LESSON MAKER PRO

Quadratic Shape Shifts

Change forms to reveal zeros and turning points.

HIGH SCHOOL · MT.CORE.ALG.QUAD.3.b

MT.CORE.ALG.QUAD.3.b "Understand that quadratic expressions can be represented in multiple forms and the specific features of each form by: Converting between factored, standard, and vertex forms symbolically and using representations,"

NAME _____ DATE _____

THREE USEFUL FORMS

Factored form shows where a quadratic equals 0. Vertex form shows its highest or lowest point, while standard form shows its value at x = 0. Expand to reach standard form, factor to find zeros, or complete the square to reach vertex form.

WORKED EXAMPLE

Write $f(x) = (x - 9)^2 - 7$ in standard form.

1. Expand the square: $f(x) = (x - 9)(x - 9) - 7$.
2. Multiply: $f(x) = x^2 - 18x + 81 - 7$.
3. Combine constants: $f(x) = x^2 - 18x + 74$.

Answer: $f(x) = x^2 - 18x + 74$

PRACTICE 6 problems

1 Write $f(x) = (x - 1)(x - 5)$ in standard form.

ANSWER _____

2 Write $f(x) = x^2 + x - 12$ in factored form.

ANSWER _____

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

ANSWER _____

4 Write $f(x) = (x + 1)^2 - 16$ in factored form.

ANSWER _____

5 Write $f(x) = 2(x - 1)(x - 5)$ in vertex form.

ANSWER _____

6 A quadratic function f has the values in the table. Write it in vertex form and factored form.

VALUES OF F

x	f(x)
-1	0
0	-3
1	-4
2	-3
3	0

ANSWER _____

APPLY IT Show your work

1 A school club sells shirts in batches of 10. Its predicted profit in dollars is $P(x) = -5(x - 6)^2 + 180$, where x is the number of batches sold. Write P(x) in factored form. Besides selling 0 batches, how many batches can the club sell before its predicted profit returns to $0?

WORK SPACE

ANSWER _____

2 A student films a trampoline jump. The jumper's height in feet is $h(x) = -16x^2 + 32x + 4$, where x is seconds after the video starts. Write h(x) in vertex form. When does the jumper reach the greatest height, and what is that height?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Write $g(x) = -2x^2 + 12x - 10$ in both factored form and vertex form. State its zeros and its maximum value. Explain which form makes each feature easiest to find.

WORK SPACE AND ANSWER

ANSWER KEY

Quadratic Shape Shifts

HIGH SCHOOL · MT.CORE.ALG.QUAD.3.b

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write $f(x) = (x - 1)(x - 5)$ in standard form.	**$f(x) = x^2 - 6x + 5$**
2	Write $f(x) = x^2 + x - 12$ in factored form.	**$f(x) = (x + 4)(x - 3)$**
3	Write $f(x) = x^2 - 8x + 11$ in vertex form.	**$f(x) = (x - 4)^2 - 5$**
4	Write $f(x) = (x + 1)^2 - 16$ in factored form.	**$f(x) = (x - 3)(x + 5)$**
5	Write $f(x) = 2(x - 1)(x - 5)$ in vertex form.	**$f(x) = 2(x - 3)^2 - 8$**
6	A quadratic function f has the values in the table. Write it in vertex form and factored form.	**Vertex form: $f(x) = (x - 1)^2 - 4$. Factored form: $f(x) = (x + 1)(x - 3)$.**

PART 2 · APPLY IT

1. **$P(x) = -5x(x - 12)$; 12 batches.** Use the difference of squares: $-5[(x - 6)^2 - 36] = -5x(x - 12)$. Set $P(x)$ to 0 to find $x = 0$ or $x = 12$.
2. **$h(x) = -16(x - 1)^2 + 20$; greatest height of 20 feet after 1 second.** Factor -16 from the terms containing x and complete the square to get $-16(x - 1)^2 + 20$. The squared term is 0 at $x = 1$, giving the maximum height of 20 feet.

CHALLENGE

Factored form: $g(x) = -2(x - 1)(x - 5)$. Vertex form: $g(x) = -2(x - 3)^2 + 8$. The zeros are 1 and 5, which are easiest to find from factored form. The maximum value is 8 at $x = 3$, which is easiest to find from vertex form.

Accept equivalent algebraic forms with factors in either order. For the challenge, the explanation should connect the zeros to factored form and the maximum to vertex form.