MATH 1010 ~ Intermediate Algebra

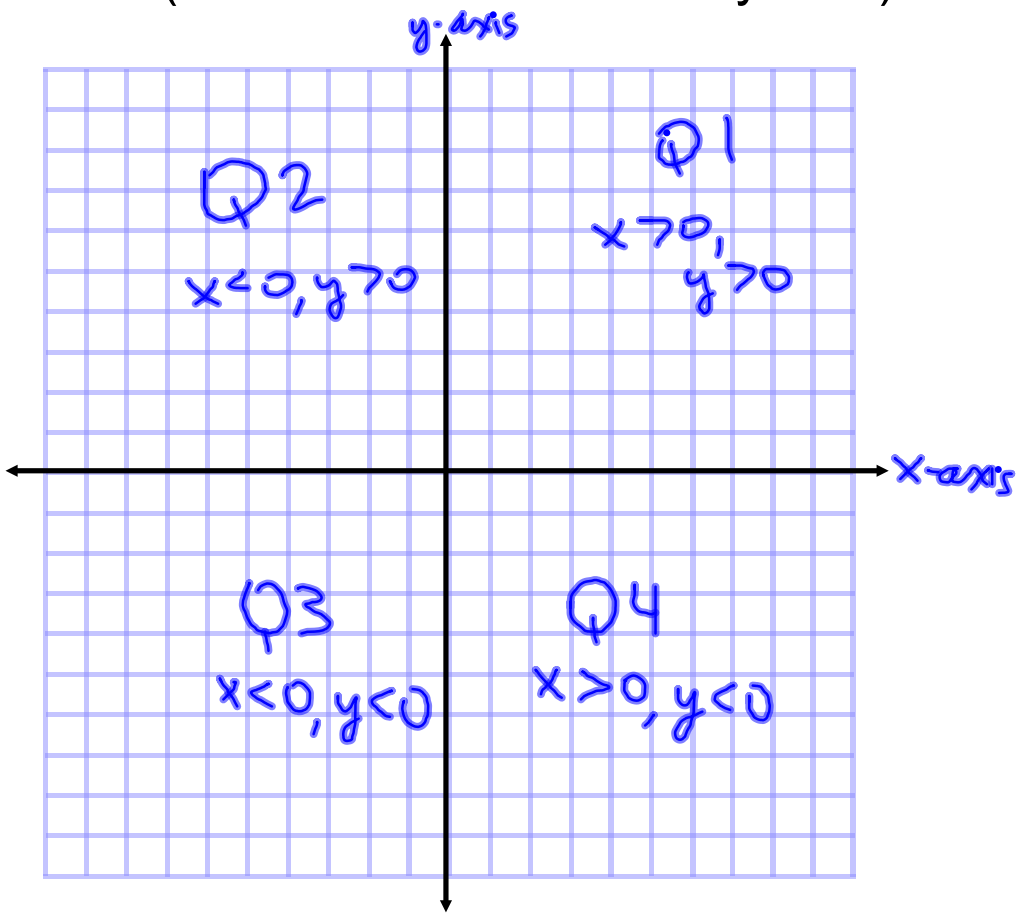
Chapter 3: GRAPHS AND FUNCTIONS

## Section 3.1: The Rectangular Coordinate System

### Objectives:

- Plot points on a rectangular coordinate system.
- Determine whether an ordered pair is a solution of an equation.
- Use the Distance Formula to find the distance between two points.
- Use the Midpoint Formula to find the midpoint of a segment.

