

QUESTION 1

The sum of the squares of two numbers is 58. The numbers differ by the positive solution to $\log_2(x^2 + 9) = 2$. Find the two pairs of numbers.

QUESTION 2

Write the equation of the line in standard form ($Ax + By = C$, where A, B, and C are relatively prime), if the line is perpendicular to the line $6x - 3y = 7$ and the line contains the intersection of $y - 3x = 2$ and $2x + 5y = -7$.

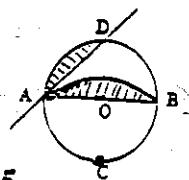
QUESTION 3

Find the sum of the squares of the complex solutions for x in the following determinant:

$$\begin{vmatrix} 2x & 2x & 4 \\ -2 & x & 1 \\ 5 & 2 & x \end{vmatrix} = 0$$

QUESTION 4

Given: AB is a diameter of circle O with radius r. C is a point on circle O. The circle with center C contains arc AB. AD is a tangent to circle C at A. Find the sum of the areas of the two shaded regions.



QUESTION 5

Suppose f is a function such that $(f \circ f)(x) = 2x^2 - 10x + 8$. Find all of the values of x such that $(f \circ f)(x) = 0$.

QUESTION 6

The x intercepts of $f(x) = 8x^4 - 56x^3 - 113x^2 - 70x + 8$ are p, q, r, and s. Find the value of $\log_p - \log_q - \log_r + \log_s$.

QUESTION 7

- A = area of: $x^2 + y^2 - 16x + 12y - 4 = 0$
- B = area of triangle ABC with vertices A(-1, 3), B(4, -2) and C(2, -4)
- C = $|6 - 4i|$
- D = the sum of the coefficients of $(x - 3y)^6$

Find $ABCD^{-1}$

QUESTION 8

An ant starts at the origin and walks 3 units up a course parallel to the line $y = 3x + 5$ and stops. At this time what is the minimum distance between the ant and the x-axis?

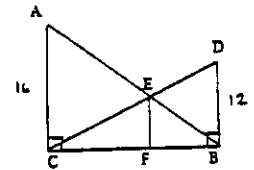
QUESTION 9

$$A = \begin{bmatrix} -1 & 3 \\ 1 & 2 \end{bmatrix} \quad B = \begin{bmatrix} i^2 & i^2 \\ i^2 & 2i^2 \end{bmatrix}$$

Matrix $C = AB^{-1}$. Find the entry c_{12} in a + bi form.

QUESTION 10

- A = the number of arrangements of 4 girls and 4 boys seated alternately (boy/girl or girl/boy) in a row.
- B = the coefficient of the 7th term of the expansion of $(3a - b)^9$
- C = the minimum value of the function f when $f(x) = x^2 - 4x + 7$
- D = the length of the segment EF in the diagram below



Find $AC(BD)^{-1}$

QUESTION 11

A ball is dropped from a building 90 feet tall. If on each bounce the ball rebounds to 75% of the height of the previous bounce, how far does the ball travel?

QUESTION 12

Jeff took a trip by car and then by train. He drove 30 miles by car to a train station. In all, he traveled 120 miles. The average rate of the train was 20 miles per hour faster than the average rate of the car. He made the entire trip in two hours. Exactly, how fast did he travel by car?

QUESTION 13

A point moves so that the sum of its distances from $(-2, -7)$ and $(-2, 9)$ is 24. Find the equation of its locus.

QUESTION 14

Find the midpoint of the line segment AB where:

- Point A is the focus of the parabola $y = 3x^2 - 18x + 20$, and
- Point B is the left-most x-intercept of the curve $y = 6x^3 + 17x^2 + 4x - 12$.

QUESTION 15

Consider the given figure. If triangle ABC is isosceles, then what are the possible values of the measure of angle ABC?

