

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) $y = -2(x + 3)(x - 1)$

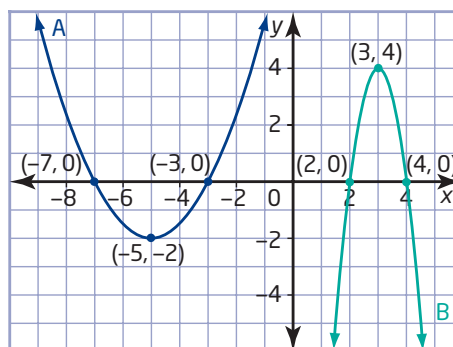
2. Sketch graphs of all three relations on the same set of axes. Label the x-intercepts, vertex, and axis of symmetry for each parabola. Then, describe the similarities and differences between the graphs.

- 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.
- Sketch a graph to show the flight of the soccer ball if the halfway line passes through the origin.
 - 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.
- 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.
 - 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.

