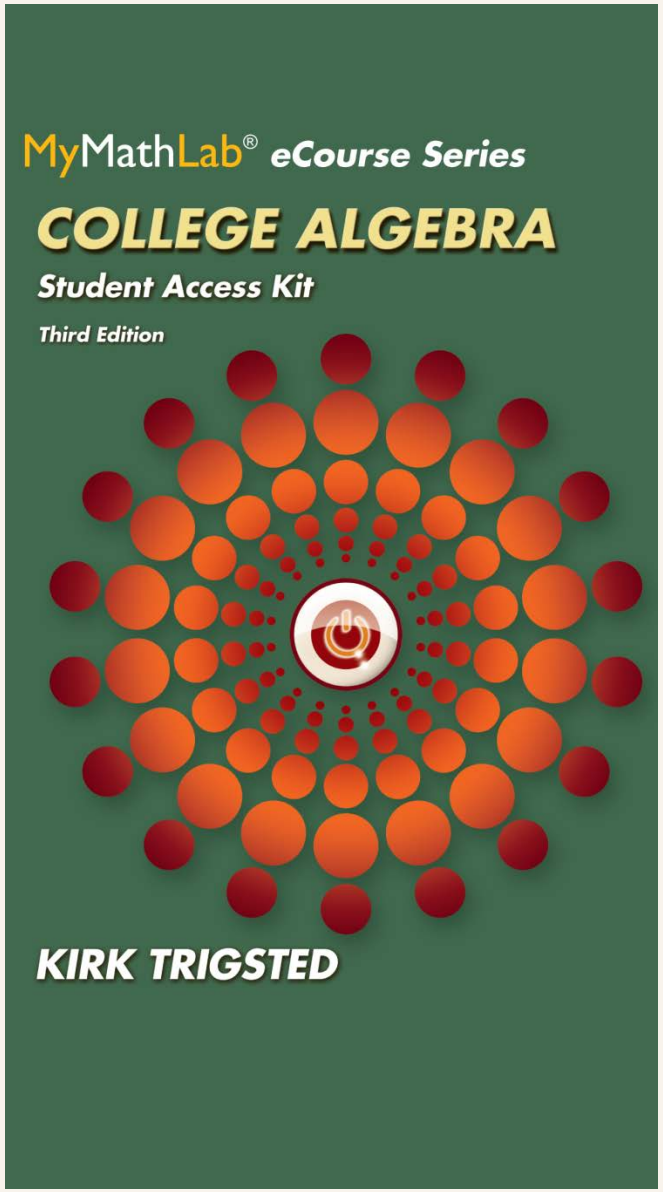
Topic 2.1

The Rectangular Coordinate System



OBJECTIVES

1. Plotting Ordered Pairs
2. Graphing Equations by Plotting Points
3. Finding the Midpoint of a Line Segment Using the Midpoint Formula
4. Finding the Distance between Two Points Using the Distance Formula

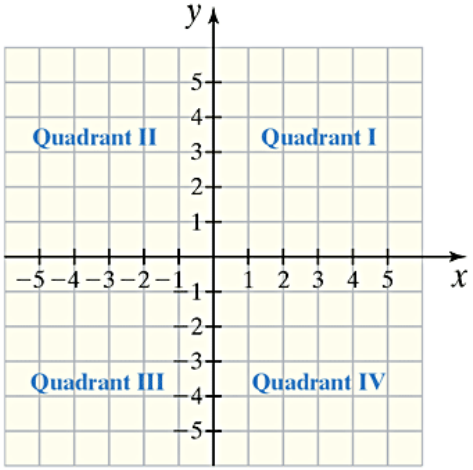
Plotting Ordered Pairs

DEFINITION: Ordered Pair

A pair of numbers, that is, an x-value and a y-value for which an equation is true; the order does matter.

DEFINITION: Cartesian Plane

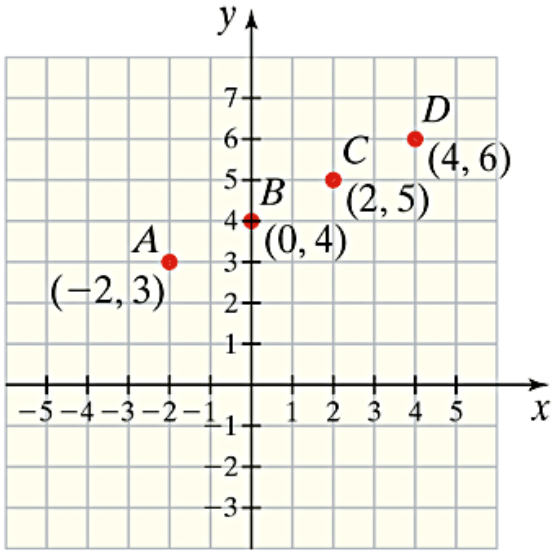
Also called a coordinate plane, it is a plane with two axes, horizontal and vertical, that intersect at the origin and divide the plane into four quadrants.



