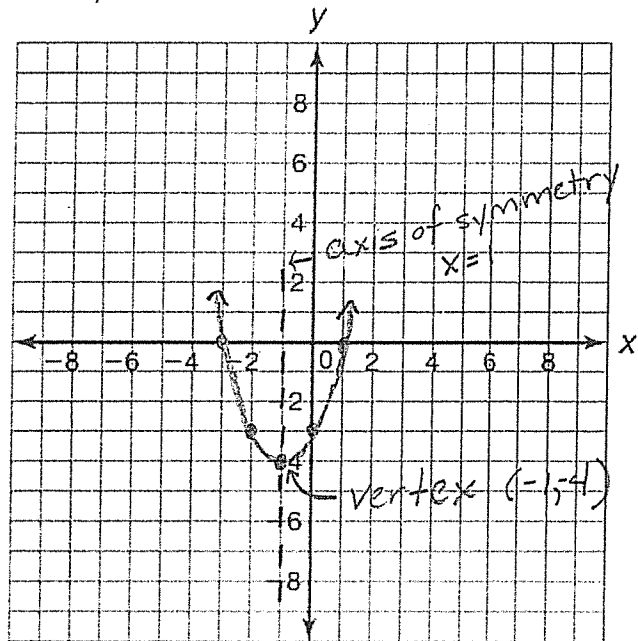


1. Graph the quadratic function. Label the vertex.
Draw and label the axis of symmetry.
How do you know which point is the vertex? How do you know where to draw the axis of symmetry?

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

t	$h(t)$
-3	0
-2	-3
-1	-4
0	-3
1	0



The vertex is the highest (maximum) or lowest (minimum) point on the parabola. The axis of symmetry is the vertical line that passes through the vertex and divides the parabola in half.

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

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

2. A catapult hurls a pineapple from a height of 49 feet at an initial velocity of 110 feet per second.

$$h(t) = -16t^2 + 110t + 49$$

3. A basketball is thrown from a height of 7 feet at an initial velocity of 58 feet per second.

$$h(t) = -16t^2 + 58t + 7$$

Use Desmos.com to identify the vertex. Then, write the equation of the axis of symmetry for each vertical motion model.

A catapult hurls a pumpkin from a height of 32 feet at an initial velocity of 96 feet per second.

4. The function $h(t) = -16t^2 + 96t + 32$ represents the height of the pumpkin $h(t)$ in terms of time t .

vertex: $(3, 176)$

axis of symmetry: $x = 3$

5. 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 .

vertex: $(1, 22)$

axis of symmetry: $x = 1$

Determine the axis of symmetry of each parabola.

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

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

Axis of symmetry: $x = -1$

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

$$\frac{-1+5}{2} = \frac{4}{2} = 2$$

Axis of symmetry: $x = 2$

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

$$\frac{-12+(-2)}{2} = \frac{-14}{2} = -7$$

Axis of symmetry: $x = -7$

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

$$\frac{-4+2}{2} = \frac{-2}{2} = -1$$

Axis of symmetry: $x = -1$

Determine the vertex of each parabola.

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

axis of symmetry: $x = -1$

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

Vertex: $(-1, -16)$

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

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

$$\begin{aligned} \frac{2+(-6)}{2} &= \frac{-4}{2} = -2 & f(-2) &= (-2)^2 + 4(-2) - 12 \\ & & &= 4 - 8 - 12 \\ & & &= -16 \end{aligned}$$

Vertex: $(-2, -16)$

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

two symmetric points on the parabola:

$(-1, 11)$ and $(9, 11)$

$$\begin{aligned} \frac{-1+9}{2} &= \frac{8}{2} = 4 & f(4) &= -(4)^2 + 8(4) + 20 \\ & & &= -16 + 32 + 20 \\ & & &= 36 \end{aligned}$$

Vertex: $(4, 36)$