Quantum Math

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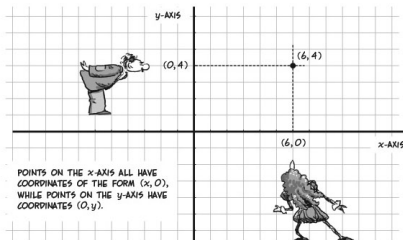August 2025

Algebra

Algebra Overview

- Functions
- Transformations
- Polynomials
- Rational Functions
- Exponentials and Logarithms

Cartesian Coordinates

Some text

THE HORIZONTAL NUMBER LINE IS OFTEN CALLED THE x-AXIS AND THE VERTICAL NUMBER LINE THE y-AXIS. THE TWO NUMBERS OF A POINT'S ADDRESS ARE CALLED ITS x-COORDINATE AND ITS y-COORDINATE. TO FIND A POINT'S x-COORDINATE, FOLLOW A VERTICAL LINE FROM THE POINT TO THE x-AXIS; TO FIND ITS y-COORDINATE, GO HORIZONTALLY FROM THE POINT TO THE y-AXIS.

POINTS ON THE x-AXIS ALL HAVE COORDINATES OF THE FORM $(x, 0)$, WHILE POINTS ON THE y-AXIS HAVE COORDINATES $(0, y)$.

IF A CITY WERE LAID OUT LIKE THIS (AND MANY ARE—CHECK OUT A MAP OF NEW YORK CITY'S MANHATTAN), YOU MIGHT SAY THAT THE POINT (x, y) IS AT THE INTERSECTION OF x AVENUE AND y STREET. OF COURSE, OUR "CITY" HAS FRACTIONAL AND IRRATIONAL STREETS, TOO...

MEET ME AT THE CORNER OF π AND $\frac{1,269,571}{896}$ ...

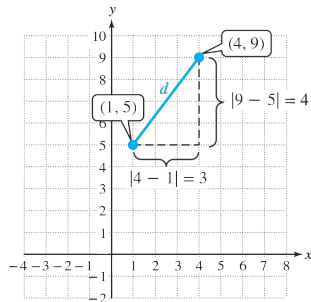# Measuring Distance - Pythagorean Theorem

Pythagorean Theorem:

$$a^2 + b^2 = c^2$$

For example:

$$d^2 = 3^2 + 4^2$$
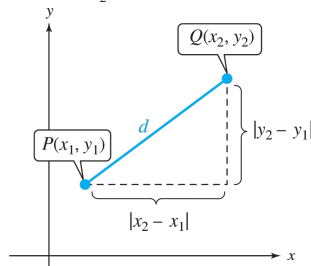$$d^2 = 9 + 16 = 25$$
$$d = \sqrt{25} = 5$$

More generally for two points $P(x_1, y_1)$ and $Q(x_2, y_2)$

$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

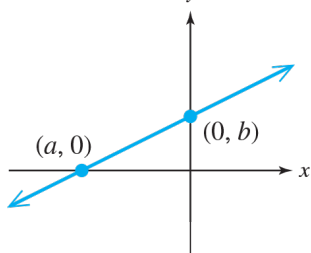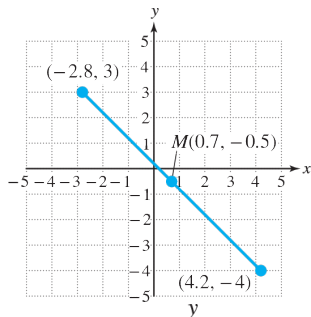Noting that $\mid a \mid = (a)^2$:

Midpoints and Intercepts

Midpoint:

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_2 + y_1}{2} \right)$$

Intercepts:

Two key features of a graph are where the graph intersects the x and y axes, the x-intercept and y-intercept, respectively.

$(-2.8, 3)$

$M(0.7, -0.5)$

$(4.2, -4)$

$(a, 0)$

$(0, b)$

The Circle

A circle is a set of all points that are equidistant from a fixed point called the center (h, k). The distance from any point on the circle to the center is called the radius (r)

$$r = \sqrt{(x - h)^2 + (y - k)^2}$$

Equation of a circle:
Standard form: $(x - h)^2 + (y - k)^2 = r^2$

Expand binomials:
$$x^2 - hx + h^2 + y^2 - ky + k^2 - r^2 = 0$$

General form:
$$x^2 + y^2 - hx - ky + (h^2 + k^2 - r^2) = 0$$
$$\text{or}$$
$$x^2 + y^2 + Ax + By + C = 0$$