Objective

Students will be able to factor a trinomial where the leading coefficient is equal to 1.

ANNOUNCEMENTS:

Summer Packet Review and Tutoring: October 19th (Wednesday- room 303) and October 24th (Monday- room 341) after school

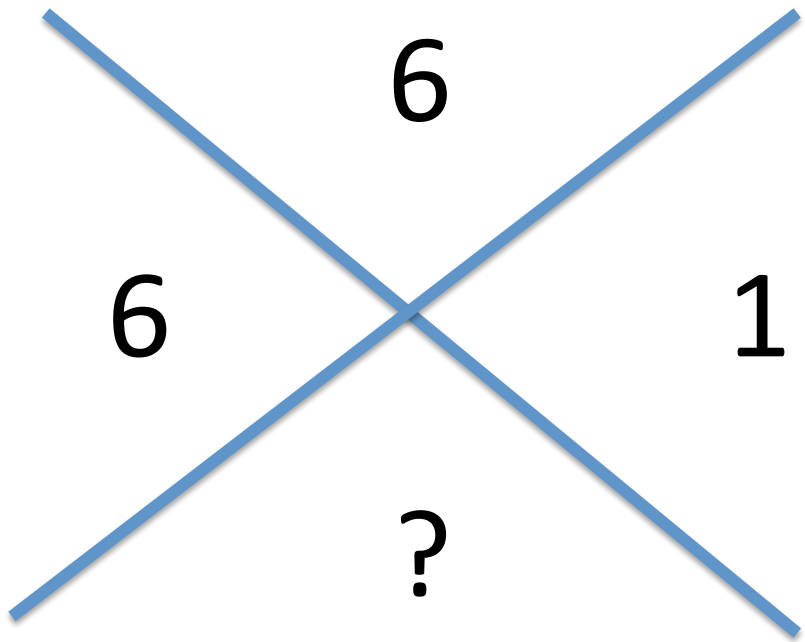
Factoring and Solving Trinomials Quiz on Monday, October 24th

