

6L / CLASSROOM LESSON

Exploring parabolas

Name: _____ Class: _____ Date: _____

Today you will

- Read a parabola's vertex, symmetry line and intercepts.
- Use a quadratic model to check the shape and clearance of a structure.

Keep these ideas

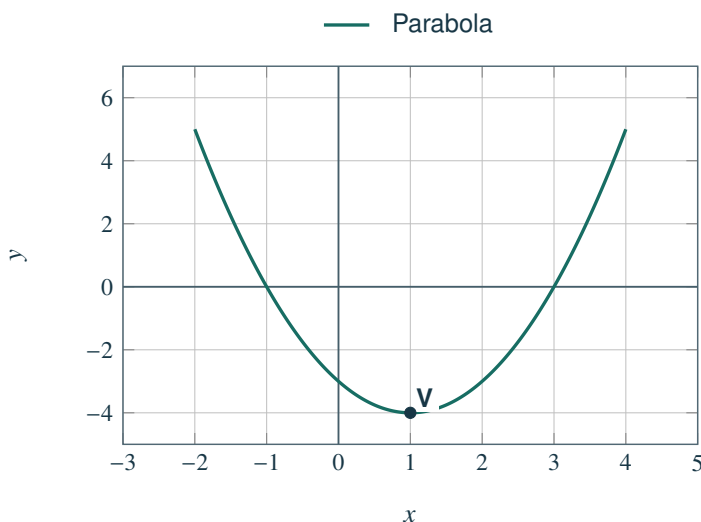
In $y = a(x - h)^2 + k$, the vertex is (h, k) and the symmetry line is $x = h$.

A positive a opens upward; a negative a opens downward. A larger $|a|$ makes the curve narrower on the same axes.

At an x -intercept, $y = 0$. Points equally far from the symmetry line have the same height.

Worked example

For $y = (x - 1)^2 - 4$, locate the vertex and find both x -intercepts.



1. At $x = 1$, the squared part is zero, so $y = -4$. The vertex is $(1, -4)$.
2. For the intercepts, $0 = (x - 1)^2 - 4$, so $(x - 1)^2 = 4$. Thus $x - 1 = 2$ or $x - 1 = -2$.

Answer

Vertex $(1, -4)$; x -intercepts $(-1, 0)$ and $(3, 0)$.

The curve shows the worked-example model; V marks its lowest point.

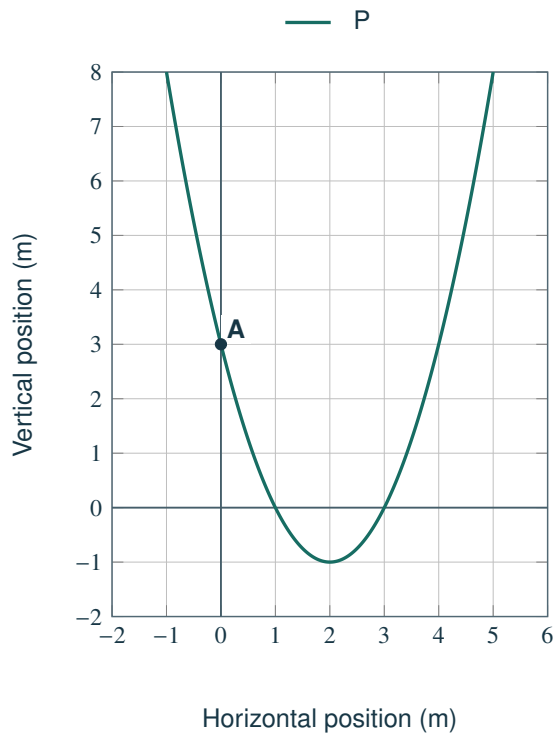
Your turn

1. For $y = -2x^2 + 8$, find y when $x = -2$.

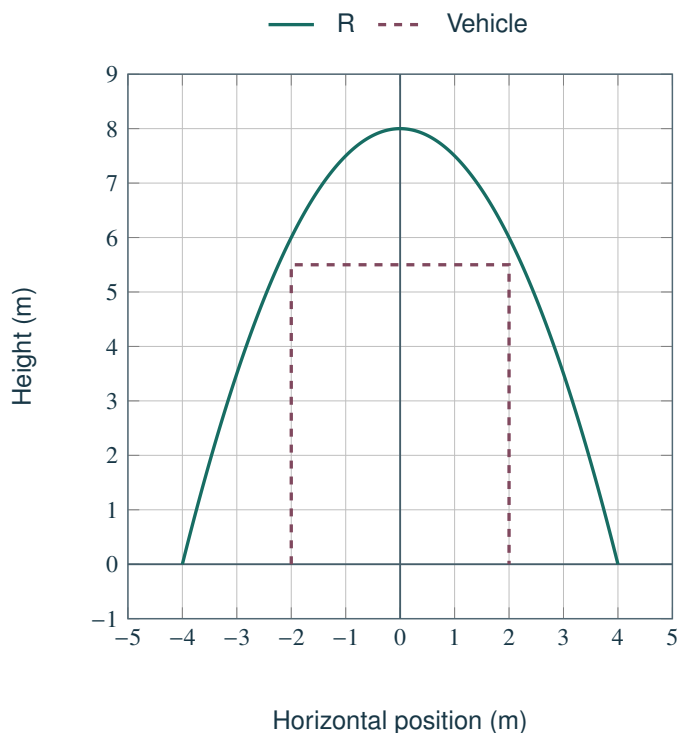
2. Compared with $y = x^2$, describe the opening direction and width of $y = \frac{1}{4}x^2$.

Apply it on the graph

Write your calculations beside each diagram. Label any points or curves you add.



Frame P is measured on site coordinates. Sensor A is at (0, 3) m.



Arch R and the vehicle cross-section for Questions 5 and 6. Ground level is $y = 0$.

3. Read frame P's vertex from the graph. Write the equation of its symmetry line.

4. On the same graph P, sensor A is at (0, 3). Give its matching point across the symmetry line and the distance between the sensors.

5. Arch R follows $y = -\frac{1}{2}x^2 + 8$, in metres. Calculate its two ground crossings and total width.

6. On the same graph R, the vehicle spans $x = -2$ to $x = 2$ and is 5.5 m high. Does it fit with 0.5 m roof clearance? Justify.