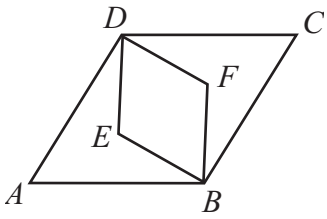
1. Rhombus $ABCD$ is similar to rhombus $BFDE$. The area of rhombus $ABCD$ is 24, and $\angle BAD = 60^\circ$. What is the area of rhombus $BFDE$?

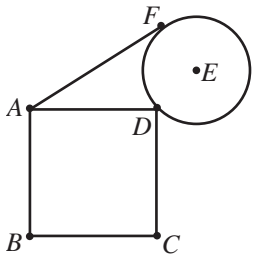


(A) 6 **(B)** $4\sqrt{3}$ **(C)** 8 **(D)** 9 **(E)** $6\sqrt{3}$

2. In rectangle $ABCD$, we have $A = (6, -22)$, $B = (2006, 178)$, and $D = (8, y)$, for some integer y. What is the area of rectangle $ABCD$?

(A) 4000 **(B)** 4040 **(C)** 4400 **(D)** 40,000 **(E)** 40,400

3. Square $ABCD$ has side length s, a circle centered at E has radius r, and r and s are both rational. The circle passes through D, and D lies on $\overline{BE}$. Point F lies on the circle, on the same side of $\overline{BE}$ as A. Segment AF is tangent to the circle, and $AF = \sqrt{9 + 5\sqrt{2}}$. What is r/s?



(A) $\frac{1}{2}$ **(B)** $\frac{5}{9}$ **(C)** $\frac{3}{5}$ **(D)** $\frac{5}{3}$ **(E)** $\frac{9}{5}$

4. Let

$$S_1 = \{(x, y) \mid \log_{10}(1 + x^2 + y^2) \leq 1 + \log_{10}(x + y)\}$$

and

$$S_2 = \{(x, y) \mid \log_{10}(2 + x^2 + y^2) \leq 2 + \log_{10}(x + y)\}.$$

What is the ratio of the area of S_2 to the area of S_1?

(A) 98 **(B)** 99 **(C)** 100 **(D)** 101 **(E)** 102

5. A circle of radius r is concentric with and outside a regular hexagon of side length 2. The probability that three entire sides of the hexagon are visible from a randomly chosen point on the circle is $1/2$. What is r?

(A) $2\sqrt{2} + 2\sqrt{3}$ **(B)** $3\sqrt{3} + \sqrt{2}$ **(C)** $2\sqrt{6} + \sqrt{3}$ **(D)** $3\sqrt{2} + \sqrt{6}$
(E) $6\sqrt{2} - \sqrt{3}$

6. Regular hexagon $ABCDEF$ has vertices A and C at $(0, 0)$ and $(7, 1)$, respectively. What is its area?

(A) $20\sqrt{3}$ **(B)** $22\sqrt{3}$ **(C)** $25\sqrt{3}$ **(D)** $27\sqrt{3}$ **(E)** 50

7. Rectangle $ABCD$ has area 2006. An ellipse with area 2006π passes through A and C and has foci at B and D. What is the perimeter of the rectangle? (The area of an ellipse is πab, where $2a$ and $2b$ are the lengths of its axes.)

(A) $\frac{16\sqrt{2006}}{\pi}$ **(B)** $\frac{1003}{4}$ **(C)** $8\sqrt{1003}$ **(D)** $6\sqrt{2006}$ **(E)** $\frac{32\sqrt{1003}}{\pi}$