# Rectangular Coordinate System
# (Cartesian Coordinate System)




origin
point (0,0)

x-axis horizontal

y-axis vertical

Quadrants

Ordered pair
(x, y)

# Plotting points

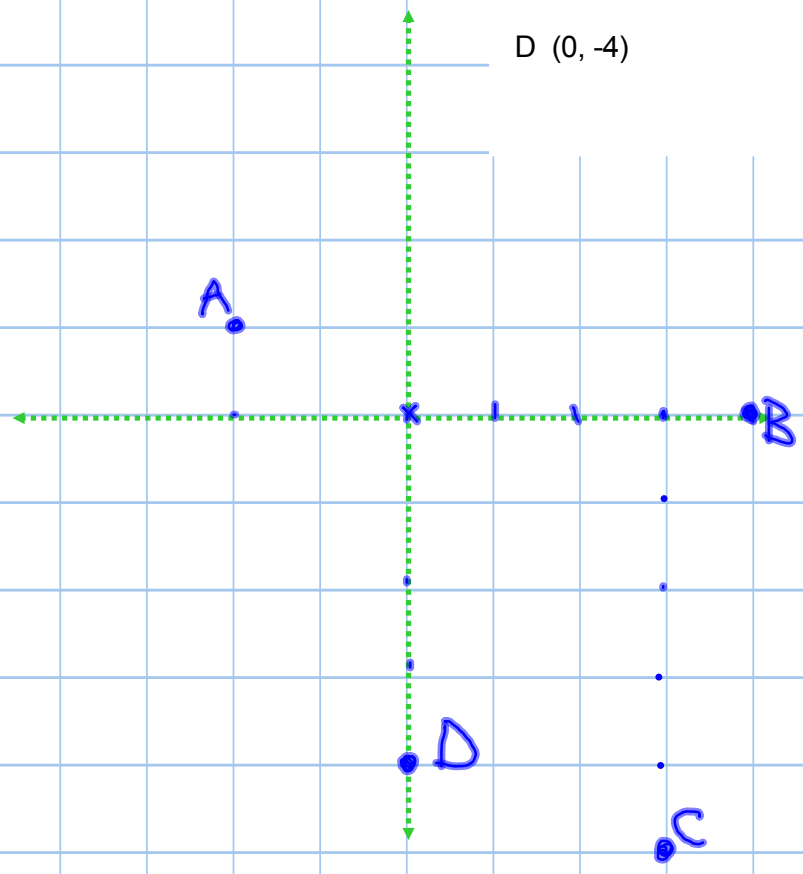
Plot these points and tell what quadrant they are in:

