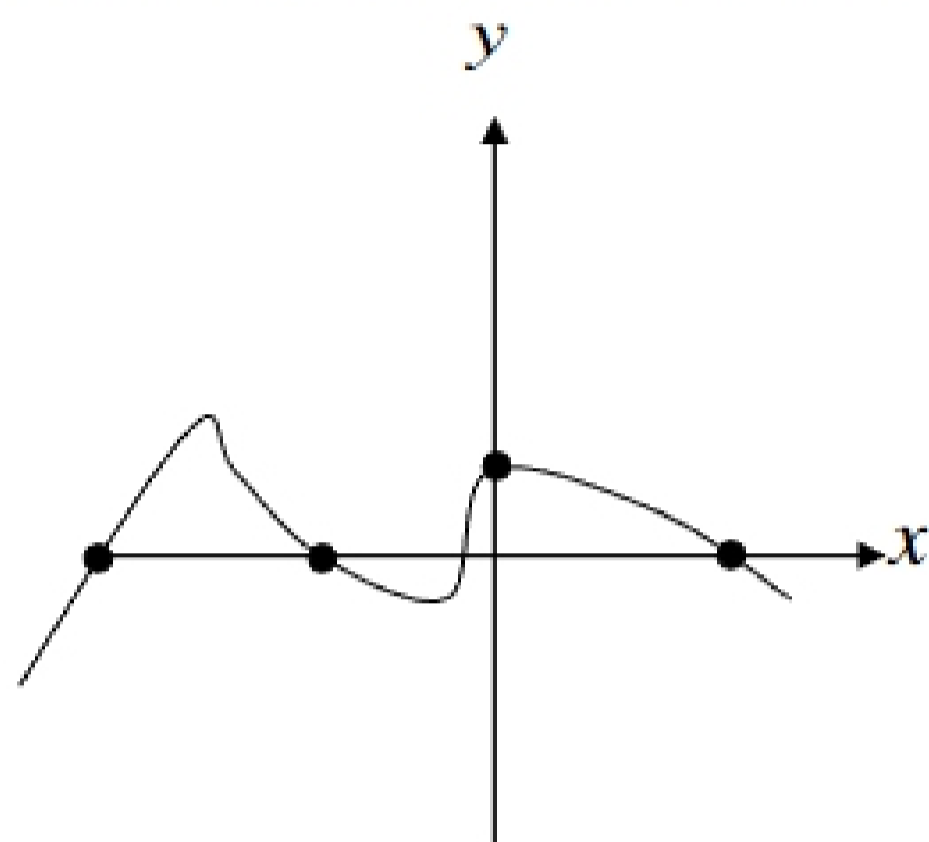


Lesson 15 Ma 152, Section 2.4 Graphs of Functions

Intercepts of Graphs: We have discussed finding the x -intercept and/or the y -intercept of a line. Similarly, any graph can have x - or y -intercepts, point(s) where the graph crosses an axis.



This graph shows 3
 x -intercepts and 1
 y -intercept.

Zero is your
friend!

Because x -intercepts have the form $(a, 0)$; to find an x -intercept, let y equal 0. Because y -intercepts have the form $(0, b)$; to find a y -intercept, let x equal 0.

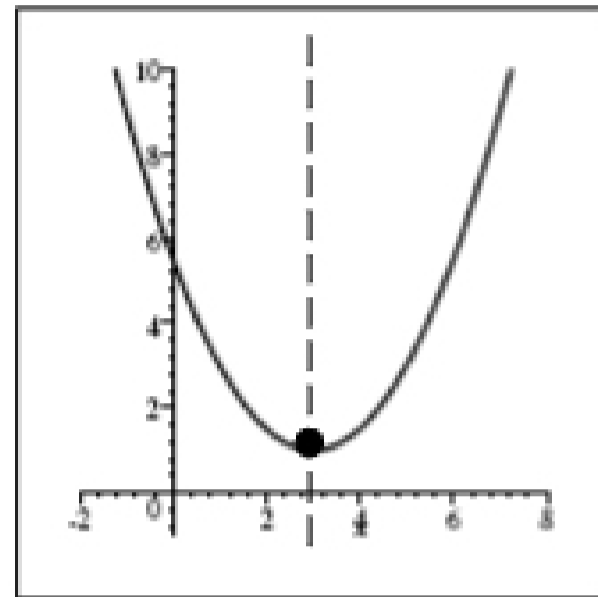
Ex 1: Find the intercepts.

