LESSON MAKER PRO

# Quadratic Routes

*Choose a method that fits the equation.*

**HIGH SCHOOL · A1P.AF.C.9**

**A1P.AF.C.9** "Select an appropriate method to solve a quadratic equation in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions..."

NAME _____ DATE _____

## CHOOSE YOUR METHOD

Inspect an isolated square, factor when the expression allows it, or use completing the square or the quadratic formula. To complete the square, first make the coefficient of $x^2$ equal to 1, then add the square of half the x coefficient to both sides. If an isolated square equals a negative number, the equation has no real solutions.

## WORKED EXAMPLE

Solve $x^2 + 18x + 65 = 0$ by completing the square.

1. Subtract 65: $x^2 + 18x = -65$.
2. Add $(18/2)^2 = 81$ to both sides: $(x + 9)^2 = 16$.
3. Take square roots: $x + 9 = \pm 4$.

**Answer: x = -5 or x = -13**

## PRACTICE 6 problems

**1** Solve by inspection: $x^2 = 144$.

**ANSWER** _____

**2** Solve by taking square roots: $(x - 17)^2 = 25$.

**ANSWER** _____

**3** Solve by factoring: $x^2 - 19x + 88 = 0$.

**ANSWER** _____

**4** Complete the square to solve $x^2 + 6x - 2 = 0$. Write the equivalent square equation and both solutions.

**ANSWER** _____

_____

**5** Use the quadratic formula to solve $3x^2 + 2x - 2 = 0$. Show your substitution into the formula.

**ANSWER** _____

_____

**6** Does $x^2 + 2x + 2 = 0$ have real solutions? Show an equivalent square equation to support your answer.

**ANSWER** _____

_____

## APPLY IT Show your work

**1** The profit from a school dance, in hundreds of dollars, is $P = -x^2 + 12x - 20$, where x is the ticket price in dollars. Which ticket prices make the profit zero?

WORK SPACE

**ANSWER** _____

**2** A skateboarder's height above the ground, in feet, is $h = -16x^2 + 24x + 7$, where x is the number of seconds since leaving a ramp. When does the skateboarder reach the ground?

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

Start with $ax^2 + bx + c = 0$, where $a \neq 0$. Complete the square to write it in the form $(x - p)^2 = q$, then take square roots to derive the quadratic formula. State when the equation has no real solutions.

WORK SPACE AND ANSWER

**ANSWER KEY** # Quadratic Routes



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Solve by inspection: $x^2 = 144$. | **$x = 12$ or $x = -12$** |
| 2 | Solve by taking square roots: $(x - 17)^2 = 25$. | **$x = 22$ or $x = 12$** |
| 3 | Solve by factoring: $x^2 - 19x + 88 = 0$. | **$x = 8$ or $x = 11$** |
| 4 | Complete the square to solve $x^2 + 6x - 2 = 0$. Write the equivalent square equation and both solutions. | **$(x + 3)^2 = 11$; $x = -3 \pm \sqrt{11}$** |
| 5 | Use the quadratic formula to solve $3x^2 + 2x - 2 = 0$. Show your substitution into the formula. | **$x = (-2 \pm \sqrt{(2^2 - 4(3)(-2))})/(2(3)) = (-1 \pm \sqrt{7})/3$** |
| 6 | Does $x^2 + 2x + 2 = 0$ have real solutions? Show an equivalent square equation to support your answer. | **No real solutions; $(x + 1)^2 = -1$.** |

## PART 2 · APPLY IT

1. **$2 and $10** Set $P = 0$ and multiply by -1 to get $x^2 - 12x + 20 = 0$. Factor as $(x - 2)(x - 10) = 0$.
2. **7/4 seconds** Set $h = 0$ and factor: $-(4x + 1)(4x - 7) = 0$. The solutions are -1/4 and 7/4, but only 7/4 is after leaving the ramp.

## CHALLENGE

**Divide by $a$ and rearrange: $x^2 + (b/a)x = -c/a$. Add $b^2/(4a^2)$ to both sides: $(x + b/(2a))^2 = (b^2 - 4ac)/(4a^2)$. Taking square roots and solving for $x$ gives $x = (-b \pm \sqrt{(b^2 - 4ac)})/(2a)$. There are no real solutions when $b^2 - 4ac < 0$.**

Accept solutions in either order and equivalent exact radical forms. In the skateboard problem, reject the negative time because the question asks when the rider reaches the ground after leaving the ramp.