Applications of quadratic equations

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1. A room contains 108 chairs arranged in rows. The number of rows is six less than twice the number of chairs per row. Find the number of rows.

2. The area of rectangle is 45 square inches. The length of the rectangle is four inches less than its width. Find the dimensions of the rectangle.

3. The area of a rectangle is 12 square meters, and its perimeter is 14 meters. Find the dimensions of the rectangle.

4. The area of a rectangle is 11 square centimeters, and its perimeter is 16 centimeters. Find the dimensions of the rectangle.

5. One leg of a right triangle is 2 units less than the other leg. Find the two legs if the hypotenuse is $\sqrt{34}$ units long.

6. One of the acute angles of a right triangle is 30°, and one of the legs is one foot more than the other. Find the lengths of the three sides of the triangle.

7. The height in feet of an object thrown in to the air from a height of h_0 feet, with initial velocity v_0 feet per second is given by the equation

$$h(t) = h_0 + v_0 t - 16t^2$$

   where t stands for the time measured in seconds. Suppose that a ball is thrown upwards from a height of 8 feet with an initial velocity of 32 feet per second.

   (a) At what time will the ball be at the highest point? What will be the height at the highest point?

   (b) At what point will the ball hit the ground?

   (c) At what point the ball will be at a height of 8 feet again?

8. The height y in feet of a ball thrown by a child is

$$y = -\frac{x^2}{12} + 6x + 6$$

   where x is the horizontal distance in feet from the point at which the ball is thrown.

   (a) What is the largest height that the ball will reach?

   (b) How far from the child will the ball hit the ground?

9. The number of bacteria in a refrigerated food is given by the function

$$N(T) = 20T^2 - 40T + 180,$$

where T is the temperature of the food in degrees Celsius.

(a) At what temperature will the number of bacteria be minimal?

(b) What is the minimum number of bacteria?

10. Your factory produces lemon-scented widgets. You know that each unit is cheaper, the more you produce. But you also know that costs will eventually go up if you make too many widgets, due to the costs of storage of the overstock. The guy in accounting says that your cost for producing x thousands of units a day can be approximated by the function

$$C(x) = 2x^2 - 10x + 280$$

(a) Find the daily production level that will minimize your costs.

(b) Find this minimum cost.