Summer Packet Retake on Tuesday, October 25th

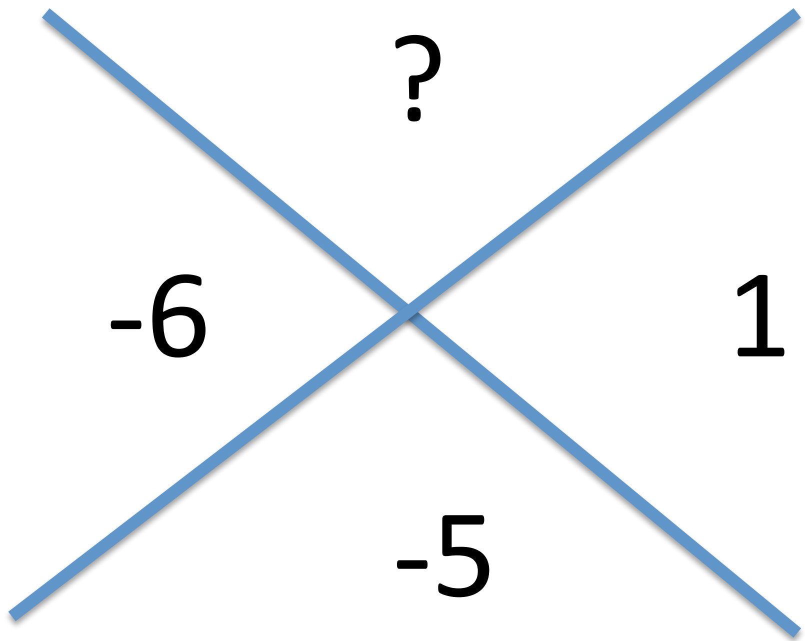
MIDTERM on Thursday, October 27th

Diamond Method

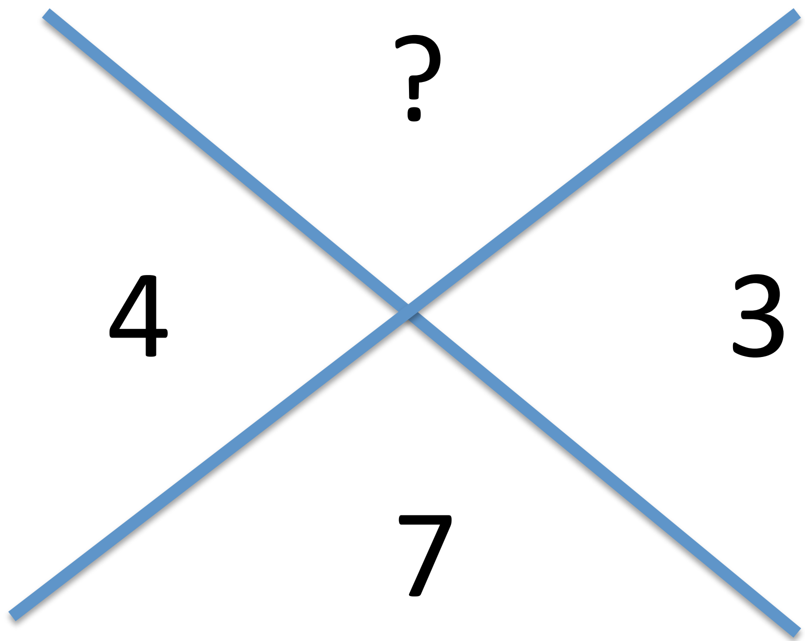
Fill in the blanks…



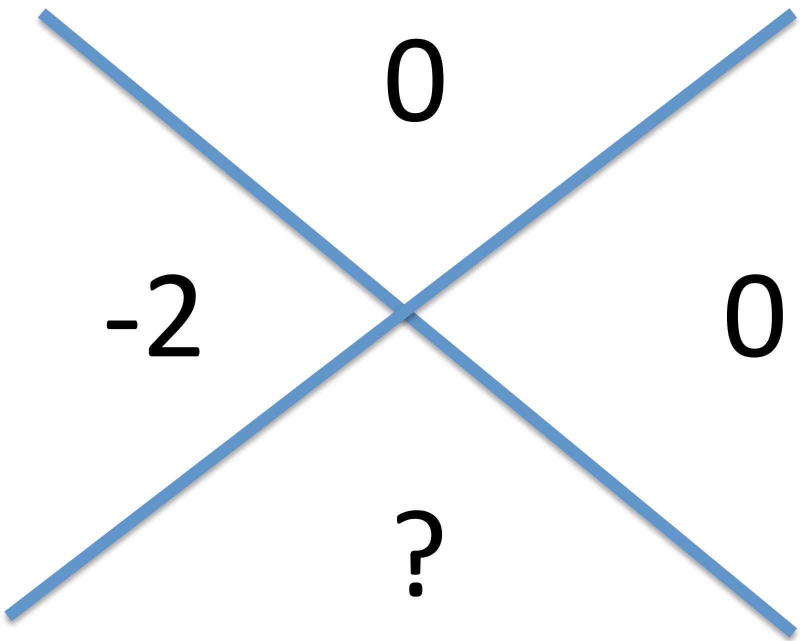
Diamond Method



Diamond Method



Diamond Method



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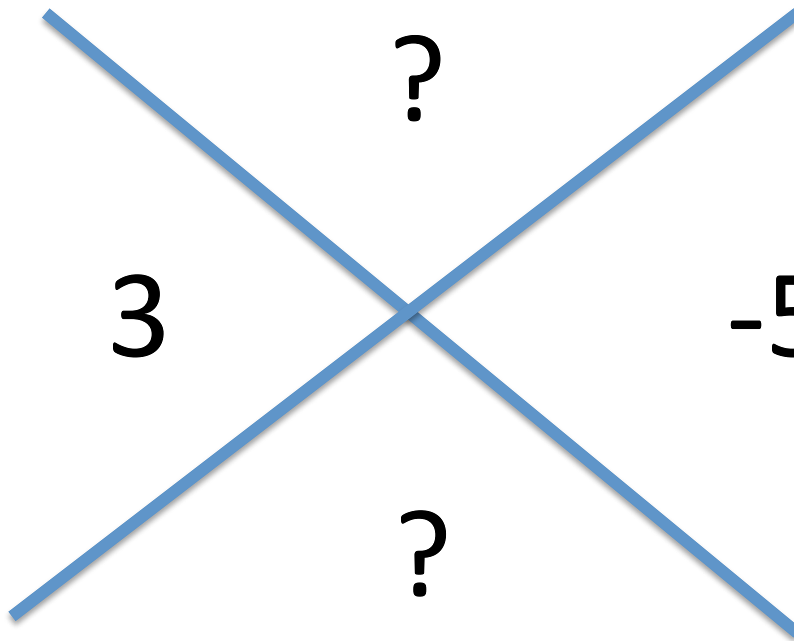
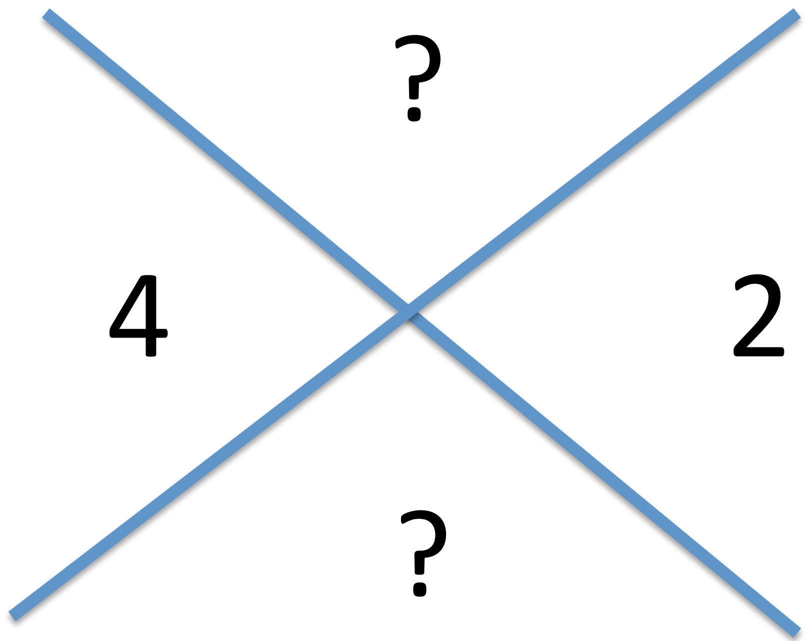
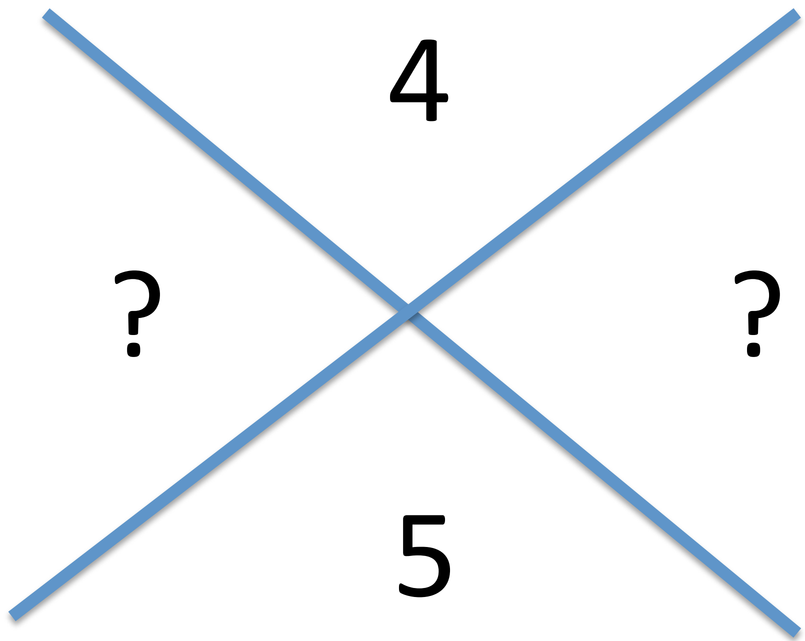