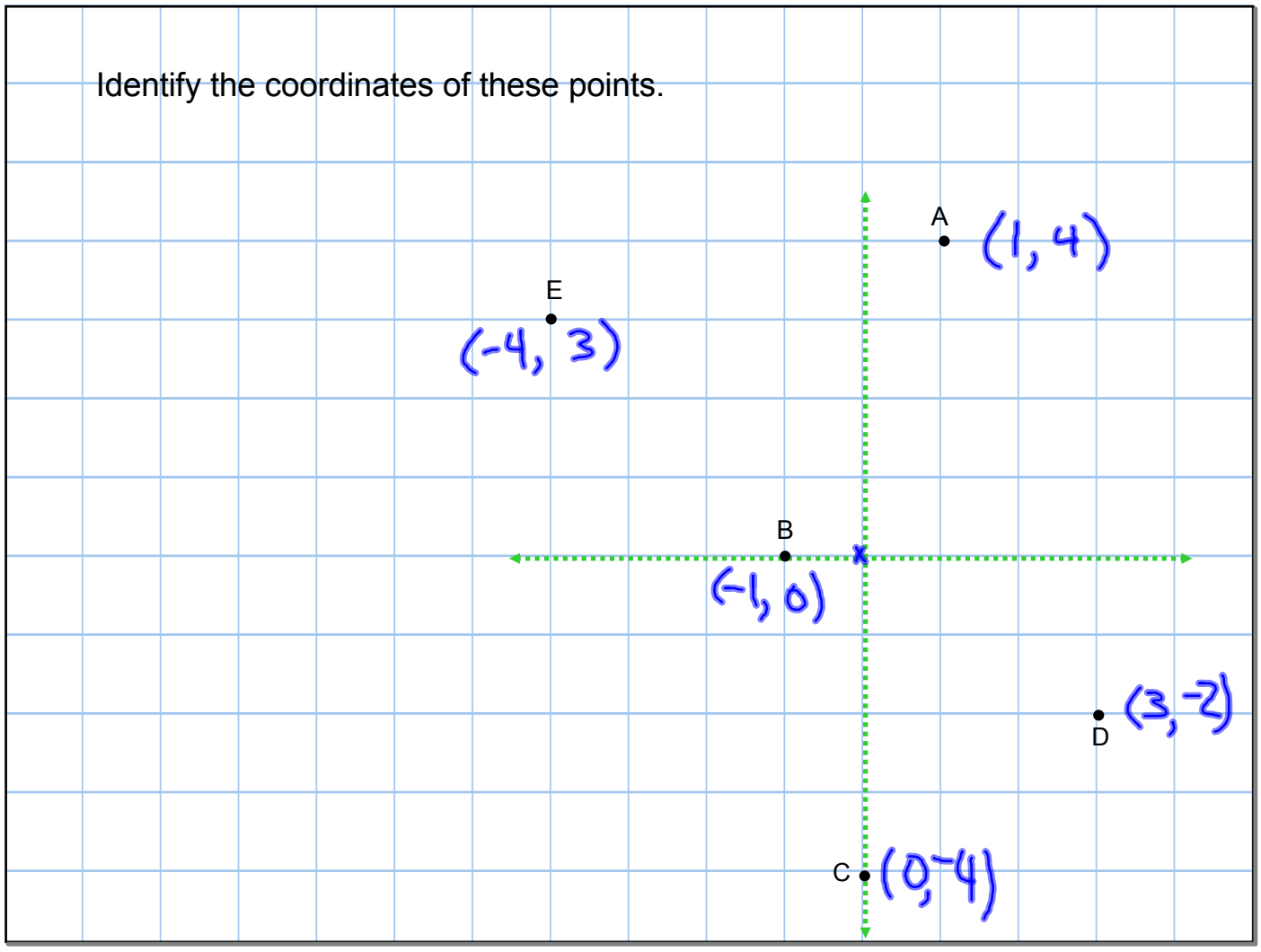
A (-2,1) $x=-2, y=1$

B (4,0)

C (3,-5)

D (0, -4)



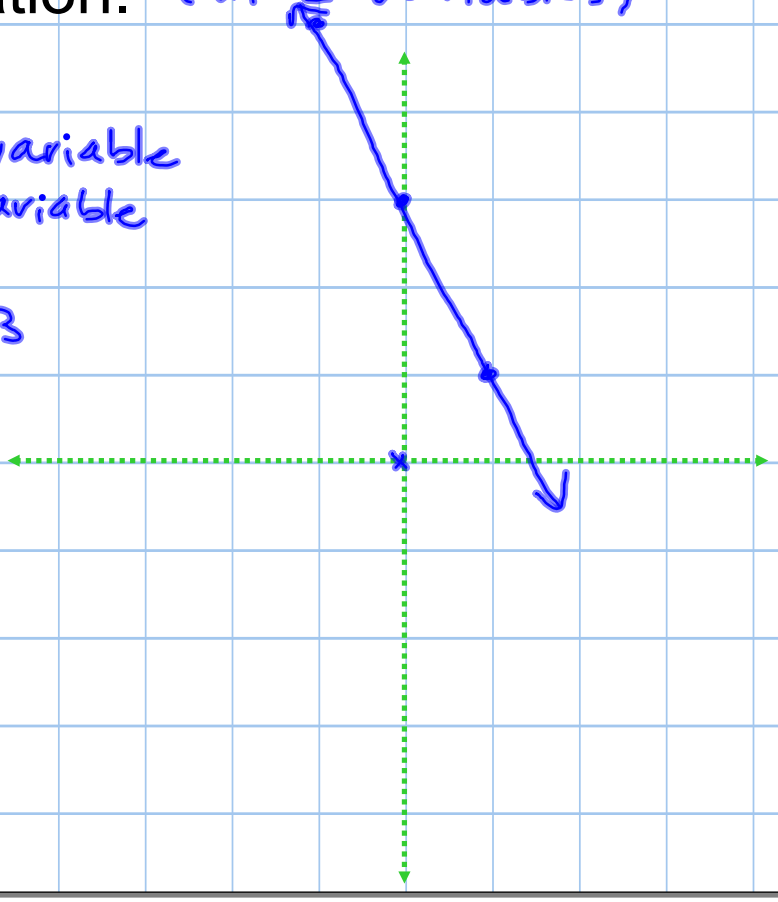

Identify the coordinates of these points.
A
(1, 4)
E
(-4, 3)
B
(-1, 0)
D
(3, -2)
C
(0, -4)

