

## Problem 25

Let  $\mathcal{S}$  be a square of side length 1. Two points are chosen independently at random on the sides of  $\mathcal{S}$ . The probability that the straight-line distance between the points is at least  $\frac{1}{2}$  is  $\frac{2-bc}{c}$ , where  $\mathbf{a}$ ,  $\mathbf{b}$ , and  $\mathbf{c}$  are positive integers with  $\gcd(a, b, c) = 1$ . What is  $\mathbf{a} + \mathbf{b} + \mathbf{c}^2$

- (A) 59
  - (B) 60
  - (C) 61
  - (D) 62
  - (E) 63
- 156

Problem 19

In  $\triangle ABC$ .  $\angle C = 90^\circ$  and  $AB = 12$ . Squares  $ABXY$  and  $ACWZ$  are constructed outside of the triangle. The points  $X, Y, Z$ , and  $W$  lie on a circle. What is the perimeter of the triangle?

- (A)  $12 + 9\sqrt{3}$
- (B)  $18 + 6\sqrt{3}$
- (C)  $12 + 12\sqrt{2}$
- (D) 30     (E) 32

Problem 22

In the figure shown below,  $ABCDE$  is a regular pentagon and  $AG = 1$ . What is  $FG + JH + CD$ ?

- (A) 3
- (B)  $12 - 4\sqrt{5}$
- (C)  $\frac{5+2\sqrt{5}}{3}$
- (D)  $1 + \sqrt{5}$
- (E)  $\frac{11+11\sqrt{5}}{10}$

16a

Problem 16

A triangle with vertices  $A(0, 2)$ ,  $B(-3, 2)$  and  $C(-3, 0)$  is reflected about the  $\mathcal{X}$ -axis, then the image  $\triangle A'B'C'$  is rotated counterclockwise about the origin by  $90^\circ$  to produce  $\triangle A''B''C''$ . Which of the following transformations will return  $\triangle A''B''C''$  to  $\triangle ABC$ ?

- (A) counterclockwise rotation about the origin by  $90^\circ$ .
- (B) clockwise rotation about the origin by  $90^\circ$ .
- (C) reflection about the  $\mathbf{x}$ -axis
- (D) reflection about the line  $y = x$
- (E) reflection about the  $\mathbf{y}$ -axis.