Plotting Ordered Pairs

EXAMPLE

Plot the ordered pairs $(-2,3)$, $(0,4)$, $(2,5)$, and $(4,6)$.



A: Quadrant II

B: *y*-axis

C: Quadrant I

D: Quadrant I

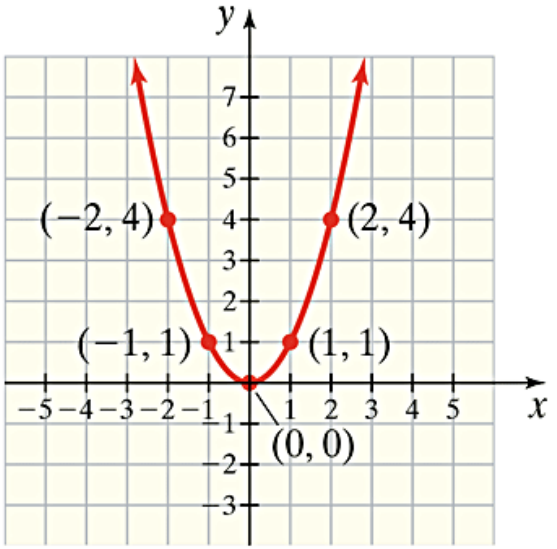
Graphing Equations by Plotting Points

EXAMPLE

Sketch the graph of $y = x^2$.

Choose arbitrary x-values and solve for corresponding values of y

x	$y = x^2$	Ordered pair that lies on the graph of $y = x^2$
-2	4	$(-2, 4)$
-1	1	$(-1, 1)$
0	0	$(0, 0)$
1	1	$(1, 1)$
2	4	$(2, 4)$

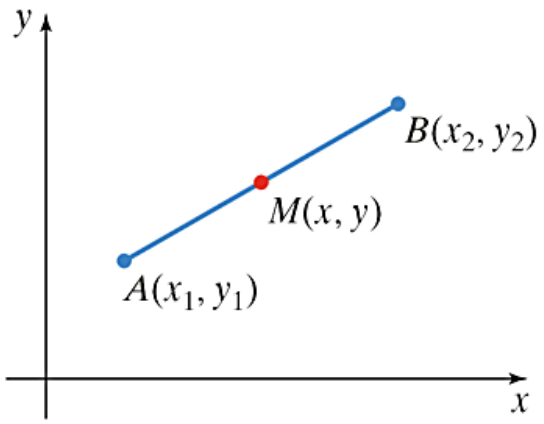


Finding the Midpoint of a Line Segment Using the Midpoint Formula

DEFINITION: Midpoint Formula

The midpoint of the line segment from $A(x_1, y_1)$ to $B(x_2, y_2)$ is

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



Finding the Midpoint of a Line Segment Using the Midpoint Formula

EXAMPLE

Find the midpoint of the segment from $(-3,2)$ to $(4,6)$.

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

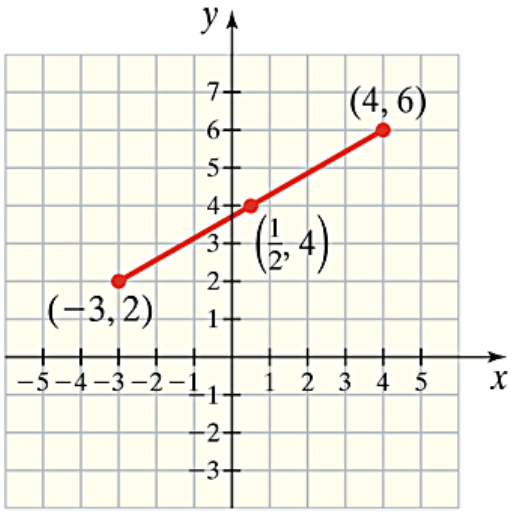
Midpoint Formula

$$\left(\frac{-3+4}{2},\frac{2+6}{2}\right)$$

Substitute values

$$\left(\frac{1}{2},4\right)$$

Simplify



Finding the Distance Between Two Points Using the Distance Formula

DEFINITION: Distance Formula

The distance between any two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by the formula

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

Finding the Distance Between Two Points Using the Distance Formula

EXAMPLE

Find the distance, $d(A,B)$, between the points A and B

$$A(-1,5); B(4,-5)$$

$$d(A,B) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$ Distance formula

$$= \sqrt{(4-(-1))^2 + (-5-5)^2}$$ Substitute in the distance formula

$$= \sqrt{5^2 + (-10)^2}$$ Combine terms

$$= \sqrt{25+100}$$ Simplify

$$= \sqrt{125}$$ Add

$$= 5\sqrt{5}$$ Simplify the radical

Finding the Distance Between Two Points Using the Distance Formula

EXAMPLE continued

The distance between the two given points is $d(A,B) = 5\sqrt{5}$ units.