]\cos\left[\frac{3x}{\pi}\right]$, where $[y]$ = greatest integer less than or equal to y	(q) $\pi/4$
(C) The volume of the parallelopiped with edges represented by the vectors $\vec{i}+\vec{j}$, $\vec{i}+2\vec{j}$ and $\vec{i}+\vec{j}+\pi\vec{k}$	(r) $\pi/3$
	(s) $\pi/2$
(D) The angle between vectors $\vec{a}$ and $\vec{b}$; where $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $\vec{a}+\vec{b}+\sqrt{3}\,\vec{c}=\vec{0}$	(t) π

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111. Match the statements/expressions given in Column I with the values given in Column II.`

Column I	Column II
(A) The number of solutions of the equation $xe^{\sin x} - \cos x = 0$ in the interval $\left(0, \frac{\pi}{2}\right)$	(p) 1
(B) The value(s) of k for which the planes $kx + 4y + z = 0$, $4x + ky + 2z = 0$ and $2x + 2y + z = 0$ intersect in a straight line	(q) 2
	(r) 3
(C) The value(s) of k for which $\lvert x+1\rvert + \lvert x-2\rvert + \lvert x+1\rvert + \lvert x+2\rvert = 4k$ has integral solution(s)	(s) 4
(D) If $y' = y + 1$ and $y(0) = 1$ then value(s) of $y(\log_e 2)$	(t) 5

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112. Match the statements/expressions given in Column I with the values given in Column II.`

Column I	Column II
(A) The interval contained in the domain of definition of nonzero solutions of the differential equation $(x-3)^2 \cdot y' + y = 0$	(p) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
	(q) $\left(0, \frac{\pi}{2}\right)$
(B) The interval containing the value of the interval $\int_1^5 (x-1)(x-2)(x-3)(x-4)(x-5)\,dx$	(r) $\left(\frac{\pi}{8}, \frac{5\pi}{4}\right)$
(C) The interval in which at least one of the points of local maximum of $\cos^2 x + \sin x$ lies	(s) $\left(0, \frac{\pi}{8}\right)$
(D) The interval in which $\tan^{-1}(\sin x + \cos x)$ is increasing	(t) $(-\pi, \pi)$

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113. Match the statements/expressions given in Column I with the values given in Column II.`

Column I	Column II
(A) Circle	(p) The locus of the point (h, k) for which the line $hx + ky = 1$ touches the circle $x^2 + y^2 = 4$
(B) Parabola	(q) Points z in the complex plane satisfying $\lvert z+2\rvert - \lvert z-2\rvert = \pm 3$
	(r) Points of the conic have parametric representation $x = \sqrt{3}\left(\frac{1-t^2}{1+t^2}\right), y = \frac{2t}{1+t^2}$
(C) Ellipse	(s) The eccentricity of the conic lies in the interval $1 \le x < \infty$
(D) Hyperbola	(t) Points z in the complex plane satisfying $\text{Re}\,(z+1)^2 = \lvert z\rvert^2 + 1$

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114. Match the statements/expressions given in Column I with the values given in Column II. '

Column I	Column II
(A) A line from the origin meets the lines $\frac{x-2}{1}=\frac{y-1}{-2}=\frac{z+1}{1}$ and $\frac{x-\frac{8}{3}}{2}=\frac{y+3}{-1}=\frac{z-1}{1}$ at P and Q respectively. If the length $PQ=d$ then d^2 is	(p) -4 (q) 0
(B) The values of x satisfying $\tan^{-1}(x+3)-\tan^{-1}(x-3)=\sin^{-1}\left(\frac{3}{5}\right)$ are	(r) 4
(C) Nonzero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ satisfy $\vec{a}\cdot\vec{b}=0$, $(\vec{b}-\vec{a})\cdot(\vec{b}+\vec{c})=0$ and $2\lvert\vec{b}+\vec{c}\rvert=\vec{b}-\vec{a}$. If $\vec{a}=\mu\vec{b}+4\vec{c}$ then the possible values of μ are	(s) 5
(D) Let f be the function on $[-\pi,\pi]$ given by $f(0)=9$ and $f(x)=\frac{\sin\frac{9}{2}x}{\sin\frac{1}{2}x}$ for $x\neq 0$. The value of $\frac{2}{\pi}\int_{-\pi}^{\pi} f(x)\,dx$ is	(t) 6

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115. Let (x, y, z) be points with integer coordinates satisfying the system of homogeneous equations3x-y-z 0-3x + z = 0-3x+2y + z = 0.Then find the number of such points for which$x+y+z\leq 100$.

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116. Let $ABCandABC'$ be two non-congruent triangles with sides $AB=4, AC=AC'=2\sqrt{2}$ and angle $B=30^0$. The absolute value of the difference between the areas of these triangles is

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117. The centres of two circles C_1 and C_2, each of unit radius are at a distance of 6 units from each other. Let P be the mid point of the line segment joining the centres of C_1 and C_2, and C be a circle touching circles C_1 and C_2 externally. If a common tangent to C_1 and C passing through P is also a common tangent to C_2 and C. then the radius of the circle C is.

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118. Let $p(x)$ be a polynomial of degree 4 having extremum at $x = 1, 2$ and $\lim_{x \to 0}\left(1 + \frac{p(x)}{x^2}\right) = 2$. Then find the value of $p(2)$.

