Section 1.2

The **graph** of a relation defined as an equation is the set of all points (x, y) in the plane whose coordinates satisfy the equation.

An ***x*-intercept** is any point (a, 0) where the graph intersects the X- AXIS.

To find: set y=0 and solve for x

A ***y*-intercept** is any point (0, b) where the graph intersects the Y- AXIS.

To find: set x=0 and solve for y

Find the intercepts of $y = 2x^2 - 9x + 5$ analytically.

x-intercepts:

$y = 0$

$0 = 2x^2 - 9x + 5$

$x = \dfrac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(5)}}{2(2)}$

$= \dfrac{9 \pm \sqrt{41}}{4}$ $\left(\dfrac{9 \pm \sqrt{41}}{4}, 0 \right)$

$\approx$

```
(9+√(41))/4
        3.850781059
(9-√(41))/4
        .6492189406
```

y-intercepts:

$x = 0$

$y = 2(0)^2 - 9(0) + 5$

$= 5$

$(0, 5)$

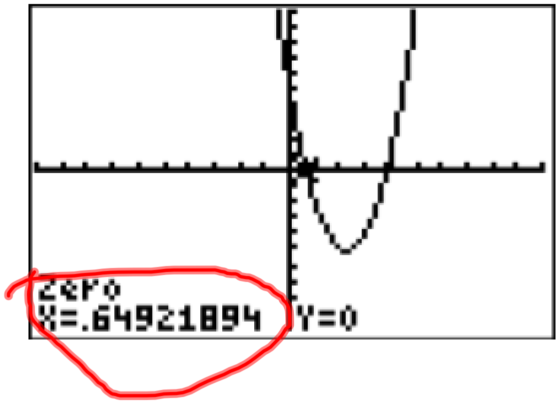
On the TI-84, we find *x*-intercepts using the **zero** command.

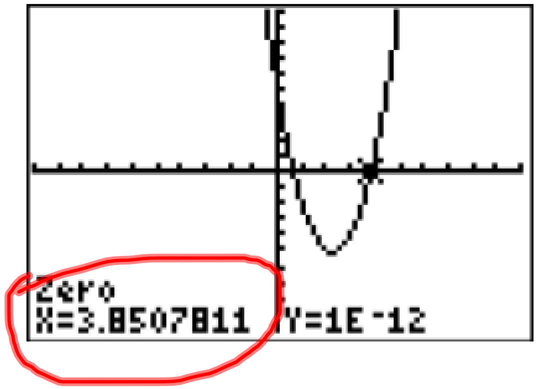
Key sequence: 2nd CALC 2:

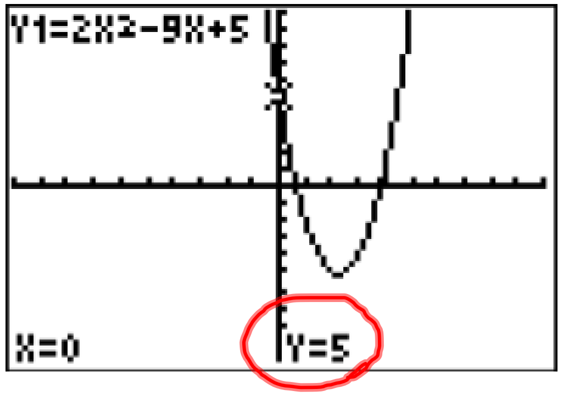
On the TI-84, we find *y*-intercepts using the **value** command with $x = 0$.

Key sequence: 2nd CALC 1: 0 ENTER

Find the intercepts of $y = 2x^2 - 9x + 5$ graphically.



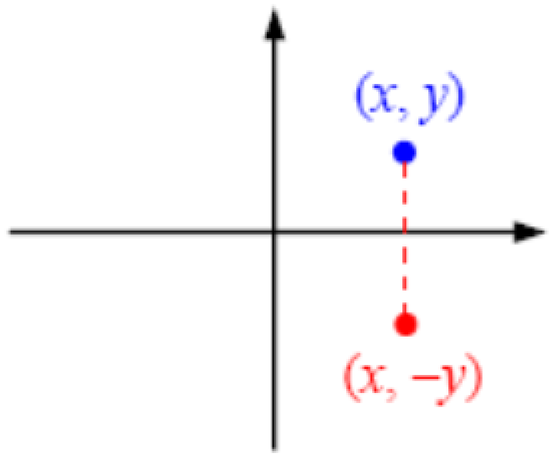




Symmetry

In mathematics, we use the word *symmetry* to describe the property that one part of a graph is a mirror image, or reflection, of another part in some way.

