

**Problem 1.** The length of a rectangle increases by 20% and its width decreases by 10%. By what percentage does the area of the rectangle increase?



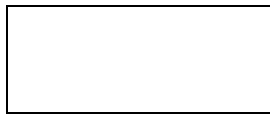
**Problem 1.** The length of a rectangle increases by 20% and its width decreases by 10%. By what percentage does the area of the rectangle increase?



**Problem 2.** Four circles with radius 1 are packed tightly together. What is the radius of the smallest circle that will contain them all?



**Problem 2.** Four circles with radius 1 are packed tightly together. What is the radius of the smallest circle that will contain them all?



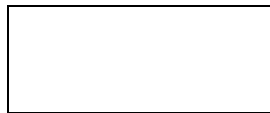
**Problem 3.** Find *all* real solutions of the equation  $x + 4\sqrt{x} - 21 = 0$ .

**Problem 3.** Find *all* real solutions of the equation  $x + 4\sqrt{x} - 21 = 0$ .

**Problem 4.** Four identical tennis balls are packed, one on top of the other, tightly (but without changing their spherical shape) in a cylindrical can. What fraction of the volume of the can is outside the balls?



**Problem 4.** Four identical tennis balls are packed, one on top of the other, tightly (but without changing their spherical shape) in a cylindrical can. What fraction of the volume of the can is outside the balls?



**Problem 5.** Derek has in his pocket assorted coins (some combination of pennies, nickels, dimes, quarters, and fifty-cent pieces). What is the largest possible amount of money he can have without being able to make change for a nickel, a dime, a quarter, a fifty cent piece or a dollar?

**Problem 5.** Derek has in his pocket assorted coins (some combination of pennies, nickels, dimes, quarters, and fifty-cent pieces). What is the largest possible amount of money he can have without being able to make change for a nickel, a dime, a quarter, a fifty cent piece or a dollar?

**Problem 6.** Justin, Miley, and Charice are among eight singers who will be divided at random into two groups of four. What is the probability that all three end up in the same group?

**Problem 6.** Justin, Miley, and Charice are among eight singers who will be divided at random into two groups of four. What is the probability that all three end up in the same group?

**Problem 7.** The midpoints of a regular hexagon are joined to form another regular hexagon inside. What is the ratio of the area of the inner hexagon to the area of the outer hexagon?



**Problem 7.** The midpoints of a regular hexagon are joined to form another regular hexagon inside. What is the ratio of the area of the inner hexagon to the area of the outer hexagon?



**Problem 8.** What is the minimum value of

$$x^2 + y^2 + x - 4y + 5$$

as  $x$  and  $y$  range over all real numbers?

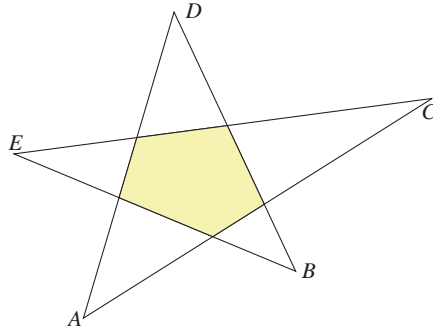
**Problem 8.** What is the minimum value of

$$x^2 + y^2 + x - 4y + 5$$

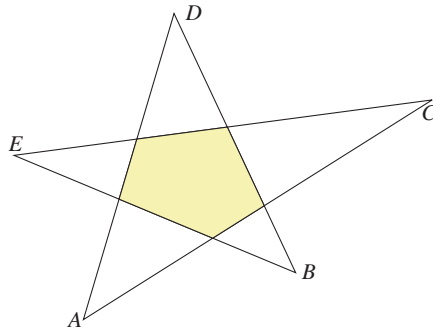
as  $x$  and  $y$  range over all real numbers?



**Problem 9.** In radians, what is the sum  $\angle A + \angle B + \angle C + \angle D + \angle E$  in the figure?



**Problem 9.** In radians, what is the sum  $\angle A + \angle B + \angle C + \angle D + \angle E$  in the figure?



**Problem 10.** Given a set  $A$  of real numbers, define  $A + A = \{a + b : a, b \in A\}$ . For example, if  $A = \{1, 4\}$ , then  $A + A = \{2, 5, 8\}$ . If  $A$  consists of precisely *four* (different) numbers, what is the smallest number of elements in  $A + A$ ?

**Problem 10.** Given a set  $A$  of real numbers, define  $A + A = \{a + b : a, b \in A\}$ . For example, if  $A = \{1, 4\}$ , then  $A + A = \{2, 5, 8\}$ . If  $A$  consists of precisely *four* (different) numbers, what is the smallest number of elements in  $A + A$ ?