# Graph an equation. (in 2 variables)

$y = -2x + 3$

x is independent variable
y is dependent variable

| x | y = -2x + 3 |
|---|---|
| 0 | $y = -2(0) + 3 = 3$ |
| 1 | $-2(1) + 3 = 1$ |
| -1 | $-2(-1) + 3 = 5$ |



① EXAMPLE

Check to see if each ordered pair is a solution of the equation.

$y^2 - 4x = 8$

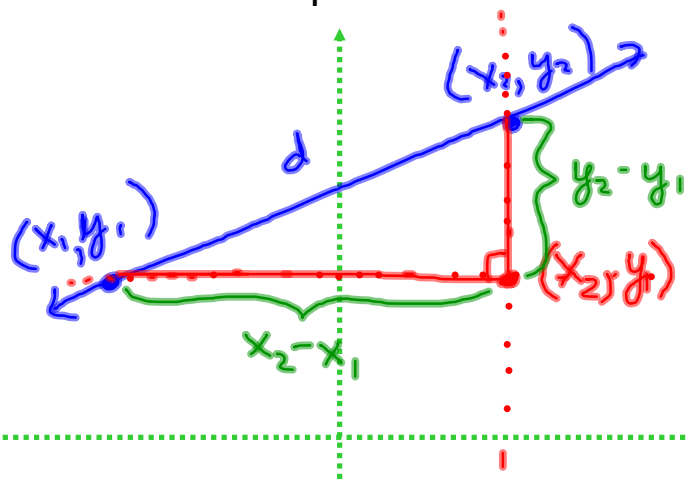
a. (0,6) $6^2 - 4(0) = 36 - 0 = 36 \neq 8$ no

b. (-1,-2) $(-2)^2 - 4(-1) = 4 + 4 = 8$ ✓ yes

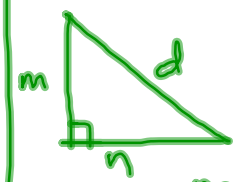
c. (-1,3) $3^2 - 4(-1) = 9 + 4 = 13 \neq 8$ no