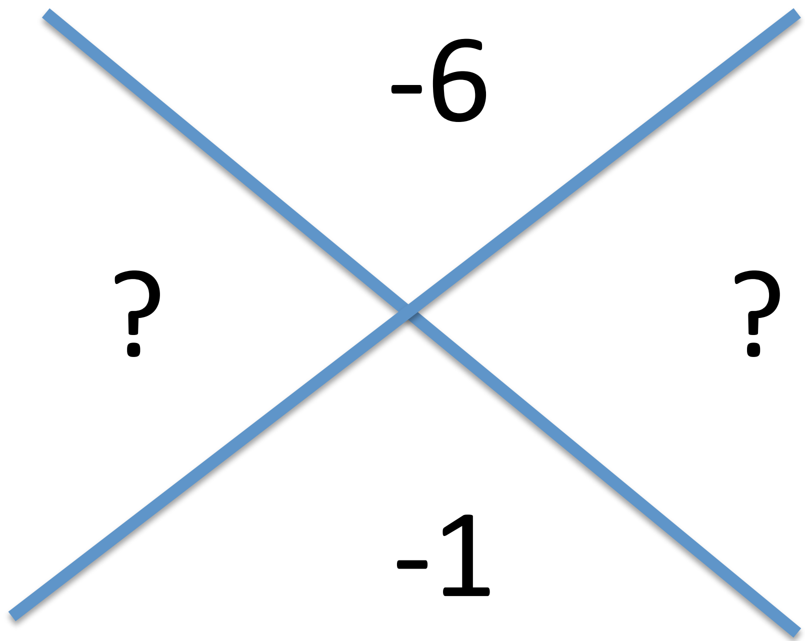
Diamond Method



Diamond Method



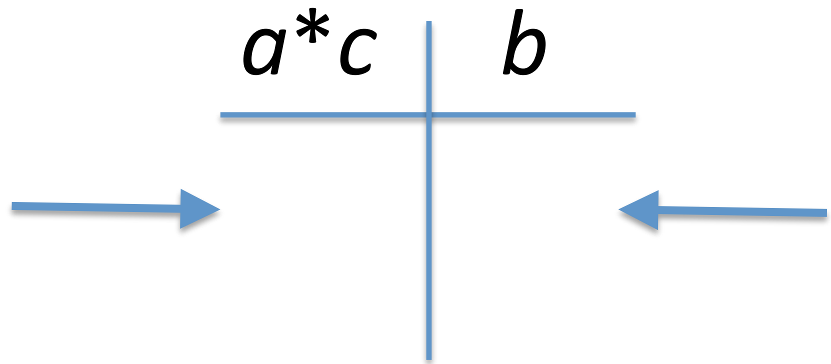
Diamond Method



Factoring a trinomial

To factor a trinomial $ax^2 + bx + c$, we need two numbers that multiply together to equal $a*c$ and add together to equal b

list all factors of $a*c$



add those factors together to see what equals b

$$x^2 + 5x + 6$$

*a*c*	*b*
6	5
1, 6	7
2, 3	5

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

You can check to see if your factors are correct by FOIL-ing

An expression that cannot be factored is considered <u>prime</u>.

