Parabola Peak Hunt

Find each quadratic's turning point and x-intercepts.

HIGH SCHOOL · MA.912.AR.3.6

MA.912.AR.3.6 "Given an expression or equation representing a quadratic function, determine the vertex and zeros and interpret them in terms of a real-world context."

NAME ______________________ DATE ____________

VERTEX AND ZEROS

In $y = a(x-h)^2 + k$, the vertex is (h, k). To find zeros, set y equal to 0 and solve for x. In a real situation, the vertex shows a maximum or minimum, and zeros show where the quantity is 0.

WORKED EXAMPLE

Find the vertex and zeros of $y = 4(x-6)^2 - 36$.

1. The expression is in vertex form, so the vertex is $(6, -36)$.
2. Set y equal to 0: $0 = 4(x-6)^2 - 36$.
3. $4(x-6)^2 = 36$, so $(x-6)^2 = 9$.
4. $x-6 = 3$ or $x-6 = -3$, so $x = 9$ or $x = 3$.

Answer: Vertex: (6, -36). Zeros: x = 3 and x = 9.

PRACTICE 6 problems

1 Find the vertex and zeros of $y = (x-7)^2 - 49$.

ANSWER ____________________

2 Find the vertex and zeros of $y = -2(x+5)^2 + 18$.

ANSWER ____________________

3 Find the vertex and zeros of $y = x^2 - 24x + 143$.

ANSWER ____________________

4 Find the vertex and zeros of $y = -x^2 + 22x - 120$.

ANSWER ____________________

5 Find the vertex and zeros of $y = 5(x+2)^2 - 45$.

ANSWER ____________________

6 Find the vertex and zeros of $y = 2x^2 - 30x + 112$.

ANSWER ____________________

APPLY IT Show your work

1 A water rocket's height, h, in feet, after t seconds is $h(t) = -16t^2 + 64t + 80$. Find the vertex and zeros. Interpret each value in this situation.

WORK SPACE

ANSWER ______________________

2 A school club's profit, P, in dollars, from selling x concert tickets is $P(x) = -2(x-15)^2 + 450$. Find the vertex and zeros. Interpret each value in this situation.

WORK SPACE

ANSWER ______________________

CHALLENGE One step up

CHALLENGE

A stage prop's height, h, in feet, is modeled by $h(t) = -5(t-1)(t-11)$, where t is time in seconds. Find the zeros and vertex. Explain why the vertex occurs at that time.

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ANSWER KEY **Parabola Peak Hunt** HIGH SCHOOL · MA.912.AR.3.6

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the vertex and zeros of y = (x-7)^2 - 49.	**Vertex: (7, -49). Zeros: x = 0 and x = 14.**
2	Find the vertex and zeros of y = -2(x+5)^2 + 18.	**Vertex: (-5, 18). Zeros: x = -8 and x = -2.**
3	Find the vertex and zeros of y = x^2 - 24x + 143.	**Vertex: (12, -1). Zeros: x = 11 and x = 13.**
4	Find the vertex and zeros of y = -x^2 + 22x - 120.	**Vertex: (11, 1). Zeros: x = 10 and x = 12.**
5	Find the vertex and zeros of y = 5(x+2)^2 - 45.	**Vertex: (-2, -45). Zeros: x = -5 and x = 1.**
6	Find the vertex and zeros of y = 2x^2 - 30x + 112.	**Vertex: (15/2, -1/2). Zeros: x = 7 and x = 8.**

PART 2 · APPLY IT

1. **Vertex: (2, 144). Zeros: t = -1 and t = 5. The rocket reaches a maximum height of 144 feet after 2 seconds. It hits the ground after 5 seconds, and t = -1 is not meaningful in this situation.** Factor h(t) as -16(t-5)(t+1) to find the zeros. Use t = 2, the midpoint of the zeros, to find the maximum height.
2. **Vertex: (15, 450). Zeros: x = 0 and x = 30. The greatest profit is $450 when 15 tickets are sold. The club breaks even at 0 tickets and 30 tickets.** The equation is in vertex form, so the vertex gives the maximum profit. Set P(x) equal to 0, then solve (x-15)^2 = 225 for the break-even ticket amounts.

CHALLENGE

Zeros: t = 1 and t = 11. Vertex: (6, 125). The zeros are equally spaced around t = 6, so the axis of symmetry is t = 6. At t = 6, the prop reaches its maximum height of 125 feet.

Accept zeros in either order and equivalent coordinate notation. For the rocket problem, students should list both algebraic zeros but identify only the nonnegative time as physically meaningful.