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119. The maximum value of the function $f(x) = 2x^3 - 15x^2 + 36x - 48$ on the set $a = \{x \mid x^2 + 20 \leq 9x\}$ is

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120. If the function $f(x) = x^3 + e^{x/2}$ and $g(x) = f^{-1}(x)$, then the value of $g'(1)$ is

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121. Let $f: R \to R$ be a continous function which satisfies $f(x) = \int_0^x f(t)dt$. Then , the value of $f(\ln 5)$ is _____.

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122. The smallest value of k for which both the roots of the equation $x^2 - 8kx + 16(k^2 - k + 1) = 0$ are real, distinct and have values at least 4, is............

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123. Let w be the complex number $\frac{\cos(2\pi)}{3} + \frac{\sin(2\pi)}{3}$. Then the number of distinct complex numbers z satisfying $\begin{vmatrix} z+1 & w & w^2 \\ 2 & z+w^2 & 1 \\ w^2 & 1 & z+w \end{vmatrix} = 0$ is equal

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124. Let $s_k, k = 1, 2, 3, \ldots, 100$ denote the sum of the infinite geometric series whose first term is $\frac{k-1}{\lfloor k}$ and the common ratio is $\frac{1}{k}$. Then, the value of

$$\frac{100^2}{\lfloor 100} + \sum_{k=2}^{100} |(k^2 - 3k + 1)S_k| \text{ is}$$

is

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125. The number of all possible values of θ, where $0 < \theta < \pi$, for which the system of equations $(y+z)\cos 3\theta = (xyz)\sin 3\theta$, $x \sin 3\theta = \frac{2\cos 3\theta}{y} + \frac{2\sin 3\theta}{z}$ and $(xyz)\sin 3$

have a solution (x_0, y_0, z_0) wiith $y_0 z_0 \neq 0$ is

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126. The number of values of θ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ such that $\theta \neq \frac{n\pi}{5}$ for $\text{n} = 0, \pm 1, \pm 2$ and $\tan\theta = \cot 5\theta$ as well as $\sin 2\theta = \cos 4\theta$

, is

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127. The maximum value of the expression $\dfrac{1}{\sin^2\theta + 3\sin\theta\cos\theta + 5\cos^2\theta}$

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128. The line $2x + y = 1$ is tangent to the hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$. If this line passes through the point of intersection of the nearest directrix and the x-axis, then the eccentricity of the hyperbola is

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129. If $\vec{a}$ and $\vec{b}$ are vectors in space given by $\vec{a} = \dfrac{\hat{i} - 2\vec{j}}{\sqrt{5}}$ and $\vec{b} = \dfrac{2\hat{i} + \hat{j} + 3\hat{k}}{\sqrt{14}}$ then the value of $\left(2\vec{a} + \vec{b}\right)$ is

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130. Lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ lie on the plane

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131. Let f be a real-valued differentiable function on R (the set of all real numbers) such that $f(1)=1$. If the $y- \in tercept$ of the tangent at any point $P(x, y)$ on the curve $y=f(x)$ is equal to the cube of the abscissa of P, then the value of $f(-3)$ is equal to_______

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132. For any real number x, let $[x]$= largest integer less than or equalto x. Let f be a real valued function defined on the interval$[-10, 10]$ by

$$f(x)=\begin{cases} x-[x] & \text{if}[x] \text{ is odd} \\ 1+[x]-x & \text{if}[x] \text{ is even} \end{cases}$$

Then, the value of $\left(\frac{\pi}{10}\right)^2\left(\int_{-10}^{10} f(x)\cos \pi x dx\right.$ is

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133. Le $a_1, a_2, a_3, , a_{11}$ be real numbers satisfying $a_2 = 15, 27 - 2a_2 > 0 and a_k = 2a_{k-1} - a_{k-2}$ for $k = 3, 4, , 11.$ If $\frac{a12 + a22 + \ldots + a112}{11} = 90,$ then the value of $\frac{a1 + a2 + \ + a11}{11}$ is equals to ______.

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134. Two parallel chords of a circle of radius 2 are at a distance $\sqrt{3} + 1$ apart. If the chords subtend at the centre, Angles of $\frac{\pi}{k}$ and $2\frac{\pi}{k}$, where k > 0 then the value of [k] is :

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135. Consider a triangle ABC and let a , b , and c denote the lengths of the sides opposite to vertices A , B and C respectively. suppose a = 6 , b = 10 and the area of the triangle is $15\sqrt{3}$. If $\angle ACB$ is obtuse and if r denotes the radius of the in circle of the triangle , then r^2 is equal to

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136. Let K be a positive real number and $A = \begin{bmatrix}2k - 1 & 2\sqrt{k} & 2\sqrt{k} \\ 2\sqrt{k} & 1 & -2k \\ -2\sqrt{k} & 2k & -1\end{bmatrix} and B = \begin{bmatrix}0 & 2k - 1 & \sqrt{k} \\ 1 - 2k\end{bmatrix}$

. If det $(adj A) + \det(adj B) = 10^6, then [k]$ is equal to. [Note: $adj M$ denotes the adjoint of a square matix M and $[k]$ denotes the largest integer less than or equal to K].

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137. Let f be a function defined on R (the set of all real numbers) such that $f'(x) = 2010(x - 2009)(x - 2010)^2(x - 2011)^3(x - 2012)^4$, for all $x \in R$. If g is a function defined on R with values in the interval $(0, \infty)$ such that $f(x) = \ln(g(x))$, for all $x \in R$, then the number of point is R at which g has a local maximum is ___

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