

Day 5 - Solving by Completing the Square
Practice Assignment

Name: _____

$$1. \quad x^2 - 16x - 8 = 0$$

$$\begin{array}{r} x^2 - 16x = 8 \\ +8 \quad +8 \\ \hline x^2 - 16x = 16 \end{array}$$

$$\left(\frac{-16}{2}\right)^2 \rightarrow (-8)^2 \rightarrow 64$$

$$(x-8)^2 = 72$$

$$x-8 = \pm\sqrt{72}$$

$$x-8 = \pm 6\sqrt{2}$$

$$\begin{array}{r} x-8 = 6\sqrt{2} \\ +8 \quad +8 \\ \hline x = 8 + 6\sqrt{2} \end{array} \quad \begin{array}{r} x-8 = -6\sqrt{2} \\ +8 \quad +8 \\ \hline x = 8 - 6\sqrt{2} \end{array}$$

$$x = \boxed{8 \pm 6\sqrt{2}}$$

$$2. \quad x^2 - 8x + 6 = 0$$

$$\begin{array}{r} x^2 - 8x = -6 \\ -4 \quad -4 \\ \hline x^2 - 8x = -10 \end{array}$$

$$\left(\frac{-8}{2}\right)^2 \rightarrow (-4)^2 \rightarrow 16$$

$$(x-4)^2 = 10$$

$$x-4 = \pm\sqrt{10}$$

$$x = 4 \pm \sqrt{10}$$

$$x = \boxed{4 \pm \sqrt{10}}$$

$$3. \quad x^2 - 12x + 10 = 0$$

$$\begin{array}{r} x^2 - 12x = -10 \\ -10 \quad -10 \\ \hline x^2 - 12x = -20 \end{array}$$

$$\left(\frac{-12}{2}\right)^2 \rightarrow (-6)^2 \rightarrow 36$$

$$(x-6)^2 = 26$$

$$x-6 = \pm\sqrt{26}$$

$$\begin{array}{r} x-6 = \sqrt{26} \\ +6 \quad +6 \\ \hline x = 6 + \sqrt{26} \end{array} \quad \begin{array}{r} x-6 = -\sqrt{26} \\ +6 \quad +6 \\ \hline x = 6 - \sqrt{26} \end{array}$$

$$x = 6 + \sqrt{26} \quad x = 6 - \sqrt{26}$$

$$x = \boxed{6 \pm \sqrt{26}}$$

$$4. \quad x^2 + 20x - 15 = 0$$

$$\begin{array}{r} x^2 + 20x = 15 \\ +15 \quad +15 \\ \hline x^2 + 20x = 30 \end{array}$$

$$\left(\frac{20}{2}\right)^2 \rightarrow (10)^2 \rightarrow 100$$

$$(x+10)^2 = 115$$

$$x+10 = \pm\sqrt{115}$$

$$x = -10 \pm \sqrt{115}$$

$$x = \boxed{-10 \pm \sqrt{115}}$$

$$5. \quad x^2 + 14x + 5 = -5$$

$$\begin{array}{r} x^2 + 14x = -10 \\ -5 \quad -5 \\ \hline x^2 + 14x = -15 \end{array}$$

$$\left(\frac{14}{2}\right)^2 \rightarrow (7)^2 \rightarrow 49$$

$$(x+7)^2 = 39$$

$$x+7 = \pm\sqrt{39}$$

$$\begin{array}{r} x+7 = \sqrt{39} \\ -7 \quad -7 \\ \hline x = -7 + \sqrt{39} \end{array} \quad \begin{array}{r} x+7 = -\sqrt{39} \\ -7 \quad -7 \\ \hline x = -7 - \sqrt{39} \end{array}$$

$$x = -7 + \sqrt{39} \quad x = -7 - \sqrt{39}$$

$$x = \boxed{-7 \pm \sqrt{39}}$$

$$6. \quad x^2 + 6x - 18 = -9$$

$$\begin{array}{r} x^2 + 6x = 9 \\ +9 \quad +9 \\ \hline x^2 + 6x = 18 \end{array}$$

$$\left(\frac{6}{2}\right)^2 \rightarrow (3)^2 \rightarrow 9$$

$$(x+3)^2 = 18$$

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

$$-3 \quad -3$$

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

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

Defend:

Matt is trying to solve the following problem by completing the square:

$$x^2 - 18x + 6 = 0$$

He believes he has got the answer and wants to compare it with his classmate, Marcus. He says, "Hey Marcus, I got $x = 9 + 5\sqrt{3}$ and $9 - 5\sqrt{3}$, what did you get?"

Marcus replied, "hmm that's weird I got $x = 9 + \sqrt{75}$ and $9 - \sqrt{75}$."

Matt then says "well we both got the 9 part so we have similar thinking, lets ask Tiffany!"

Tiffany looks at their work and says "I got the same thing as Matt I just combined like terms and got $x = 14\sqrt{3}$ and $4\sqrt{3}$."

More confused than ever they call over Mrs. Dombrowski. She assures them that one of them has the correct answer...

Who is correct? Explain.

$$\begin{aligned} x^2 - 18x + 6 &= 0 \\ x^2 - 18x &= -6 \\ \left(\frac{-18}{2}\right)^2 &\rightarrow (-9)^2 \rightarrow 81 \\ (x-9)^2 &= 75 \\ x-9 &= \pm 5\sqrt{3} \\ x &= 9 \pm 5\sqrt{3} \end{aligned}$$

Matt has the correct answer.
 Marcus did not simplify his radical. $\sqrt{75} \rightarrow \sqrt{25} \sqrt{3} \rightarrow 5\sqrt{3}$
 Tiffany combined not like terms

Error Analysis:

Describe and correct the error Emma made when attempting to solve by completing the square.

Problem: $x^2 + 20x - 8 = 0$

Emma's Process:

$$\begin{aligned} x^2 + 20x - 8 &= 0 \\ x^2 + 20x + \underline{\quad} &= 8 + \underline{\quad} \\ x^2 + 20x + 10 &= 8 + 10 \\ (x + 10)^2 &= 18 \\ x + 10 &= \pm\sqrt{18} \\ x &= -10 \pm 3\sqrt{2} \end{aligned}$$

Answer: $x = -10 \pm 3\sqrt{2}$

a. What was Emma's mistake when solving by completing the square?

$$\left(\frac{20}{2}\right)^2 \rightarrow (10)^2 \rightarrow 100$$

She did not square the 10

b. Solve the problem correctly below.

$$\begin{aligned} x^2 + 20x - 8 &= 0 \\ x^2 + 20x &= 8 \\ \left(\frac{20}{2}\right)^2 &\rightarrow (10)^2 \rightarrow 100 \\ \downarrow \\ (x+10)^2 &= 108 \\ x+10 &= \pm 6\sqrt{3} \\ -10 &\quad -10 \end{aligned}$$

$$\boxed{x = -10 \pm 6\sqrt{3}}$$