Examples:

1) $x^2 - 3x - 18$

$a*c$	b
-18	-3
-9, 2	-7
9, -2	7
-18, 1	-17
18, 1	17
-6, 3	-3
6, -3	3

$= (x - 6)(x + 3)$

2) $b^2 - 11b + 28$

$a*c$	b
28	-11
1, 28	29
2, 14	16
4, 7	11
-4, -7	-11
-2, -14	-16
-1, -28	-29

$= (b - 4)(b - 7)$

3) $c^2 + 2c + 4$

$a*c$	b
4	2
2, 2	4
1, 4	5

prime

Difference of Two Squares

$$a^2 - b^2 = (a+b)(a-b)$$

has to be subtraction

**a^2 and b^2 are perfect squares

Example:

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

Homework

Factoring Trinomials and Difference of Two Squares WS

Objective

Students will be able to factor a trinomial where the leading coefficient is greater than 1.

<u>ANNOUNCEMENTS:</u>

Summer Packet Review and Tutoring: October 24th (Monday- room 341) after school

Factoring and Solving Trinomials Quiz on Monday, October 24th

Summer Packet Retake on Tuesday, October 25th

MIDTERM on Thursday, October 27th

Greatest Common Factor

A whole number that is a factor of two or more nonzero whole numbers is a common factor of the numbers. The largest of the common factors is the greatest common factor (GCF).

What is the GCF of 12 and 16? 4

What is the GCF of 4a and 2a? 2a

GCF when Factoring

When you factor any relation, you should pull out the GCF as your first step!

For the following examples, what is the GCF and how would your first step to factoring look like?

1) $2x^2 + 2x + 4$ GCF = 2 $2(x^2 + x + 2)$

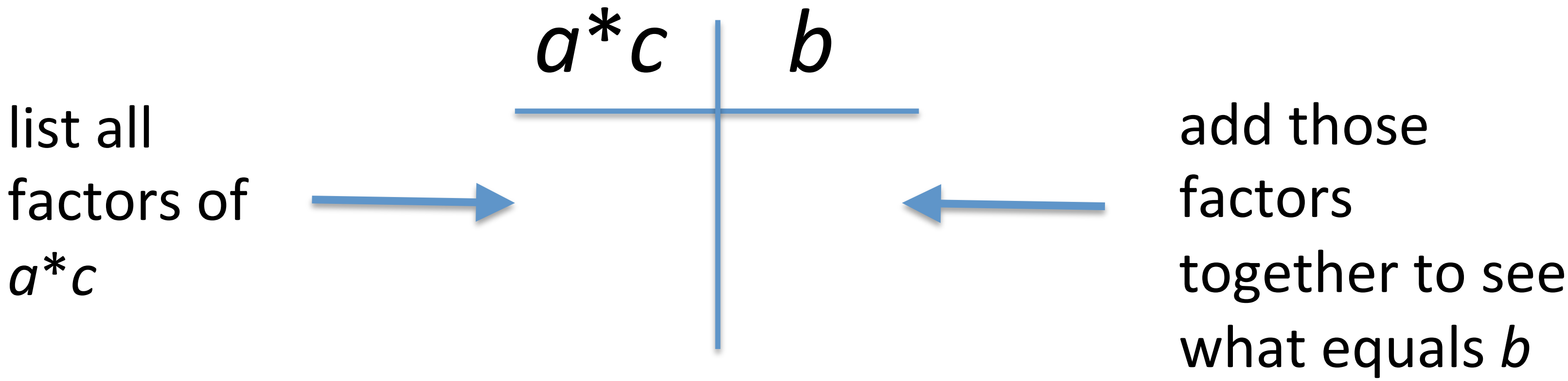
2) $3x^2 – 30x + 15$ GCF = 3 $3(x^2 - 10x + 5)$

3) $24x^3 + 30x^2 – 12x$ GCF = 6x $6x(4x^2 + 5x - 2)$

**Pulling out a GCF is like the opposite of distributing

Factoring a trinomial (a > 1)

To factor a trinomial $ax^2 + bx + c$ where a > 1, we need two numbers that multiply together to equal $a*c$ and add together to equal b



HOWEVER, now that a > 1, these factors are what we use to split the middle term (factor by grouping)!

Factoring when a > 1

Example:

$a*c$	b
$2*3$	
6	7
6, 1	7

$$2x^2 + 7x + 3 =$$

1) split the middle term

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

2) factor by grouping

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

3) GCF of each group

want these to be the same in order to take out the GCF again

$$(x + 3)(2x + 1)$$

Homework

GCF & Factoring Trinomials a > 1 WS

Objectives

Students will be able to solve trinomials by factoring.

