

$$t = \frac{-6 \pm \sqrt{6^2 - 4(0.7)(-8500)}}{2(0.7)}$$

$$t = \frac{-6 \pm \sqrt{36 + 23,800}}{1.4}$$

$$t = \frac{-6 \pm \sqrt{23,836}}{1.4}$$

$$t \approx \frac{-6 \pm 154.389}{1.4}$$

$$t \approx \frac{-6 + 154.389}{1.4} \text{ or } \frac{-6 - 154.389}{1.4}$$

This means that  $t \approx 105.992$  years or  $t \approx -114.564$  years. Since we are looking for a future date, the only logical answer would be  $t \approx 105.992$  years. But what month and year does this represent?

As the initial population was measured in 2012, and we are talking about 105 and some fraction of a year later, the year is going to be  $2012 + 105 = 2117$ . Now multiply 0.992 of a year by the number of months in a year, 12, to find the month.

$$12 \cdot 0.992 = 11.904$$

The number of months is 11.904, which means that 11 months have passed as well as part of the 12<sup>th</sup> month, which is December. So the population of Pleasantburg will reach 19,500 in December of 2117.

## 5.R.6 Exercises

### Concept Check

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

1. The quadratic formula will always work when solving quadratic equations.
2. If the discriminant is a perfect square, the quadratic equation is factorable.
3. When using the quadratic formula, if the discriminant is greater than zero, there are infinite solutions.
4. If the discriminant is less than zero, there is no real solution.

## Practice

Find the discriminant and determine the nature of the solutions of each quadratic equation.

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5.  $x^2 + 6x - 8 = 0$

6.  $x^2 - 8x + 16 = 0$

Solve each of the quadratic equations using the quadratic formula.

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7.  $x^2 + 4x - 4 = 0$

8.  $x^2 - 2x + 7 = 0$

9.  $3x^2 - 7x + 4 = 0$

## Applications

Solve.

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10. An orange is thrown down from the top of a building that is 300 feet tall with an initial velocity of 6 feet per second. The distance of the object from the ground can be calculated using the equation  $d = 300 - 6t - 16t^2$ , where  $t$  is the time in seconds after the orange is thrown.
- On a balcony, a cup is sitting on a table located 100 feet from the ground. If the orange is thrown with the right aim to fall into the cup, how long will the orange fall? Round to the nearest hundredth. (**Hint:** The distance is 100 feet.)
  - If the orange misses the cup and falls to the ground, how long will it take for the orange to splatter on the sidewalk? (**Hint:** What is the height of the orange when it hits the ground?)

- c. Approximately how much longer would it take for the orange to fall to the sidewalk than it would for the orange to fall into the cup?

## Writing & Thinking

11. Find an equation of the form  $Ax^4 + Bx^2 + C = 0$  that has the four roots  $\pm 2$  and  $\pm 3$ . Explain how you arrived at this equation.
12. The surface area of a right circular cylinder can be found using the following formula:  $S = 2\pi r^2 + 2\pi rh$ , where  $r$  is the radius of the cylinder and  $h$  is the height. Estimate the radius of a circular cylinder of height 30 cm and surface area  $300 \text{ cm}^2$ . Explain how you used your knowledge of quadratic equations.

