

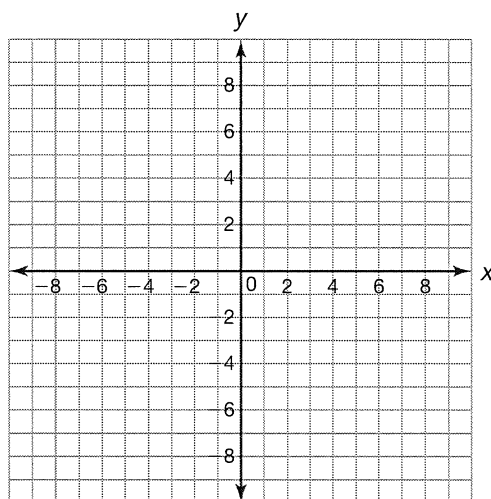
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Just Watch That Pumpkin Fly! Investigating the Vertex of a Quadratic Function

Vocabulary

Graph the quadratic function. Plot and label the vertex. Then draw and label the axis of symmetry. Explain how you determine each location.

$$h(t) = t^2 + 2t - 3$$



Problem Set

Write a function that represents the vertical motion described in each problem situation.

1. A catapult hurls a watermelon from a height of 36 feet at an initial velocity of 82 feet per second.


$$h(t) = -16t^2 + v_0t + h_0$$

$$h(t) = -16t^2 + 82t + 36$$

2. A catapult hurls a cantaloupe from a height of 12 feet at an initial velocity of 47 feet per second.

3. A catapult hurls a pineapple from a height of 49 feet at an initial velocity of 110 feet per second.
4. A basketball is thrown from a height of 7 feet at an initial velocity of 58 feet per second.
5. A soccer ball is thrown from a height of 25 feet at an initial velocity of 46 feet per second.
6. A football is thrown from a height of 6 feet at an initial velocity of 74 feet per second.

Identify the vertex and the equation of the axis of symmetry for each vertical motion model.

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7. A catapult hurls a grapefruit from a height of 24 feet at an initial velocity of 80 feet per second.
The function $h(t) = -16t^2 + 80t + 24$ represents the height of the grapefruit $h(t)$ in terms of time t .
The vertex of the graph is $(2.5, 124)$.
The axis of symmetry is $x = 2.5$.
 8. A catapult hurls a pumpkin from a height of 32 feet at an initial velocity of 96 feet per second.
The function $h(t) = -16t^2 + 96t + 32$ represents the height of the pumpkin $h(t)$ in terms of time t .
 9. A catapult hurls a watermelon from a height of 40 feet at an initial velocity of 64 feet per second.
The function $h(t) = -16t^2 + 64t + 40$ represents the height of the watermelon $h(t)$ in terms of time t .
 10. A baseball is thrown from a height of 6 feet at an initial velocity of 32 feet per second. The function $h(t) = -16t^2 + 32t + 6$ represents the height of the baseball $h(t)$ in terms of time t .

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11. A softball is thrown from a height of 20 feet at an initial velocity of 48 feet per second. The function $h(t) = -16t^2 + 48t + 20$ represents the height of the softball $h(t)$ in terms of time t .
12. A rocket is launched from the ground at an initial velocity of 112 feet per second. The function $h(t) = -16t^2 + 112t$ represents the height of the rocket $h(t)$ in terms of time t .

Determine the axis of symmetry of each parabola.

13. The
- x
- intercepts of a parabola are
- $(3, 0)$
- and
- $(9, 0)$
- .

$$\frac{3 + 9}{2} = \frac{12}{2} = 6$$

The axis of symmetry is $x = 6$.

14. The
- x
- intercepts of a parabola are
- $(-3, 0)$
- and
- $(1, 0)$
- .

15. The
- x
- intercepts of a parabola are
- $(-12, 0)$
- and
- $(-2, 0)$
- .

16. Two symmetric points on a parabola are
- $(-1, 4)$
- and
- $(5, 4)$
- .

17. Two symmetric points on a parabola are
- $(-4, 8)$
- and
- $(2, 8)$
- .

18. Two symmetric points on a parabola are (3, 1) and (15, 1).

Determine the vertex of each parabola.

19. $f(x) = x^2 + 2x - 15$

axis of symmetry: $x = -1$

The axis of symmetry is $x = -1$.

The x-coordinate of the vertex is -1 .

The y-coordinate when $x = -1$ is:

$$\begin{aligned} f(-1) &= (-1)^2 + 2(-1) - 15 \\ &= 1 - 2 - 15 \\ &= -16 \end{aligned}$$

The vertex is $(-1, -16)$.

20. $f(x) = x^2 - 8x + 7$

axis of symmetry: $x = 4$

21. $f(x) = x^2 + 4x - 12$

x-intercepts: (2, 0) and (-6, 0)

22. $f(x) = -x^2 - 14x - 45$

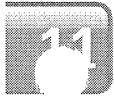
x-intercepts: (-9, 0) and (-5, 0)

23. $f(x) = -x^2 + 8x + 20$

two symmetric points on the parabola:
(-1, 11) and (9, 11)

24. $f(x) = -x^2 + 16$

two symmetric points on the parabola:
(-3, 7) and (3, 7)



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Determine another point on each parabola.

- 25.**
- The axis of symmetry is
- $x = 3$
- .

A point on the parabola is $(1, 4)$.Another point on the parabola is a symmetric point that has the same y -coordinate as $(1, 4)$. The x -coordinate is:

$$\frac{1 + a}{2} = 3$$

$$1 + a = 6$$

$$a = 5$$

Another point on the parabola is $(5, 4)$.

- 26.**
- The axis of symmetry is
- $x = -4$
- .

A point on the parabola is $(0, 6)$.

- 27.**
- The axis of symmetry is
- $x = 1$
- .

A point on the parabola is $(-3, 2)$.

- 28.**
- The vertex is
- $(5, 2)$
- .

A point on the parabola is $(3, -1)$.

- 29.**
- The vertex is
- $(-1, 6)$
- .

A point on the parabola is $(2, 3)$.

- 30.**
- The vertex is
- $(3, -1)$
- .

A point on the parabola is $(4, 1)$.