

Topic: Midpoint and Distance Formula

Question: How do you study for math?

Homework: Pages 414-416
#10,11,24,25,56-59 all

Warm-Up. Write in vertex form

$$1.) \quad y = x^2 - 4x + 1$$

$$y = (x^2 - 4x) + 1$$

complete the square $(\frac{b}{2})^2 = (\frac{-4}{2})^2$

$$y = (x^2 - 4x + 4) - 4(1) + 1$$

\uparrow
factor

$$y = (x - 2)^2 - 3$$

$$\#2) \quad y = -3x^2 - 18x - 10$$

$$y = (-3x^2 - 18x) - 10$$

$$y = -3(x^2 + 6x) - 10$$

$$(\frac{b}{2})^2 = (\frac{6}{2})^2$$

$$y = -3(x^2 + 6x + 9) - 10 - 9(-3)$$

$$y = -3(x+3)^2 - 10 - (-27)$$

$$\boxed{y = -3(x+3)^2 + 17}$$

Write in vertex form...

Practice: $y = 2x^2 + 20x + 50$

$$y = (2x^2 + 20x) + 50$$

$$y = 2(x^2 + 10x) + 50$$

Add $(\frac{b}{2})^2$
 $(\frac{10}{2})^2$
 $5^2 = 25$

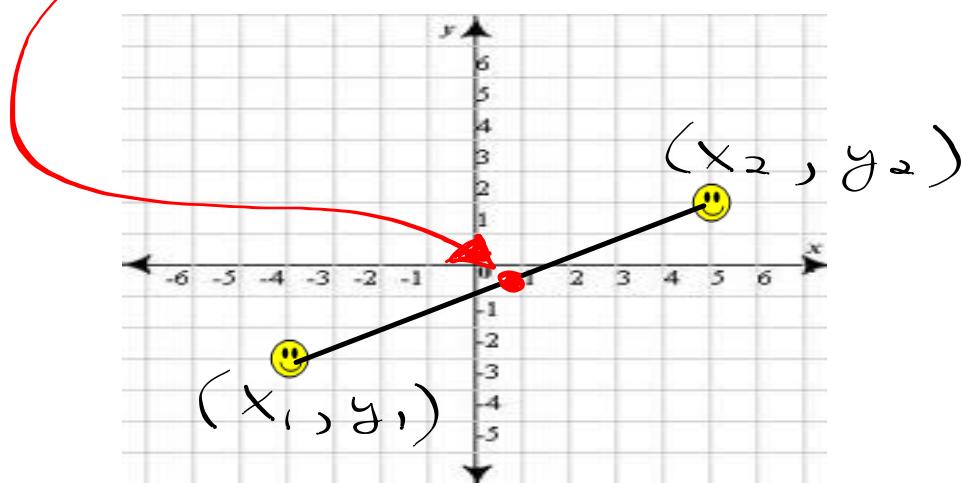
$$y = 2(x^2 + 10x + 25) + 50 - 2(25)$$

$$y = 2(x + 5)^2$$

$$\begin{array}{l} x^2 + 10x + 25 \\ \cancel{x^2 + 5x + 5x + 25} \\ \cancel{x^2} \cancel{+ 5x} \cancel{+ 5x} \cancel{+ 25} \\ 5 \quad 5 \\ 10 \end{array}$$

Notes. Midpoint Formula

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



Ex 1) What is the midpoint?

$$(8, 3), (16, 7)$$

$x_1 \quad y_1 \qquad x_2 \quad y_2$

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

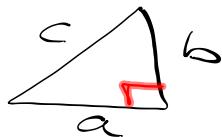
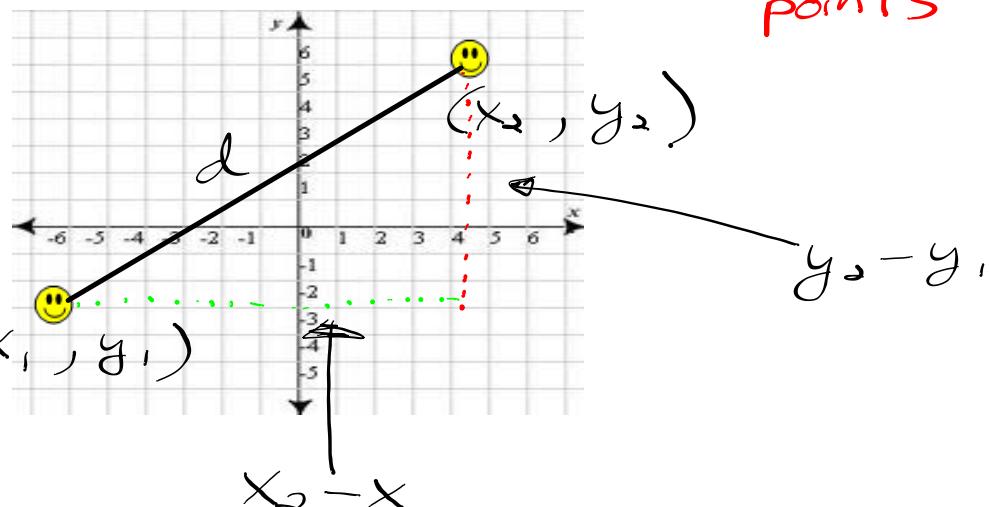
$$= \left(\frac{8+16}{2}, \frac{3+7}{2} \right)$$

$$= \left(\frac{24}{2}, \frac{10}{2} \right)$$

$$= (12, 5)$$

Distance Formula

tells the distance (length) between two points



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



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

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

Example 2.