ANNOUNCEMENTS:

Summer Packet Review and Tutoring: October 24th (Monday- room 341) after school

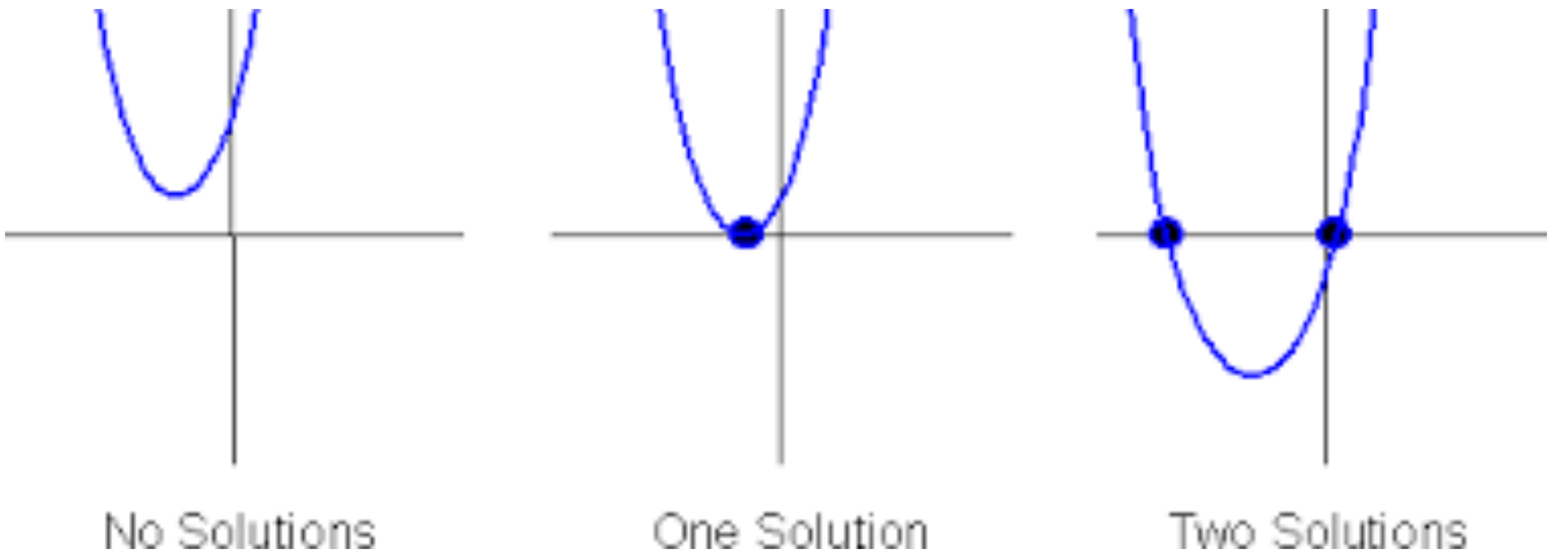
Factoring and Solving Trinomials Quiz on Monday, October 24th

Summer Packet Retake on Tuesday, October 25th

MIDTERM on Thursday, October 27th

What is the difference between factoring and solving?

How many solutions can a quadratic equation have?



What is Zero Product Property?

If $ax^2 + bx + c = 0$ can be factored, then the equation can be solved using the Zero Product Property.

If the product of two expressions is zero, then one or both of the expressions equal zero.

If A and B are expressions and AB = 0, then A = 0 or B = 0

Example: If $(x + 5)(x + 2) = 0$, then $x + 5 = 0$ or $x + 2 = 0$.

So $x = -5$ or $x = -2$

Solve the following problems:

1) $a^2 + 3a - 28 = 0$

a = -7 or a = 4

2) $16c^2 - 20c - 6 = 0$

c = -1/4 or c = 3/2

3) $49z^2 + 3z - 9 = 3z$

z = -3/7 or z = 3/7

4) $3x^2 - 10x = -6$

prime

*When solving, you need to set your equation equal to 0 first!

Zoo

A rectangular enclosure at a zoo is 35 feet long by 18 feet wide. The zoo wants to double the area of the enclosure by adding the same distance *x* to the length and the width. Write and solve an equation to find the value of *x*. What are the new dimensions of the enclosure?

$$2(35)(18) = (35 + x)(18 + x)$$

$$1260 = (35 + x)(18 + x)$$

$$1260 = 630 + 35x + 18x + x^2$$

$$0 = -630 + 53x + x^2$$

$$0 = (x + 63)(x - 10)$$

$$x = \cancel{-63} \text{ or } 10$$

$$l = 35 + x \quad = 35 + 10$$

$$w = 18 + x = 18 + 10$$

45 feet by 28 feet

Homework

Solving Trinomials by Factoring and Zero Product Property Worksheet

Study for your Factoring and Solving Trinomials Quiz on Monday

Objective

Students will be able to use their knowledge about quadratic functions to solve real world problems.

Word Problem

You have made a rectangular quilt that is 5 feet by 4 feet. You want to use the remaining 10 square feet of fabric to add a decorative border of uniform width to the quilt. What should the width of the quilt's border be?

