

Warm-up 4-9

Solve the following quadratics. You can use any method you prefer. (square roots, graphing, factoring)

1. $x^2 - 2x - 15 = 0$

2. $-4x^2 = 3$

3. $2(x + 6)^2 = 98$

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

Warm-up 4-9

Solve the following quadratics. You can use any method you prefer. (square roots, graphing, factoring)

1. $x^2 - 2x - 15 = 0$

$$\begin{array}{r} +x^2 \\ -2x \\ -15 \\ \hline \end{array}$$

x^2	$-5x$
$3x$	-15

$(x-5)(x+3) = 0$
 $x-5=0$ $x+3=0$
 $x=5$ $x=-3$

2. $-4x^2 = 3$

$$\sqrt{x^2} = \sqrt{\frac{3}{-4}}$$

no real solution

3. $2(x+6)^2 = 98$

$$\sqrt{(x+6)^2} = \sqrt{49}$$

$x+6 = \pm 7$

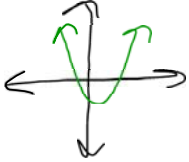
$x+6=7$	$x+6=-7$
$-6-6$	$-6-6$
$x=1$	$x=-13$

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

$x = -1, 2$

$2(-1)^2 - 2(-1) - 4$
 $2+2-4=0 \checkmark$

$2(2)^2 - 2(2) - 4$
 $8-4-4=0 \checkmark$



Homework Questions?

#4 no real solutions

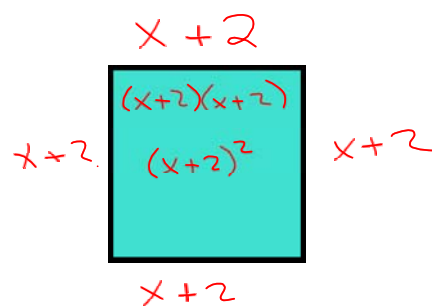
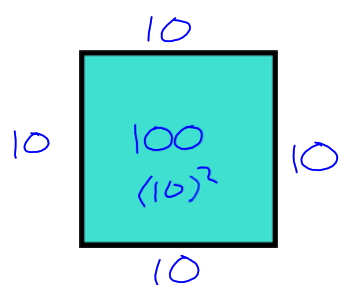
#14 5 seconds

Discuss with your partners Perfect Square Trinomials

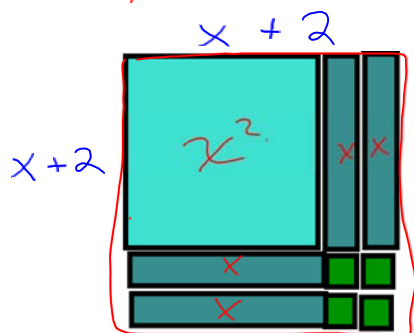
Write down in your notes some characteristics of perfect square trinomials.

Today's Goal

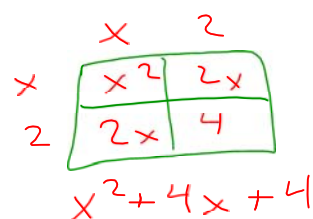
I can solve quadratic functions by completing the square



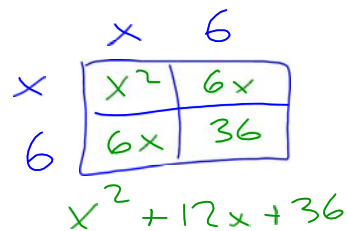
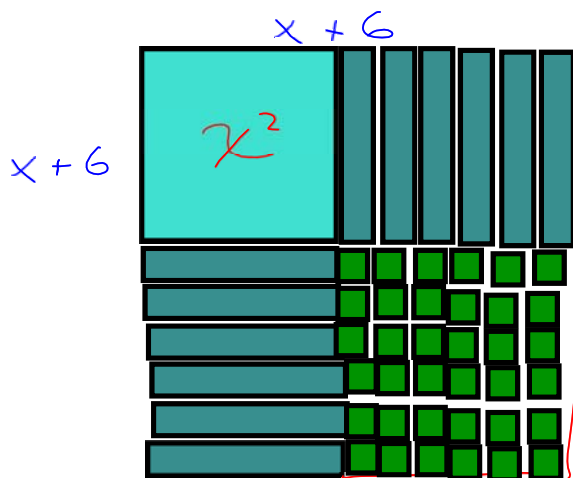
$$x^2 + 4x + \underline{4} = (x+2)^2$$



