

**Opportunity to Learn: Complete all questions that are visible.**

1. Sketch graphs of all three relations on the same set of axes. Label the  $x$ -intercepts, vertex, and axis of symmetry for each parabola. Then, describe the similarities and differences between the graphs.

a)  $y = (x + 3)(x - 1)$   
 b)  $y = 2(x + 3)(x - 1)$   
 c)  $y = -2(x + 3)(x - 1)$

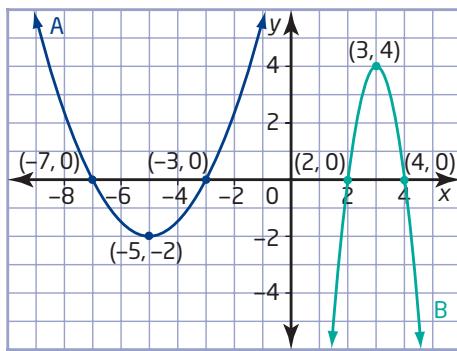
2. Sketch graphs of all three relations on the same set of axes. Label the  $x$ -intercepts, vertex, and axis of symmetry for each parabola. Then, describe the similarities and differences between the graphs.

a)  $y = (x - 4)(x - 8)$   
 b)  $y = \frac{1}{2}(x - 4)(x - 8)$   
 c)  $y = \frac{1}{4}(x - 4)(x - 8)$

3. Sketch each parabola. Label the  $x$ -intercepts and vertex.

a)  $y = (x - 6)(x - 2)$   
 b)  $y = -(x + 3)(x + 7)$   
 c)  $y = 2(x - 3)(x + 2)$   
 d)  $y = -2(x - 4)(x + 2)$

5. Determine an equation in the form  $y = a(x - r)(x - s)$  to represent each parabola. Consider the vertex and  $x$ -intercepts.



**Connect and Apply**

6. You investigated the graphs of  $y = (x - h)^2$  in Section 4.3. Consider the quadratic relation  $y = (x - 5)^2$ .

a) Write the coordinates of the vertex of the parabola.  
 b) How many  $x$ -intercepts does the parabola have?  
 c) Rewrite the equation in the form  $y = a(x - r)(x - s)$ .

7. A parabola has equation  $y = (x + 2)^2$ .

a) Write its  $x$ -intercepts.  
 b) Determine the coordinates of its vertex.

8. The predicted flight path of a toy rocket is defined by the relation  $h = -2(d - 3)(d - 15)$ , where  $d$  is the horizontal distance, in metres, from a safety wall, and  $h$  is the height, in metres, above the ground.

a) Sketch a graph of the path of the rocket.  
 b) How far from the wall is the rocket when it lands on the ground?  
 c) What is the maximum height of the rocket, and how far, horizontally, is it from the wall at that moment?

—

**10.** A soccer ball is kicked from a point 23 m to the left of the halfway line and lands at a point 17 m to the right of the halfway line. It reaches a maximum height of 10 m during its parabolic flight.

- a)** Sketch a graph to show the flight of the soccer ball if the halfway line passes through the origin.
- b)** Determine an equation to represent the path of the soccer ball.

**11.** The Ambassador Bridge is a suspension bridge that crosses the Detroit River and connects Windsor, Ontario, to Detroit, Michigan. The two towers that support the centre span of cables rise 118 m above the river and are 564 m apart. The cable reaches its lowest point approximately 46 m above the river.

- a)** Sketch a graph to show the curve of the cable if the origin is centred under the lowest point of the cable at the river's surface.
- b)** Determine an equation to represent the curve of the cables in the form  $y = a(x - r)(x - s)$ , if possible. If not, explain why.

