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.

▷ **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.

1. Find the zeros of $P(x) = -x^2 + 50x - 400$.

2. Find the vertex time for $h(t) = -16t^2 + 64t + 5$.

3. Find the maximum value of $P(x) = -2(x - 3)^2 + 18$.

4. A rectangle has area $x(20 - x)$. Write the quadratic.

5. Find break-even points for $-x^2 + 12x - 20 = 0$.

6. Find the axis of $y = -x^2 + 6x + 4$.

7. If revenue is $R = -5p^2 + 100p$, find price for maximum revenue.

8. Find the height at $t = 3$ for $h = -5t^2 + 30t + 2$.

9. Find the positive zero of $h = -t^2 + 9$.

10. Does $y = x^2 - 4x + 4$ touch or cross the x-axis?

♦ Word Problems

11. A ball is launched with $h = -t^2 + 8t + 9$. When does it hit the ground?

12. A garden side lengths are x and $30 - x$. What x maximizes area?

Answer Keys

1. $\boxed{x = 10, 40}$
2. $\boxed{t = 2}$
3. $\boxed{18}$
4. $\boxed{-x^2 + 20x}$
5. $\boxed{x = 2, 10}$
6. $\boxed{x = 3}$
7. $\boxed{p = 10}$
8. $\boxed{47}$
9. $\boxed{t = 3}$
10. $\boxed{\text{Touch}}$
11. $\boxed{t = 9}$
12. $\boxed{15}$

Step-by-Step Explanations

1. Set it to zero and flip the sign so $x^2 - 50x + 400$ factors easily into $(x - 10)(x - 40)$.
2. The high point always sits at $t = -b/(2a)$. Plug in: $-64/(-32) = 2$ seconds.
3. In vertex form, the $+18$ at the end IS the peak — the squared part can only drag the value down.
4. Just distribute the x through the parentheses, and the area formula unfolds into a quadratic.
5. Multiplying by -1 makes factoring cleaner: $x^2 - 12x + 20 = (x - 2)(x - 10)$ gives both break-even spots.
6. The axis of symmetry runs through $x = -b/(2a)$. That's $-6/(-2) = 3$, slicing the parabola in half.
7. Revenue peaks at the vertex, so use $p = -b/(2a) = -100/(-10) = 10$ for the best price.
8. Just substitute $t = 3$ and follow the arithmetic: $-45 + 90 + 2$ adds up to 47.
9. Setting $h = 0$ gives $t^2 = 9$. Both ± 3 work mathematically, but only positive time makes sense.
10. It collapses to $(x-2)^2$, a single repeated zero — so the parabola just kisses the axis instead of crossing.
11. Ground means $h = 0$. Tidy it to $t^2 - 8t - 9 = (t - 9)(t + 1)$, and only $t = 9$ is a real landing time.
12. The area $-x^2 + 30x$ is a downward parabola, and its vertex at $x = 15$ is where the area is biggest.

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