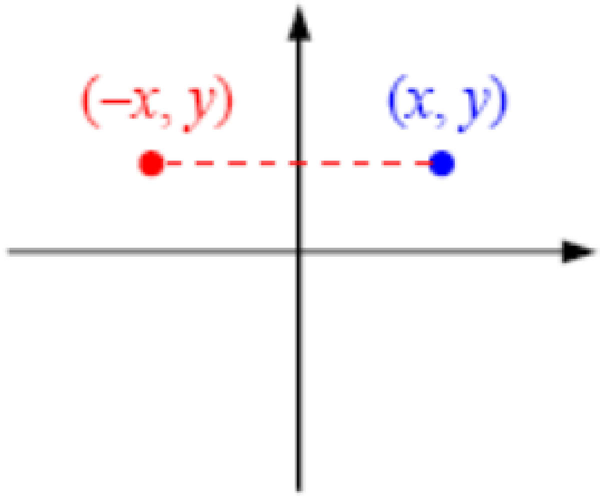
The graph of a relation R is **symmetric with respect to the *x*-axis** if, whenever (x, y) is a point on the graph, $(x, -y)$ is also a point on the graph.



For every point above the x-axis there is a corresponding point directly below the x-axis an equal but opposite distance away.

Test: Replacing y with its opposite $-y$ does not change the equation.

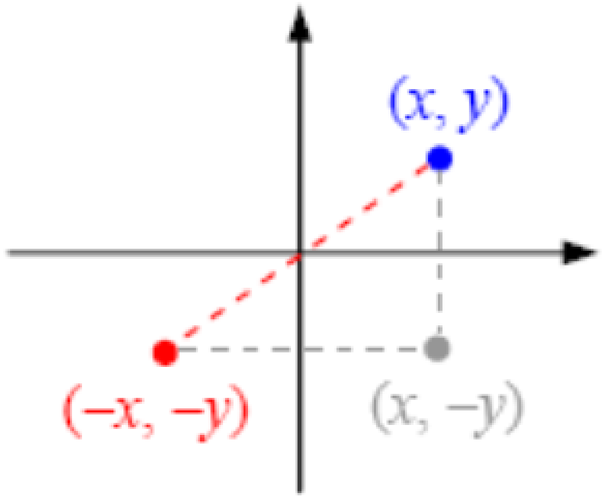
The graph of a relation R is **symmetric with respect to the *y*-axis** if, whenever (x, y) is a point on the graph, $(-x, y)$ is also a point on the graph.



For every point to the right of the y-axis there is a corresponding point to the left of the y-axis an equal but opposite distance away.

Test: Replacing x with its opposite $-x$ does not change the equation.

The graph of a relation R is **symmetric with respect to the origin** if, whenever (x, y) is a point on the graph, $(-x, -y)$ is also a point on the graph.



Every point has a mirror image directly across the origin an equal distance away. Origin symmetry is actually a combination of both x-axis and y-axis symmetry.

Test: Replacing x with $-x$ and y with $-y$ does not change the equation.

To test for symmetry, we replace x with $-x$ and/or y with $-y$, simplify, and see if the equation remains unchanged.

Test $x+\sqrt{5-y^2}=0$ for symmetry.

X-AXIS

$x+\sqrt{5-(-y)^2}=0$

$x+\sqrt{5-y^2}=0$

SAME!

HAS X-AXIS SYMM.

Y-AXIS

$-x+\sqrt{5-y^2}=0$

MULT BY -1

$x-\sqrt{5-y^2}=0$

NOT SAME

NO Y-AXIS SYMM

ORIGIN

$-x+\sqrt{5-(-y)^2}=0$

$-x+\sqrt{5-y^2}=0$

NOT SAME

NO ORIGIN SYMM

Test $2x = x^3 - 4y$ for symmetry.

X-AXIS

USE $-y$

$2x = x^3 - 4(-y)$

$2x = x^3 + 4y$

FAILS

y-AXIS

USE $-x$

$2(-x) = (-x)^3 - 4y$

$-2x = -x^3 - 4y$

FAILS

ORIGIN

USE $-x$ AND $-y$

$2(-x) = (-x)^3 - 4(-y)$

$-2x = -x^3 + 4y$

MULT BY -1

$2x = x^3 - 4y$ SAME!

HAS ORIGIN SYMM.