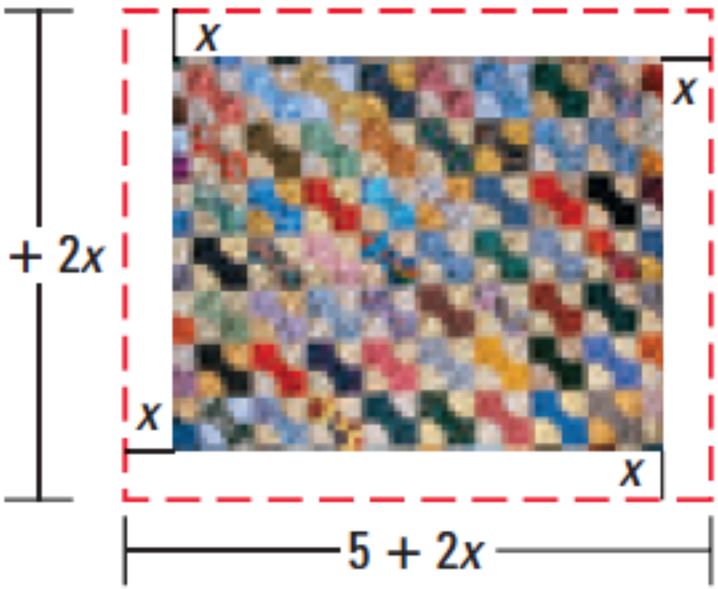
Area of border = Area of quilt and border - Area of quilt

$$10 = (5 + 2x)(4 + 2x) - (5)(4)$$

$$0 = 2(2x - 1)(x + 5)$$

$$x = \tfrac{1}{2} \text{ or } x = -5$$

½ foot or 6 inches



Word Problem

A missile is launched across the ocean. Its trajectory can be mapped by the equation $y = -2000(x - 100)(x - 60)$, where x and y are measured in kilometers.

a) How far is the missile launched?

40 kilometers

b) How high is the missile launched?

800,000 kilometers

Word Problem

A ball is thrown straight up into the air. The height of the ball is modeled by the equation

$h = -5t^2 + 14t + 3$, where h is the height in yards and t is the time in seconds since the ball was thrown.

a) What does 3 represent in our problem?

the height the ball starts at is 3 yards

b) How long does it take the ball to hit the ground?

3 seconds

c) What is the maximum height of the ball?

12.8 yards

d) How long does it take the ball to reach its maximum height?

1.4 seconds

Homework

Quadratic Word Problems WS

Objective

Students will be able to solve quadratic inequalities by factoring.

Solve a Quadratic Inequality Algebraically (by Factoring)

Solve $x^2 - 2x > 15$ algebraically.

First, write and solve the equation obtained by replacing > with =.

$x^2 - 2x = 15$	**Write equation that corresponds to original inequality.**
$x^2 - 2x - 15 = 0$	**Write in standard form.**
$(x + 3)(x - 5) = 0$	**Factor.**
$x = -3$ or $x = 5$	**Zero product property**

The numbers −3 and 5 are the *critical x-values* of the inequality $x^2 - 2x > 15$. Plot −3 and 5 on a number line, using open dots because the values do not satisfy the inequality. The critical x-values partition the number line into three intervals. Test an x-value in each interval to see if it satisfies the inequality.

Test $x = -4$:
$(-4)^2 - 2(-4) = 24 > 15$ ✓

Test $x = 1$:
$1^2 - 2(1) = -1 \ngtr 15$

Test $x = 6$:
$6^2 - 2(6) = 24 > 15$ ✓

▸ The solution is $x < -3$ or $x > 5$. $(-\infty, -3) \cup (5, \infty)$

Solve $3x^2 - 9x - 12 \leq 0$.

$3x^2 - 9x - 12 = 0$

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

$3(x - 4)(x + 1) = 0$

$x = 4$ or $x = -1$

Test:

$x = -2$	$x = 0$	$x = 5$
$3(-2)^2 - 9(-2) - 12 \leq 0$	$3(0)^2 - 9(0) - 12 \leq 0$	$3(5)^2 - 9(5) - 12 \leq 0$
$18 \leq 0$	$-12 \leq 0$	$18 \leq 0$
NO	YES	NO

$-1 \leq x \leq 4$ $[-1, 4]$

Homework

p. 305: 46 - 51

For the following problems, also write their answers in interval notation.

SOLVING ALGEBRAICALLY **Solve the inequality algebraically.**

46. $4x^2 < 25$

47. $x^2 + 10x + 9 < 0$

48. $x^2 - 11x \geq -28$

49. $3x^2 - 13x > 10$

50. $2x^2 - 5x - 3 \leq 0$

51. $4x^2 + 8x - 21 \geq 0$

Objective:

Students will be able to simplify square roots (radicals).

Radicals

The expression $\sqrt{s}$ is called a radical. The symbol $\sqrt{}$ is a radical sign (and also in this case a square root), and the number *s* beneath the radical sign is called the radicand of the expression.

Properties of square roots (a > 0, b > 0):

Product Property- $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$

Quotient Property- $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Simplifying radicals

To simplify radicals, you want to look for the largest perfect square that the radicand can be divided by.

