

What is the relationship between an equation and its graph?

Quick Check

1. Sketch the graph of the equation $y = -3x + 7$.
2. Identify three points that lie on this graph.
3. How do you know that these points actually lie on the graph? Explain.

Conclusion

Fundamental principle of analytic geometry:

A point (x, y) lies on the graph of an equation if and only if its coordinates satisfy the equation. In other words, the set of all solution points is the graph of the equation.

Sketch the graph by point plotting

$$y = x^2 - 2$$

Advantage:

Easy and good enough for simple functions and hints of the graph.

Disadvantage:

To get a good idea of the graph, you may need to plot many points.

Use point plotting to sketch the graph of the following equation:

$$y = \frac{1}{30}x(39 - 10x^2 + x^4)$$

Verify whether the points $(-3, -3)$, $(-1, -1)$, $(0, 0)$, $(1, 1)$, $(3, 3)$ lie on the graph of the above equation, then sketch its graph.

Graphing Calculator

Notice: Work along with the instructor step-by-step.

Graph the following equation in the given window size and note observations about the graph.

$$y = x^3 - 150x$$

| Step | Window Size |
|------|--------------------------|
| 1 | [-5,5] by [-5,5] |
| 2 | [-20,20] by [-20,20] |
| 3 | [-20,20] by [-500,500] |
| 4 | [-20,20] by [-1000,1000] |

Lessons Learned

1. Be careful! Choose the graph that fits the context of the problem.
2. Identify some features of the graph analytically and check what you see.

→ What are these features of the graph that we may check quickly?

1. Intercepts

- useful in graphing an equation
- are points where the graph crosses the x - or y -*axis*.

x -intercept:

y -intercept:

How many intercepts can the graph of one equation have?

Find all intercepts.

1. $y = x^3 - 4x$

2. $x = y^2 - 4$

2. Symmetry

How is Symmetry helpful in sketching a graph or solving an equation?

- You need half as many points to sketch the graphor even less.
- Symmetry can highlight additional solutions without computation.



→ Create an example to illustrate each of the above answers.

Test For Symmetry

Symmetry

$x - axis$

$y - axis$

Origin

Graph?

How can I check?

→ Which of the above symmetries does the graph of $y = 2x^3 - x$ have?