LESSON MAKER PRO

Quadratic Graph Clues

Factor and complete the square to reveal key graph features.

HIGH SCHOOL · HSF-IF.C.8a

CCSS.Math.Content.HSF-IF.C.8a "Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context."

NAME _____ DATE _____

TWO USEFUL FORMS

Factored form, $y = a(x - r)(x - s)$, shows the zeros r and s. Their midpoint is the axis of symmetry. Vertex form, $y = a(x - h)^2 + k$, shows the vertex (h, k) and whether it is a maximum or minimum.

WORKED EXAMPLE

The number line marks the x-intercepts of $y = x^2 - 6x + 8$. Use the figure and the equation to find the zeros, axis of symmetry, and minimum value.



1. Factor: $y = (x - 2)(x - 4)$.
2. Zeros are $x = 2$ and $x = 4$.
3. Complete the square: $y = x^2 - 6x + 9 - 1$.
4. $y = (x - 3)^2 - 1$, so the vertex is (3, -1).

Answer: Zeros: 2 and 4. Axis: x = 3. Minimum value: -1.

PRACTICE 4 problems

1 For $y = x^2 + 11x + 30$, factor. Then find the zeros, axis of symmetry, and minimum value.

ANSWER _____

2 For $y = -x^2 + 14x - 45$, factor. Then find the zeros, axis of symmetry, and maximum value.

ANSWER _____

3 Rewrite $y = 5x^2 - 50x + 7$ in vertex form.

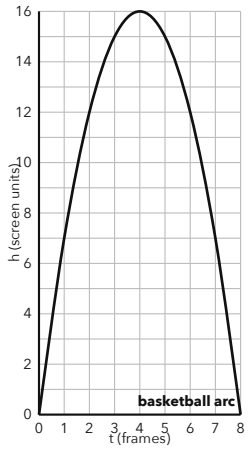
ANSWER _____

4 For $y = -2x^2 - 20x + 48$, find the zeros, axis of symmetry, and maximum value.

ANSWER _____

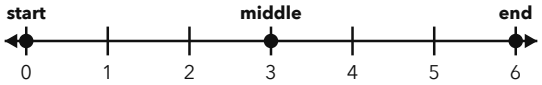
APPLY IT Show your work

1 A game designer graphs an animated basketball arc. Use the graph to find when the ball is on the ground and its greatest height.



ANSWER _____

2 A student club's promo video earns $P(d) = -2d^2 + 12d$ hundred views on day d. Use the timeline. When does it earn 0 views, and what is the greatest number of views?



ANSWER _____

CHALLENGE One step up

A quadratic has zeros x = 1 and x = 7 and a maximum value of 18. Find an equation for the quadratic in factored form and vertex form. Explain how the zeros and maximum determine your equation.

WORK SPACE AND ANSWER

ANSWER KEY

Quadratic Graph Clues

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $y = x^2 + 11x + 30$, factor. Then find the zeros, axis of symmetry, and minimum value.	**$y = (x + 5)(x + 6)$; zeros: -5, -6; axis: $x = -11/2$; minimum: -1/4.**
2	For $y = -x^2 + 14x - 45$, factor. Then find the zeros, axis of symmetry, and maximum value.	**$y = -(x - 5)(x - 9)$; zeros: 5, 9; axis: $x = 7$; maximum: 4.**
3	Rewrite $y = 5x^2 - 50x + 7$ in vertex form.	**$y = 5(x - 5)^2 - 118$**
4	For $y = -2x^2 - 20x + 48$, find the zeros, axis of symmetry, and maximum value.	**Zeros: -12, 2; axis: $x = -5$; maximum: 98.**

PART 2 · APPLY IT

1. **The ball is on the ground at t = 0 and t = 8. Its greatest height is 16 screen units at t = 4.** The x-intercepts are 0 and 8. The highest point, halfway between them, is (4, 16).
2. **It earns 0 views on days 0 and 6. The greatest number is 1,800 views on day 3.** Factor $P(d) = -2d(d - 6)$ for the zero-view days. Completing the square gives $P(d) = -2(d - 3)^2 + 18$, so the maximum is 18 hundred views.

CHALLENGE

$y = -2(x - 1)(x - 7)$ and $y = -2(x - 4)^2 + 18$. The axis is halfway between the zeros, so $x = 4$. In $y = a(x - 1)(x - 7)$, substituting $x = 4$ gives $18 = -9a$, so $a = -2$.

Accept equivalent factored or vertex forms. For contextual answers, accept 18 hundred views if the student identifies it as 1,800 views.