Never leave a radical in the denominator!

Simplifying radicals examples

1) $\sqrt{48} = \sqrt{16 \cdot 3}$

$= \sqrt{16} \cdot \sqrt{3}$

$= 4\sqrt{3}$

Find the highest perfect square that goes into 48

2) $\dfrac{\sqrt{27}}{\sqrt{36}} = \dfrac{\sqrt{9}\sqrt{3}}{6}$

$= \dfrac{3\sqrt{3}}{6}$

$= \dfrac{\sqrt{3}}{2}$

Rationalizing the Denominator

How to eliminate a radical from the denominator where a and b are rational numbers:

Form of the denominator	Multiply numerator and denominator by:
$\sqrt{b}$	$\sqrt{b}$
$a + \sqrt{b}$	$a - \sqrt{b}$
$a - \sqrt{b}$	$a + \sqrt{b}$

The expressions $a+\sqrt{b}$ and $a-\sqrt{b}$ are called conjugates of each other. Their product is always a rational number.

Simplifying radicals examples cont.

3) $\sqrt{\dfrac{5}{3}} = \dfrac{\sqrt{5}}{\sqrt{3}}$

Cannot have a radical in the denominator!

$= \dfrac{\sqrt{5}}{\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}}$

$= \dfrac{\sqrt{15}}{3}$ or $\dfrac{1}{3}\sqrt{15}$

4) $\dfrac{3}{7+\sqrt{2}} = \dfrac{3}{7+\sqrt{2}} \cdot \dfrac{7-\sqrt{2}}{7-\sqrt{2}}$

Multiply the numerator and the denominator by the conjugate

$= \dfrac{21-3\sqrt{2}}{49-7\sqrt{2}+7\sqrt{2}-2}$

$= \dfrac{21-3\sqrt{2}}{47}$

Homework

p. 269: 1-6, 8, 13, 14, 17, 18

1. **VOCABULARY** In the expression $\sqrt{72}$, what is 72 called?

2. ★ **WRITING** *Explain* what it means to "rationalize the denominator" of a quotient containing square roots.

SIMPLIFYING RADICAL EXPRESSIONS **Simplify the expression.**

3. $\sqrt{28}$

4. $\sqrt{192}$

5. $\sqrt{150}$

6. $\sqrt{3} \cdot \sqrt{27}$

8. $5\sqrt{24} \cdot 3\sqrt{10}$

13. $\sqrt{\frac{18}{11}}$

14. $\sqrt{\frac{13}{28}}$

17. $\frac{\sqrt{2}}{4 + \sqrt{5}}$

18. $\frac{3 + \sqrt{7}}{2 - \sqrt{10}}$

Objective

Students will be able to solve quadratic equations by finding square roots.

Chapter 4 Test (everything past graphing) Tuesday, November 15th

**Take out hall passes, I will collect them from you and give you new ones for the quarter tomorrow

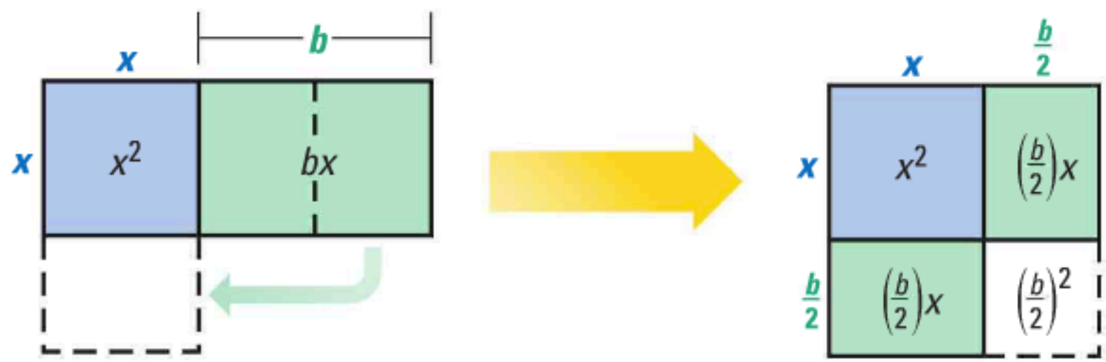
Our warm up is a perfect square because $x^2 – 8x + 16$ factors to $(x – 4)^2$.

Sometimes you need to add a term to an expression $x^2 + bx$ to make it a square. This process is called completing the square.

Completing the Square

Words To complete the square for the expression $x^2 + bx$, add $\left(\frac{b}{2}\right)^2$.

Diagrams In each diagram, the combined area of the shaded regions is $x^2 + bx$. Adding $\left(\frac{b}{2}\right)^2$ completes the square in the second diagram.



Algebra $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)\left(x + \frac{b}{2}\right) = \left(x + \frac{b}{2}\right)^2$

Making a Perfect Square Trinomial

Find the value of *c* that makes $x^2 + 16x + c$ a perfect square trinomial. Then write the expression as the square of a binomial.

