Section 2.1

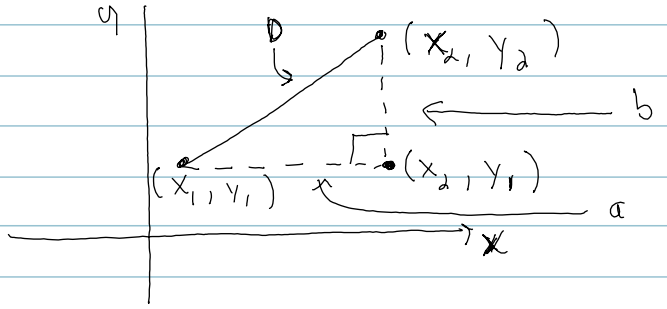
> Distance and Midpoint Formula

- What is the distance Formula?

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

- Where did it come from? Our friend Pythagoras!

> Take two arbitrary points (x_1, y_1) (x_2, y_2)



> $a = x_2 - x_1$ [The distance we travelled]
> $b = y_2 - y_1$ [Same logic]

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

★ $(3, 5)$, $(-1, 7)$; Find the distance between them

x	y
3	5
-1	7

$d = \sqrt{(3 - (-1))^2 + (5 - 7)^2}$
$d = \sqrt{(4)^2 + (-2)^2}$
$d = \sqrt{16 + 4} = \sqrt{20} = \sqrt{5 \cdot 4}$
$= \sqrt{5} \cdot \sqrt{4}$
$= 2 \cdot \sqrt{5}$

$2 \mid 20$, $2 \mid 10$, $5 \mid 5$, 1 $\Rightarrow 2\sqrt{5}$

$\sqrt{220} \rightarrow 2 \mid 220$, $2 \mid 110$, $5 \mid 55$, 11
$2\sqrt{5 \cdot 11} = \boxed{2\sqrt{55}}$

2 | 2000
2 | 1000
2 | 500
2 | 250
5 | 125
5 | 25
5

$\sqrt{2000}$

$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5}$

$20\sqrt{5}$

Look for pairs of numbers, pairs come from the index of the radical

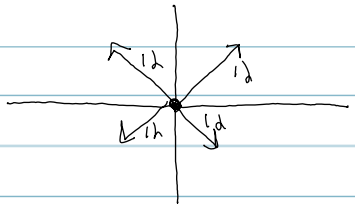
$\sqrt[n]{x}$

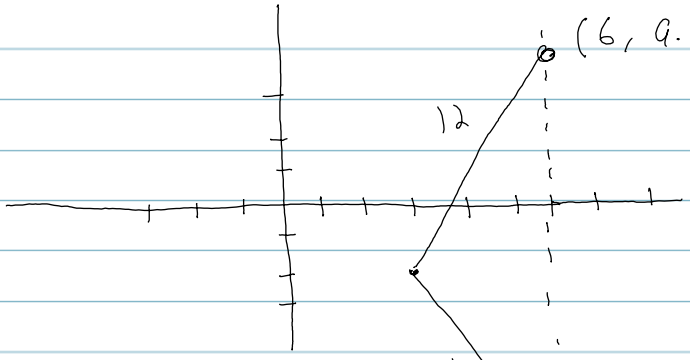
$\sqrt[4]{2000} = \sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5} = 2\sqrt[4]{125}$

Try This!

d = 12 , (3, -2) , (6, y)

Make sure you have ½ or you're missing point!





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

$12 = \sqrt{(6-3)^2 + (y+2)^2}$ ← Square both sides

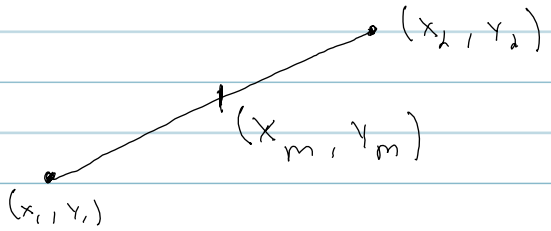
$144 = 9 + (y+2)^2$

$135 = (y+2)^2$

$\pm\sqrt{135} = y + 2 \Rightarrow -2 \pm \sqrt{135} = y$

Midpoint

(x_1, y_1) , (x_2, y_2)



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

▲ $(4, -7), (3, 6)$

$$\left(\frac{4+3}{2}, \frac{(-7)+6}{2} \right) = \left(\frac{7}{2}, \frac{-1}{2} \right)$$

• $\underbrace{(4, -6)}_{\text{midpoint}}, \underbrace{(2, 4)}_{\text{Endpoint}}$, Find the other endpoint

- There is a point (x, y) that is my missing point

Thus : $\left(\frac{x+2}{2}, \frac{y+4}{2} \right)$

$\frac{x+2}{2} = 4 \Rightarrow x + 2 = 8 \Rightarrow \boxed{x = 6}$

$\frac{y+4}{2} = -6 \Rightarrow y + 4 = -12 \Rightarrow \boxed{y = -16}$

The other endpoint is $(6, -16)$