

# Quadratic Form Switch

Use equivalent forms to uncover zeros, vertices, and intercepts.

**HIGH SCHOOL • AI-F.IF.8**

**AI-F.IF.8** "Write a function in different but equivalent forms to reveal and explain different properties of the function."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## ONE FUNCTION, DIFFERENT CLUES

A quadratic can be written in standard form, factored form, or vertex form. Factored form reveals the zeros, vertex form reveals the vertex and maximum or minimum, and standard form reveals the y-intercept. Rewrite the same function when you need a different clue.

## WORKED EXAMPLE

Write  $f(x) = x^2 + 31x + 234$  in factored form and vertex form.

- Find two numbers with a product of 234 and a sum of 31: 13 and 18.
- Write the factored form:  $f(x) = (x + 13)(x + 18)$ .
- Complete the square:  $x^2 + 31x + 234 = (x + 31/2)^2 - 961/4 + 234$ .
- Simplify:  $f(x) = (x + 31/2)^2 - 25/4$ .

**Answer:  $f(x) = (x + 13)(x + 18)$  and  $f(x) = (x + 31/2)^2 - 25/4$**

## PRACTICE 6 problems

- 1** Write  $f(x) = x^2 - 9x + 14$  in factored form. Then state the zeros.

**ANSWER** \_\_\_\_\_

- 2** For  $g(x) = (x - 8)^2 + 11$ , state the vertex and the equation of the axis of symmetry.

**ANSWER** \_\_\_\_\_

- 3** Write  $h(x) = (x + 10)(x - 12)$  in standard form. Then state the y-intercept.

**ANSWER** \_\_\_\_\_

- 4** Write  $p(x) = x^2 + 16x + 39$  in vertex form.

**ANSWER** \_\_\_\_\_

- 5** For  $r(x) = -(x - 17)^2 + 21$ , state the maximum value and the x-value where it occurs.

**ANSWER** \_\_\_\_\_

- 6** A quadratic has zeros of -19 and 22 and a leading coefficient of 1. Write the function in factored form.

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** For the student council dance,  $P(x) = -x^2 + 40x - 336$  models profit in hundreds of dollars when a ticket costs  $x$  dollars. Write  $P(x)$  in vertex form. What ticket price gives the greatest profit, and what is that profit?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** In a game design project, a character's height is modeled by  $h(t) = -7t^2 + 98t + 84$ , where  $h$  is height in game units and  $t$  is time in seconds. Write  $h(t)$  in vertex form. What is the greatest height, and when does it occur?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

A quadratic has  $x$ -intercepts of 22 and 28 and passes through  $(0, 616)$ . Write the function in factored form, standard form, and vertex form. In one sentence, explain which form reveals the  $x$ -intercepts and which form reveals the vertex.

WORK SPACE AND ANSWER

## PART 1 • PRACTICE

| # | PROBLEM                                                                                                  | ANSWER                                                            |
|---|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1 | Write $f(x) = x^2 - 9x + 14$ in factored form. Then state the zeros.                                     | <b><math>f(x) = (x - 2)(x - 7)</math>; zeros: 2 and 7</b>         |
| 2 | For $g(x) = (x - 8)^2 + 11$ , state the vertex and the equation of the axis of symmetry.                 | <b>Vertex: (8, 11); axis of symmetry: <math>x = 8</math></b>      |
| 3 | Write $h(x) = (x + 10)(x - 12)$ in standard form. Then state the y-intercept.                            | <b><math>h(x) = x^2 - 2x - 120</math>; y-intercept: (0, -120)</b> |
| 4 | Write $p(x) = x^2 + 16x + 39$ in vertex form.                                                            | <b><math>p(x) = (x + 8)^2 - 25</math></b>                         |
| 5 | For $r(x) = -(x - 17)^2 + 21$ , state the maximum value and the x-value where it occurs.                 | <b>Maximum value: 21; it occurs at <math>x = 17</math></b>        |
| 6 | A quadratic has zeros of -19 and 22 and a leading coefficient of 1. Write the function in factored form. | <b><math>f(x) = (x + 19)(x - 22)</math></b>                       |

## PART 2 • APPLY IT

1.  **$P(x) = -(x - 20)^2 + 64$ ; a \$20 ticket price gives a greatest profit of \$6,400.** Complete the square to write the function in vertex form. The vertex gives the ticket price and greatest profit.
2.  **$h(t) = -7(t - 7)^2 + 427$ ; the greatest height is 427 game units at 7 seconds.** Factor -7 from the first two terms and complete the square. The vertex gives the greatest height and the time when it occurs.

## CHALLENGE

**$f(x) = (x - 22)(x - 28) = x^2 - 50x + 616 = (x - 25)^2 - 9$ . Factored form reveals the x-intercepts, and vertex form reveals the vertex (25, -9).**

Accept algebraically equivalent forms with terms in a different order. For vertex form, accept an equivalent expression that clearly shows the same vertex.