d. (2,4) $4^2 - 4(2) = 16 - 8 = 8$ ✓ yes

## Distance between two points




**Pythagorean Theorem**




$m^2 + n^2 = d^2$

★ only true in right $\triangle$

$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

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

ex distance between $(-1, 4)$ and $(3, -2)$

$x_1 \; y_1 \qquad x_2 \; y_2$

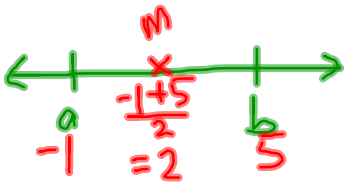
$$d = \sqrt{(-1-3)^2 + (4-(-2))^2}$$

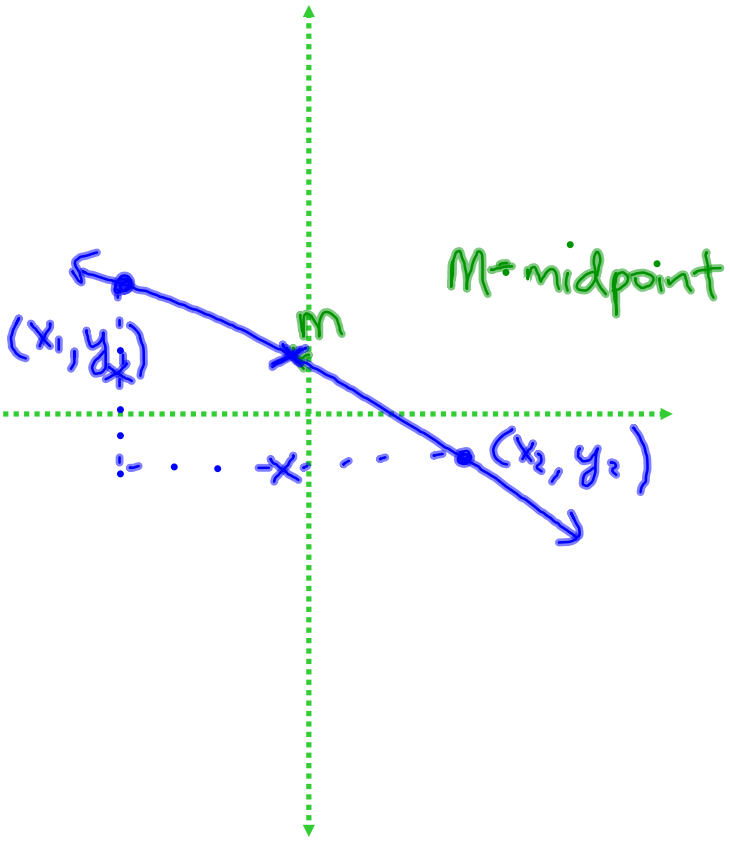
$$= \sqrt{(-4)^2 + (6)^2}$$

$$= \sqrt{16 + 36}$$

$$= \sqrt{52} = \sqrt{4(13)} = \sqrt{4}\sqrt{13} = 2\sqrt{13}$$

## Midpoint of a segment



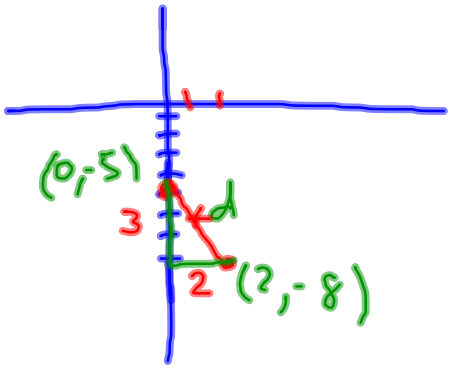




$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

## ② EXAMPLE

$x_1\ y_1 \quad x_2\ y_2$

Find the distance between these two points: (0,-5) and (2,-8).




$d^2 = 3^2 + 2^2$

$d^2 = 9 + 4$

$d^2 = 13$

$d = \sqrt{13}$

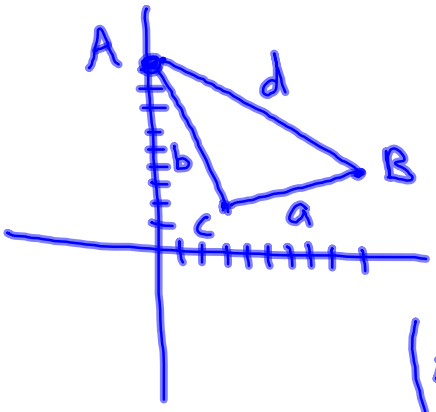
Find the midpoint of the segment above.

$$\left(\frac{0+2}{2}, \frac{-5+-8}{2}\right) = \left(1, \frac{-13}{2}\right)$$

③ EXAMPLE $\text{dist} = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

Show that these points are the vertices of a right triangle.

A (0,9) B (9,4) C (2,2) (use Pythagorean Thm)




BC $a = \sqrt{(9-2)^2+(4-2)^2}$

$= \sqrt{7^2+2^2} = \sqrt{49+4} = \sqrt{53}$

AC $b = \sqrt{(0-2)^2+(9-2)^2}$

$= \sqrt{(-2)^2+7^2} = \sqrt{4+49} = \sqrt{53}$

AB $d = \sqrt{(0-9)^2+(9-4)^2}$

$= \sqrt{(-9)^2+5^2}$

$= \sqrt{81+25} = \sqrt{106} = \sqrt{2(53)}$

Question $(\sqrt{53})^2+(\sqrt{53})^2 \overset{?}{=} (\sqrt{2(53)})^2$

$53+53 \overset{?}{=} 2(53)$

$2(53) = 2(53)$

yes ✓

fits Pythagorean Thm

⇒ yes it's a right triangle