a) $x = y^2 - 9$

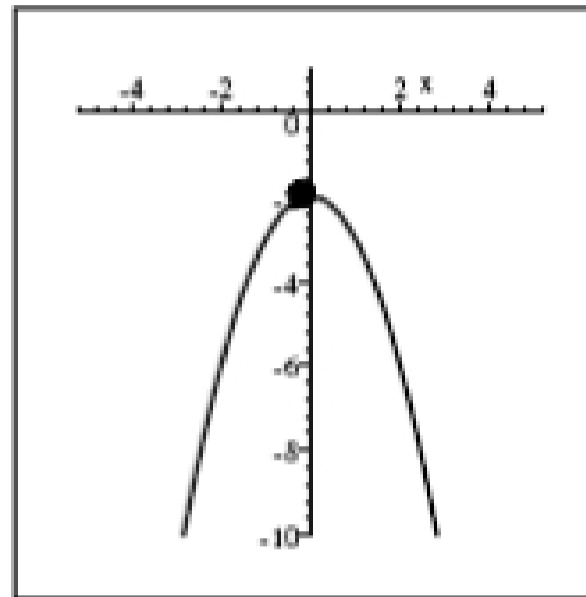
b) $y = x^2 - 10x + 21$

c) $y = x^4 - 1$

The graph of an equation of the form $y = ax^2 + bx + c$ (2^{nd} degree polynomial equation) is called a **parabola**. It has a 'U' shape, such as the examples below. The point where the 'turn' occurs is called the **vertex**. A vertical line through the vertex is called the **axis of symmetry** because it divides the parabola into two congruent halves.



