

Parabola Plot Lab

Solve polynomial zeros and graph key features.

HIGH SCHOOL • MA.912.AR.6

MA.912.AR.6 "Solve and graph polynomial equations and functions in one and two variables."

NAME _____

DATE _____

ZEROS AND GRAPH FEATURES

For a polynomial equation, factor when possible and use the zero-product rule to find each solution. For a quadratic function, the x-intercepts occur where $y = 0$. The vertex lies on the axis of symmetry, halfway between the x-intercepts when there are two real intercepts.

WORKED EXAMPLE

Graph $y = x^2 - 6x + 8$ by finding its x-intercepts, axis of symmetry, and vertex.

1. Factor: $y = (x - 2)(x - 4)$.
2. Set $y = 0$, so $x = 2$ or $x = 4$.
3. Average the roots: $(2 + 4)/2 = 3$, so the axis is $x = 3$.
4. Evaluate: $y(3) = -1$, so the vertex is $(3, -1)$.

**Answer: x-intercepts: (2, 0) and (4, 0);
axis of symmetry: $x = 3$; vertex: (3, -1)**

PRACTICE 6 problems

1 Solve $x^2 - 14x + 45 = 0$.

ANSWER _____

2 Solve $x^2 - 25 = 0$.

ANSWER _____

3 Graph $y = x^2 + 14x + 45$. State the vertex, axis of symmetry, x-intercepts, and y-intercept.

ANSWER _____

4 Graph $y = -x^2 + 22x - 120$. State the vertex, axis of symmetry, x-intercepts, and y-intercept.

ANSWER _____

5 Solve $x^3 - 11x^2 - 17x + 315 = 0$.

ANSWER _____

6 Graph $y = x^2 - 49$. State the vertex, axis of symmetry, and x-intercepts.

ANSWER _____

APPLY IT Show your work

- 1** A skateboarder's height above the ground is modeled by $h(t) = -7t^2 + 70t$, where h is measured in feet and t is measured in seconds. What is the maximum height, and when does the skateboarder land?

WORK SPACE

ANSWER _____

- 2** A student club models its net profit from a shirt sale by $P(x) = -x^2 + 18x - 65$, where P is in hundreds of dollars and x is the number of dozens of shirts sold. At how many dozens of shirts does the club break even, and what is the greatest possible profit?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Graph both functions, $y = x^2 - 15x + 56$ and $y = x - 7$. Find their intersection points and explain how you know the points are on both graphs.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Solve $x^2 - 14x + 45 = 0$.	$x = 5$ or $x = 9$
2	Solve $x^2 - 25 = 0$.	$x = -5$ or $x = 5$
3	Graph $y = x^2 + 14x + 45$. State the vertex, axis of symmetry, x-intercepts, and y-intercept.	Vertex: $(-7, -4)$; axis of symmetry: $x = -7$; x-intercepts: $(-9, 0)$ and $(-5, 0)$; y-intercept: $(0, 45)$
4	Graph $y = -x^2 + 22x - 120$. State the vertex, axis of symmetry, x-intercepts, and y-intercept.	Vertex: $(11, 1)$; axis of symmetry: $x = 11$; x-intercepts: $(10, 0)$ and $(12, 0)$; y-intercept: $(0, -120)$
5	Solve $x^3 - 11x^2 - 17x + 315 = 0$.	$x = -5, x = 7, \text{ or } x = 9$
6	Graph $y = x^2 - 49$. State the vertex, axis of symmetry, and x-intercepts.	Vertex: $(0, -49)$; axis of symmetry: $x = 0$; x-intercepts: $(-7, 0)$ and $(7, 0)$

PART 2 • APPLY IT

- The maximum height is 175 feet at 5 seconds. The skateboarder lands at 10 seconds.** The vertex occurs at $t = 5$, and $h(5) = 175$. Factor $h(t) = -7t(t - 10)$ to find that the height returns to 0 at $t = 10$.
- The club breaks even at 5 dozen shirts and 13 dozen shirts. The greatest possible profit is \$1,600 when 9 dozen shirts are sold.** Set $P(x) = 0$ and factor $x^2 - 18x + 65$ to get $x = 5$ and $x = 13$. The vertex is at $x = 9$, where $P(9) = 16$, or \$1,600.

CHALLENGE

The intersection points are $(7, 0)$ and $(9, 2)$. Set $x^2 - 15x + 56$ equal to $x - 7$, giving $x^2 - 16x + 63 = 0$. Factoring gives $(x - 7)(x - 9) = 0$, and substituting each x-value into $y = x - 7$ gives the two y-values.

Accept equivalent factored forms and solution sets in any order. For graphing items, accept correctly labeled features and a matching sketch with the stated intercepts, vertex, and axis of symmetry.