$$\left(\frac{b}{2}\right)^2$$

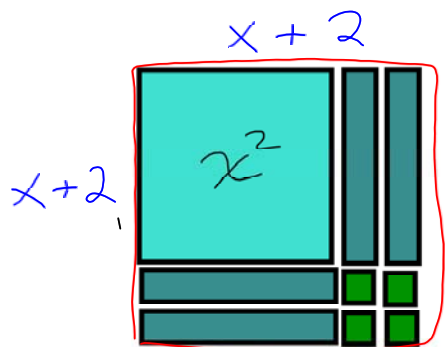


$$x^2 + 12x + 36 = (x+6)^2$$



$$x^2 + 4x + \underline{4}$$

$$\left(\frac{b}{2}\right)^2$$

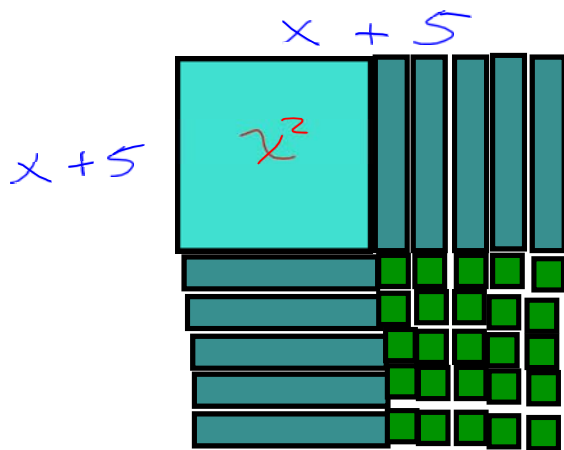


$$(x+2)^2$$

	x	2
x	x^2	$2x$
2	$2x$	4

$$x^2 + 4x + 4$$

$$x^2 + 10x + \underline{25} = (x+5)^2$$



	x	5
x	x^2	$5x$
5	$5x$	25

$$x^2 + 10x + 25$$

Section 10.7: Solving by Completing the Square

Completing the Square: manipulate the equation to become a perfect square trinomial

Perfect Square Trinomial:

How to Complete the Square:

Words

Numbers $x^2 + 6x +$

Algebra

$x^2 + bx +$

To complete the square of $x^2 + bx$, add $(b/2)^2$ to the expression. This forces a perfect square trinomial.		
---	--	--

Complete the square to form a perfect square trinomial

$$x^2 + 12x + \underline{\hspace{2cm}}$$

$$x^2 - 5x + \underline{\hspace{2cm}}$$

$$8x + x^2 + \underline{\hspace{2cm}}$$

Solving quadratic equation by Completing the Square

Step 1 Write the equation in the form $x^2 + bx = c$.

Step 2 Find $\left(\frac{b}{2}\right)^2$.

Step 3 Complete the square by adding $\left(\frac{b}{2}\right)^2$ to both sides of the equation.

Step 4 Factor the perfect-square trinomial.

Step 5 Take the square root of both sides.

Step 6 Write two equations, using both the positive and negative square root, and solve each equation.

Example:

$$x^2 + 14x = 15$$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{14}{2}\right)^2 = 49$$

$$x^2 + 14x + 49 = 15 + 49$$

$$\sqrt{(x+7)^2} = \sqrt{64}$$

$$x+7 = \pm 8$$

$$x+7 = 8$$

$$x+7 = -8$$

Solve by completing the square.

$$x^2 + 10x = -9$$

$$x^2 - 8x - 5 = 0$$

$$-2x^2 + 12x - 20 = 0$$

$$3x^2 - 5x - 2 = 0$$

Solve by completing the square.

