

PROBLEMS

Problem 1: Find the distance between the parallel lines $2x - 3y = 12$ and $2x - 3y = 36$.

Problem 2: What is the shortest distance between the circle $x^2 + y^2 = 25$ and the line $3x + 4y = 48$?

Problem 3: Find the positive integer m if the line $13x + 11y = 145$ intersects $y = mx - 1$ in a lattice point (whose coordinates are integers).

Problem 4: (NC Math Contest) Let P be the point $(3,2)$. Let Q be the reflection of P about the x -axis, let R be the reflection of Q about the line $y = -x$ and let S be the reflection of R through the origin. Then $PQRS$ is a convex quadrilateral. What is the area of $PQRS$?

- (a) 14 (b) 15 (c) 16 (d) 17 (e) 18

Problem 5: Line 1 (l_1) $x - 2y + 3 = 0$ intersects the x -axis at A . Line 2 (l_2) is obtained by rotating l_1 45° about A . If the rotation is counterclockwise, find the equation for l_2 .

Problem 6: Find the equation of the line passing through $p(1, 2)$ and the length of its segment cut between two lines $4x + 3y + 1 = 0$ and $4x + 3y + 6 = 0$ is $\sqrt{2}$.

Problem 7: Find the image of line $x - y - 2 = 0$ under the reflection in line $3x - y + 3 = 0$.

Problem 8: Find the greatest possible value of $g(x) = \left| \sqrt{x^2 - 2x + 5} - \sqrt{x^2 - 4x + 13} \right|$.

Problem 9: A line segment is between two lines: $l_1 : x - 3y + 10 = 0$ and

$l_2: 2x + y - 8 = 0$. The midpoint of the segment is $P(0, 1)$. Find the equation of the line containing the segment.

Problem 10: Find a if the distance between line $l_1: 2x + 3y - 6 = 0$ and line $l_2: 4x + 6y + a = 0$ is $\frac{5\sqrt{13}}{26}$.

Problem 11: Quadrilateral $ABCD$ is in the first quadrant with the coordinates $A = (4, 10)$, $B = (2, 2)$, $C = (6, 4)$, and $D = (s, t)$. A new quadrilateral is formed by connecting the midpoints of AB , BC , CD , DA . Find the value of $s + t$ if the new quadrilateral is a square.

Problem 12: The point $P = (1, 2, 5)$ is reflected in the xy -plane, then its image Q is rotated by 180° about the x -axis to produce R , and finally, R is translated by 5 units in the positive- y direction to produce S . What are the coordinates of S ?

(A) $(1, 7, -5)$ (B) $(-1, 7, -5)$ (C) $(-1, -2, 8)$ (D) $(-1, 3, 5)$ (E) $(1, 3, 5)$

Problem 13: (AIME) A triangle has vertices $P = (-8, 5)$, $Q = (-15, -19)$ and $R = (1, -7)$. The equation of the bisector of $\angle P$ can be written in the form $ax + 2y + c = 0$. Find $a + c$.