$$y = \frac{1}{2}x^2 - 3x + \frac{11}{2}$$

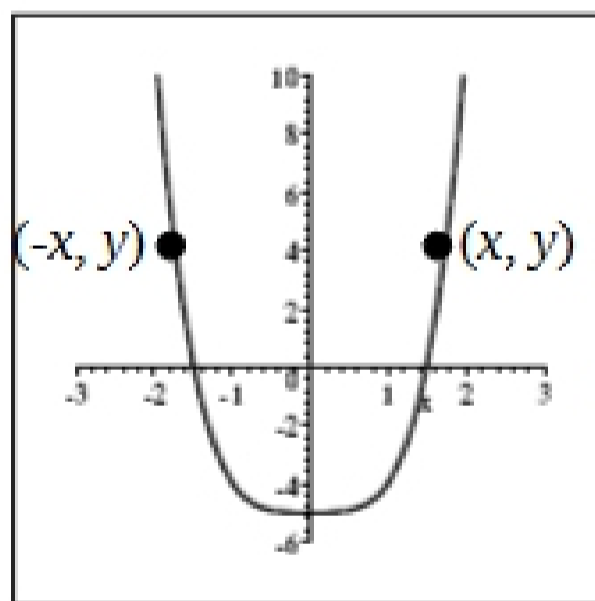


$$y = -x^2 - 2$$

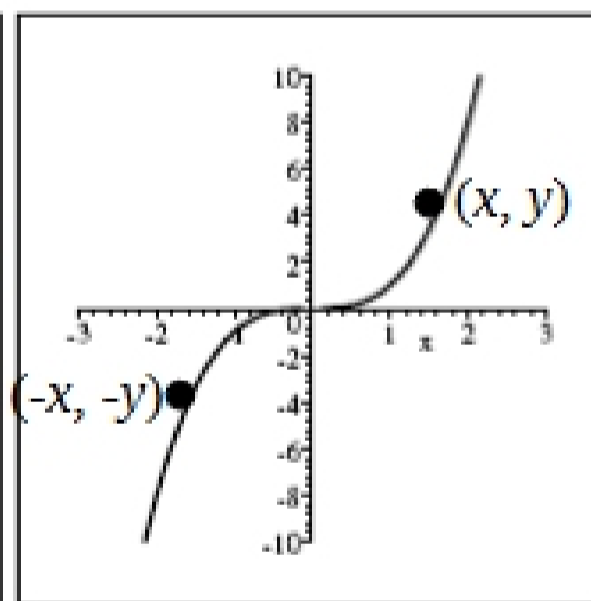
Symmetries of Graphs: There are 3 types of symmetries possible for a graph.

1. If for every point (x, y) of a graph there exists a point $(-x, y)$, the graph has **symmetry about the y-axis**.
2. If for every point (x, y) of a graph there exists a point $(-x, -y)$, the graph has **symmetry about the origin**.
3. If for every point (x, y) of a graph there exists a point $(x, -y)$, the graph has **symmetry about the x-axis**.

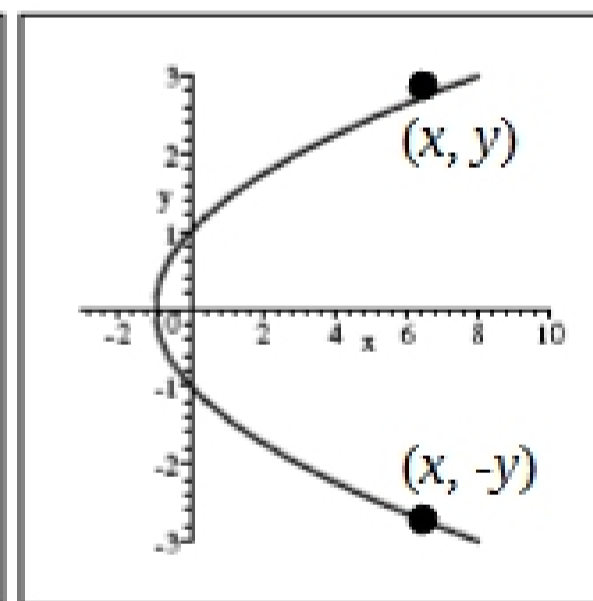
The graphs below show each type of symmetry.



symmetry about the y-axis



symmetry about the origin



symmetry about the x-axis

How to test for symmetry:

1. To test for symmetry about the y-axis: Replace the x in the equation with $(-x)$. If the resulting equation is equivalent to the original equation, the graph is symmetric about the y-axis.
2. To test for symmetry about the origin: Replace the x in the equation with $(-x)$ **and** the y with $(-y)$. If the resulting equation is equivalent to the original one, the graph is symmetric about the origin.
3. To test for symmetry about the x-axis: Replace the y in the equation with $(-y)$. If the resulting equation is equivalent to the original equation, the graph is symmetric about the x-axis.

4. Ex 2: Test each equation for any symmetry.

a) $y^2 + 1 = x$

b) $y = 2x^2 + x^4 - 1$

c) $y = 2x^3 + x$

d) $y = x^2 - x$

Most equations we've discussed so far have been polynomial equations (including those that graphed are parabolas) or linear equations. There are other types of equations.

Absolute Value equations: A basic absolute value equation is $y = |x|$.

Square Root equations: A basic square root equation is $y = \sqrt{x}$.

| |
|--|
| An absolute value equation will have a V shape. A square root equation will have an 'endpoint' with a curve flowing from the endpoint. |
|--|

Graphing Equations:

Use the following steps to graph an equation.

1. Find any intercepts.
2. Find any symmetries.
3. Perhaps, find some other points (as needed).
4. Connect points in a smooth curve (unless a line or absolute value equation).