$$x^2 + 10x = -9 \quad \left(\frac{b}{2}\right)^2 = \left(\frac{10}{2}\right)^2 = 25$$

$$x^2 + 10x + 25 = -9 + 25$$

$$\sqrt{(x+5)^2} = \sqrt{16}$$

$$x+5 = \pm 4$$

$$\begin{array}{l} x+5=4 \\ -5 \quad -5 \\ \hline x=-1 \end{array} \quad \begin{array}{l} x+5=-4 \\ -5 \quad -5 \\ \hline x=-9 \end{array}$$

$$(x + \frac{b}{2})^2$$

$$x^2 - 8x - 5 = 0 \quad \left(\frac{b}{2}\right)^2 = \left(\frac{-8}{2}\right)^2 = 16$$

$$\begin{array}{l} +5 \quad +5 \\ \hline \end{array}$$

$$x^2 - 8x + 16 = 5 + 16$$

$$\sqrt{(x-4)^2} = \sqrt{21}$$

$$x-4 = \pm\sqrt{21}$$

$$\begin{array}{l} x-4 = \sqrt{21} \\ +4 \quad +4 \\ \hline x = 4 + \sqrt{21} \end{array} \quad \begin{array}{l} x-4 = -\sqrt{21} \\ +4 \quad +4 \\ \hline x = 4 - \sqrt{21} \end{array}$$

$$\frac{-2x^2}{-2} + \frac{12x}{-2} - \frac{20}{-2} = 0$$

$$x^2 - 6x + 10 = 0$$

$$\begin{array}{l} -10 \quad -10 \\ \hline \end{array}$$

$$x^2 - 6x + 9 = -10 + 9$$

$$\sqrt{(x-3)^2} = \sqrt{-1}$$

no real solution

$$\frac{3x^2}{3} - \frac{5x}{3} - \frac{2}{3} = 0$$

$$x^2 - \frac{5}{3}x - \frac{2}{3} = 0 \quad \left(\frac{5}{3}\right)^2 = \frac{25}{36}$$

$$x^2 - \frac{5}{3}x + \frac{25}{36} = \frac{2}{3} + \frac{25}{36}$$

$$\sqrt{\left(x - \frac{5}{6}\right)^2} = \sqrt{\frac{49}{36}}$$

$$x - \frac{5}{6} = \pm \frac{7}{6}$$

$$\begin{array}{l} x - \frac{5}{6} = \frac{7}{6} \\ +\frac{5}{6} \quad +\frac{5}{6} \\ \hline \end{array} \quad \begin{array}{l} x - \frac{5}{6} = -\frac{7}{6} \\ +\frac{5}{6} \quad +\frac{5}{6} \\ \hline \end{array}$$

$$x = \frac{12}{6} = 2 \quad x = -\frac{2}{6} = -\frac{1}{3}$$

Before you leave...

Tell how to solve a quadratic in the form $x^2 + bx + c = 0$ using the completing the square method.

Then show your knowledge by solving the problem below.

Solve by completing the square.

$$x^2 - 4x - 12 = 0$$

Homework

pg. 579 #3-9 (odd), 17

GUIDED PRACTICE

1. **Vocabulary** Describe in your own words how to *complete the square* for the equation $1 = x^2 + 4x$.

SEE EXAMPLE 1 Complete the square to form a perfect-square trinomial.

2. $x^2 + 14x + \square$ 3. $x^2 - 4x + \square$ 4. $x^2 - 3x + \square$

Solve by completing the square.

SEE EXAMPLE 2 5. $x^2 + 6x = -5$ 6. $x^2 - 8x = 9$ 7. $x^2 + x = 30$
 8. $x^2 + 2x = 21$ 9. $x^2 - 10x = -9$ 10. $x^2 + 16x = 91$

SEE EXAMPLE 3 11. $-x^2 - 5x = -5$ 12. $-x^2 - 3x + 2 = 0$ 13. $-6x = 3x^2 + 9$
 14. $2x^2 - 6x = -10$ 15. $-x^2 + 8x - 6 = 0$ 16. $4x^2 + 16 = -24x$

- SEE EXAMPLE 4 17. **Multi-Step** The length of a rectangle is 4 meters longer than the width. The area of the rectangle is 80 square meters. Find the length and width. Round your answers to the nearest tenth of a meter.