Find the distance between $(-4, 9)$ and $(1, -3)$

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

$$d = \sqrt{(1 - (-4))^2 + (-3 - 9)^2}$$

$$d = \sqrt{5^2 + (-12)^2}$$

$$d = \sqrt{25 + 144}$$

$$d = \sqrt{169}$$

$$d = 13$$

Test Corrections#2 Write the problemIncorrect

Correct Work

A Sentence explaining where you went wrong.

Solve by completing the square

$$3x^2 + x - 2 = 0$$

$$\frac{3x^2 + x}{3} = \frac{-2}{3}$$

$$x^2 + \frac{1}{3}x = \frac{-2}{3}$$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-\frac{1}{3}}{2}\right)^2 = \left(\frac{1}{6}\right)^2 = \frac{1}{36}$$

$$x^2 + \frac{1}{3}x + \frac{1}{36} = \frac{-2}{3} + \frac{1}{36}$$

$$x^2 + \frac{1}{3}x + \frac{1}{36} = \frac{-24}{36} + \frac{1}{36}$$

$$x^2 + \frac{1}{3}x + \frac{1}{36} = \frac{-25}{36}$$

$$\frac{b}{2} = \frac{1}{6}$$

$$(x + \frac{1}{6})^2 = \frac{-25}{36}$$

$$x + \frac{1}{6} = \pm \sqrt{\frac{-25}{36}}$$

$$x + \frac{1}{6} = \pm \frac{5}{6}$$

$$x + \frac{1}{6} = \frac{5}{6}$$

$$-\frac{1}{6} \quad -\frac{1}{6}$$

$$x + \frac{1}{6} = -\frac{5}{6}$$

$$-\frac{1}{6} \quad -\frac{1}{6}$$

$$x = \frac{4}{6} = \textcircled{2/3}$$

$$x = -\frac{6}{6} = \textcircled{-1}$$

ED - RT I

Factor and solve

$$2x^2 + 7x - 9 = 0$$

$$\begin{array}{r} \cancel{-18} \\ \cancel{9} \times \cancel{2} \\ \cancel{7} \end{array}$$

$$\begin{aligned} 2x^2 + 9x - 2x - 9 &= 0 \\ x(2x + 9) - 1(2x + 9) &= 0 \\ (x - 1)(2x + 9) &= 0 \end{aligned}$$

$$\begin{aligned} x - 1 &= 0 & 2x + 9 &= 0 \\ x &= 1 & x &= -\frac{9}{2} \end{aligned}$$

Solve by factoring

$$3x^2 - x - 4 = 0$$

$$\begin{aligned} & \cancel{-12} \quad 3x^2 + 3x - 4x - 4 = 0 \\ & \cancel{-4} \quad (3x^2 + 3x) + (-4x - 4) = 0 \\ & \cancel{-1} \quad 3x(x+1) - 4(x+1) = 0 \\ & \quad (3x-4)(x+1) = 0 \end{aligned}$$

$$\begin{aligned} 9x^2 + 1 &= 6x \\ -6x &\quad -6x \\ \hline 9x^2 - 6x + 1 &= 0 \\ (9x^2 - 3x) &(-3x + 1) \end{aligned}$$

$$\begin{aligned} & \cancel{9} \quad -3 \\ & \cancel{-6} \quad \cancel{-3} \end{aligned}$$

$$\begin{aligned} 3x(3x-1) &- 1(-3x+1) \\ (3x-1) &(3x-1) \end{aligned}$$

$$\begin{aligned} 3x - 1 &= 0 \\ \hline 1 &+1 \\ \hline 3x &= 1 \\ x &= \frac{1}{3} \end{aligned}$$

$$\begin{aligned} 3x - 1 &= 0 \\ \hline 1 &+1 \\ \hline 3x &= 1 \\ x &= \frac{1}{3} \end{aligned}$$

Write in vertex form

$$y = a(x-h)^2 + k$$

1) $y = x^2 - 8x + 9$
 $y = (x^2 - 8x) + 9$

Complete the square: add $\left(\frac{b}{2}\right)^2 = \left(\frac{-8}{2}\right)^2 = 16$

~~16~~
~~-4~~
~~-8~~

$$y = (x^2 - 8x + 16) + 9 - 16(1)$$

$$(x^2 - 4x - 4x + 16) + 9 - 16$$

$$(x-4)(x-4) + 9 - 16$$

$$y = (x-4)^2 - 7$$

2) $y = -2x^2 - 8x - 1$
 $y = -2(x^2 + 4x) - 1$
 $y = -2(x^2 + 4x + 4) - 1 - (4)(-2)$
 $y = -2(x^2 + 4x + 4) - 1 + 8$

$y = -2(x+2)^2 + 7$

Solve by completing the square:

$$\underbrace{(\frac{b}{2})^2 = \left(\frac{-6}{2}\right)^2 = 9}_{x^2 - 6x + 11 = 0} \quad x^2 - 6x = -11$$

$$x^2 - 6x + 9 = -11 + 9$$

$$(x + \frac{b}{2})^2 \quad x^2 - 6x + 9 = -2$$

$$(x - 3)^2 = -2$$

$$(x - 3) = \pm \sqrt{-2}$$

$$x - 3 = \pm i\sqrt{2}$$

$$x = 3 \pm i\sqrt{2}$$

$$x = 3 + i\sqrt{2} \quad x = 3 - i\sqrt{2}$$