LESSON MAKER PRO

Quadratic Form Detective

Choose and change forms to reveal zeros and vertices.

HIGH SCHOOL · MT.CORE.ALG.QUAD.3

MT.CORE.ALG.QUAD.3 "Understand that quadratic expressions can be represented in multiple forms and the specific features of each form by: Choosing the form strategically when writing an expression based on given information and intended use..."

NAME _____ DATE _____

CHOOSE A USEFUL FORM

Factored form, $a(x - r)(x - s)$, shows the zeros r and s. Vertex form, $a(x - h)^2 + k$, shows the vertex (h, k). Standard form, $ax^2 + bx + c$, shows the value when $x = 0$.

WORKED EXAMPLE

Write $f(x) = 3(x - 7)(x + 2)$ in standard form. Then state its zeros.

1. Multiply the binomials: $(x - 7)(x + 2) = x^2 - 5x - 14$.
2. Multiply by 3: $f(x) = 3x^2 - 15x - 42$.
3. Set each factor equal to 0: $x - 7 = 0$ or $x + 2 = 0$.

Answer: Standard form: $f(x) = 3x^2 - 15x - 42$. Zeros: 7 and -2.

PRACTICE 6 problems

1 Write $f(x) = (x - 1)(x - 6)$ in standard form. State its zeros.

ANSWER _____

2 Write $f(x) = x^2 + 3x - 10$ in factored form. State its zeros.

ANSWER _____

3 Write $f(x) = 2(x + 3)^2 - 8$ in standard form. State its vertex.

ANSWER _____

4 Write $f(x) = x^2 - 8x + 11$ in vertex form. State its vertex.

ANSWER _____

5 A quadratic has zeros -3 and 4, and $f(0) = -24$. Write it in factored form.

ANSWER _____

6 A quadratic has vertex (1, -9) and passes through (0, -7). Write it in vertex form and standard form.

ANSWER _____

APPLY IT Show your work

1 A soccer ball's height is $h(t) = -5t^2 + 10t$ meters, where t is the number of seconds after the kick. When does the ball land? What is its greatest height, and when does it reach that height? Use a different form to find each result.

WORK SPACE

ANSWER _____

2 A student club models its profit from selling sticker bundles by $P(x) = -2x^2 + 24x - 40$ dollars, where x is the price of one bundle in dollars. Write P(x) in factored form to find both break-even prices. Then write it in vertex form to find the price that gives the highest profit.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A quadratic has zeros -1 and 5 and passes through (2, 18). Write its factored, standard, and vertex forms. Explain how the zeros and the point determine the function.

WORK SPACE AND ANSWER

ANSWER KEY

Quadratic Form Detective

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write $f(x) = (x - 1)(x - 6)$ in standard form. State its zeros.	**$f(x) = x^2 - 7x + 6$; zeros: 1 and 6.**
2	Write $f(x) = x^2 + 3x - 10$ in factored form. State its zeros.	**$f(x) = (x + 5)(x - 2)$; zeros: -5 and 2.**
3	Write $f(x) = 2(x + 3)^2 - 8$ in standard form. State its vertex.	**$f(x) = 2x^2 + 12x + 10$; vertex: (-3, -8).**
4	Write $f(x) = x^2 - 8x + 11$ in vertex form. State its vertex.	**$f(x) = (x - 4)^2 - 5$; vertex: (4, -5).**
5	A quadratic has zeros -3 and 4, and $f(0) = -24$. Write it in factored form.	**$f(x) = 2(x + 3)(x - 4)$.**
6	A quadratic has vertex (1, -9) and passes through (0, -7). Write it in vertex form and standard form.	**Vertex form: $f(x) = 2(x - 1)^2 - 9$. Standard form: $f(x) = 2x^2 - 4x - 7$.**

PART 2 · APPLY IT

1. **The ball lands after 2 seconds. Its greatest height is 5 meters, reached after 1 second.** Factor to get $h(t) = -5t(t - 2)$, so the landing time is 2 seconds. Rewrite as $h(t) = -5(t - 1)^2 + 5$ to find the greatest height and its time.
2. **$P(x) = -2(x - 2)(x - 10) = -2(x - 6)^2 + 32$. The break-even prices are $2 and $10. The highest profit is $32 at a price of $6.** Factor out -2, then factor the trinomial to find the zeros. Complete the square, or use the midpoint of the zeros, to find the vertex.

CHALLENGE

The zeros give $f(x) = a(x + 1)(x - 5)$. Using (2, 18), $18 = a(3)(-3)$, so $a = -2$. Factored form: $f(x) = -2(x + 1)(x - 5)$. Standard form: $f(x) = -2x^2 + 8x + 10$. Vertex form: $f(x) = -2(x - 2)^2 + 18$. The zeros determine the factors, and the point determines the value of a.

Accept equivalent forms with factors in either order. For the soccer problem, $t = 0$ is also a zero, but it is the kick time, not the landing time.