

# Quadratic Applications and Modeling

Algebra 1 • Section 9.7

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 12

## Quick Review and Helpful Hints

Quadratic functions can be read through their zeros, vertex, axis of symmetry, and opening direction. Choose factoring, square roots, completing the square, or the quadratic formula based on the form you see.

**Q Example:** Solve  $x^2 - 5x + 6 = 0$ .

**Work:** Factor the quadratic:  $x^2 - 5x + 6 = (x - 2)(x - 3)$ . Set each factor equal to zero.

**Answer:**  $x = 2$  or  $x = 3$

## Practice Problems

Solve each problem. Show enough work that another student could follow your thinking.

- Find the zeros of  $P(x) = -x^2 + 50x - 400$ .  
\_\_\_\_\_
- Find the vertex time for  $h(t) = -16t^2 + 64t + 5$ .  
\_\_\_\_\_
- Find the maximum value of  $P(x) = -2(x - 3)^2 + 18$ .  
\_\_\_\_\_
- A rectangle has area  $x(20 - x)$ . Write the quadratic.  
\_\_\_\_\_
- Find break-even points for  $-x^2 + 12x - 20 = 0$ .  
\_\_\_\_\_
- Find the axis of  $y = -x^2 + 6x + 4$ .  
\_\_\_\_\_
- If revenue is  $R = -5p^2 + 100p$ , find price for maximum revenue.  
\_\_\_\_\_
- Find the height at  $t = 3$  for  $h = -5t^2 + 30t + 2$ .  
\_\_\_\_\_
- Find the positive zero of  $h = -t^2 + 9$ .  
\_\_\_\_\_
- Does  $y = x^2 - 4x + 4$  touch or cross the  $x$ -axis?  
\_\_\_\_\_

## Word Problems

- A ball is launched with  $h = -t^2 + 8t + 9$ . When does it hit the ground?  
\_\_\_\_\_
- A garden side lengths are  $x$  and  $30 - x$ . What  $x$  maximizes area?  
\_\_\_\_\_



## Answer Keys

1.  $x = 10, 40$

2.  $t = 2$

3.  $18$

4.  $-x^2 + 20x$

5.  $x = 2, 10$

6.  $x = 3$

7.  $p = 10$

8.  $47$

9.  $t = 3$

10. Touch

11.  $t = 9$

12.  $15$

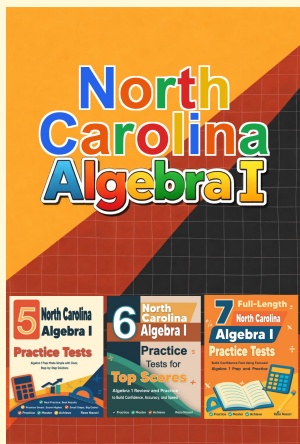
### Step-by-Step Explanations

- Set to zero, multiply by  $-1$ , and factor  $x^2 - 50x + 400 = (x - 10)(x - 40)$ .
- Use  $t = -b/(2a) = -64/(2(-16)) = 2$ .
- The vertex form shows the maximum output is 18.
- Distribute  $x$  across  $20 - x$ .
- Multiply by  $-1$  and factor  $x^2 - 12x + 20 = (x - 2)(x - 10)$ .
- The axis is  $x = -b/(2a) = -6/(2(-1)) = 3$ .

- The vertex occurs at  $p = -100/(2(-5)) = 10$ .
- Substitute 3:  $-45 + 90 + 2 = 47$ .
- Set  $-t^2 + 9 = 0$ , so  $t^2 = 9$ . Positive time is 3.
- It factors as  $(x - 2)^2$ , so it has one repeated zero.
- Set  $h = 0$ :  $-t^2 + 8t + 9 = 0$ , or  $t^2 - 8t - 9 = 0 = (t - 9)(t + 1)$ .
- The area is  $-x^2 + 30x$ , whose vertex is at  $x = 15$ .



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