Remember to complete the square we need to use: $\boxed{\left(\frac{b}{2}\right)^2}$

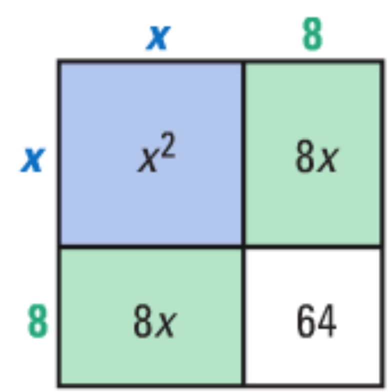
Solution

STEP 1 **Find** half the coefficient of x. $\frac{16}{2} = 8$

STEP 2 **Square** the result of Step 1. $8^2 = 64$

STEP 3 **Replace** c with the result of Step 2. $x^2 + 16x + 64$

▶ The trinomial $x^2 + 16x + c$ is a perfect square when $c = 64$. Then $x^2 + 16x + 64 = (x + 8)(x + 8) = (x + 8)^2$.



Solve the equation by finding square roots.

1) $x^2 + 6x + 9 = 36$

$x = -9, 3$

Find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

2) $x^2 + 22x + c$

$c = 121, (x + 11)^2$

3) $x^2 - 14x + c$

$c = 49, (x - 7)^2$

Solve $x^2 - 12x + 4 = 0$ by completing the square.

1) Write left side in the form $x^2 + bx$

$$x^2 - 12x = -4 \qquad x^2 - 12x + \_\_\_\_ = -4 + \_\_\_\_$$

2) Add $(-12/2)^2 = (-6)^2 = 36$ to each side

$$x^2 - 12x + 36 = -4 + 36$$

3) Write left side as a binomial squared

$$(x - 6)^2 = 32$$

4) Take square roots of each side

$$x - 6 = \pm\sqrt{32}$$

5) Solve for x

$$x = 6 \pm \sqrt{32}$$

6) Simplify

$$x = 6 \pm 4\sqrt{2}$$

Solve the equation by completing the square.

1) $x^2 - 10x + 8 = 0$

$x = 5 \pm \sqrt{17}$

2) $x^2 + 6x - 3 = 0$

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

Homework

p. 288: 3, 7, 9, 13, 17, 23, 25

SOLVING BY SQUARE ROOTS **Solve the equation by finding square roots.**

3. $x^2 + 4x + 4 = 9$

7. $x^2 - 22x + 121 = 13$

9. $t^2 + 8t + 16 = 45$

FINDING *C* **Find the value of *c* that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.**

13. $x^2 + 6x + c$

17. $x^2 - 2x + c$

COMPLETING THE SQUARE **Solve the equation by completing the square.**

23. $x^2 + 8x = -1$

25. $x^2 + 12x + 18 = 0$

Objective

Students will be able to complete the square where the leading coefficient is greater than one and can use completing the square to rewrite functions in vertex form

Chapter 4 Test (everything past graphing) Tuesday, November 15th

Solve $3x^2 + 24x - 5 = 0$ by completing the square.

1) Write left side in the form $x^2 + bx$ $\quad$ $3x^2 + 24x = 5$

2) Divide by leading coefficient (pull it out of left side)

$3(x^2 + 8x) = 5$ $\quad$ $3(x^2 + 8x + \_\_\_\_) = 5 + 3(\_\_\_\_)$

3) Add $(8/2)^2 = (4)^2 = 16$ to each side

$$3(x^2 + 8x + 16) = 5 + 3(16)$$

4) Write left side as a binomial squared

$$3(x + 4)^2 = 53$$

5) Solve for x $\quad$ $(x + 4)^2 = 53/3$ $\quad$ $x + 4 = \pm\sqrt{(53/3)}$

$$x = -4 \pm \sqrt{(53/3)}$$

6) Simplify $\quad$ $x = -4 \pm \sqrt{159}/3$

Write $y = x^2 - 10x + 22$ in vertex form. Then identify the vertex.

Write original function.	$y = x^2 - 10x + 22$
Prepare to complete the square.	$y + \_\_\_\_ = (x^2 - 10x + \_\_\_\_) + 22$
Add $(-b/2)^2$ to each side.	$y + 25 = (x^2 - 10x + 25) + 22$
Write $x^2 - 10x + 25$ as a binomial squared.	$y + 25 = (x - 5)^2 + 22$
Solve for y.	$y = (x - 5)^2 - 3$

The vertex is (5, -3).

Solving Real World Problem by Completing the Square

BASEBALL The height y (in feet) of a baseball t seconds after it is hit is given by this function:

$$y = -16t^2 + 96t + 3$$

Find the maximum height of the baseball.

**Change the equation from standard form to vertex form

$y = -16t^2 + 96t + 3$	**Write original function.**
$y = -16(t^2 - 6t) + 3$	**Factor −16 from first two terms.**
$y + (-16)(\boxed{?}) = -16(t^2 - 6t + \boxed{?}) + 3$	**Prepare to complete the square.**
$y + (-16)(9) = -16(t^2 - 6t + 9) + 3$	**Add (−16)(9) to each side.**
$y - 144 = -16(t - 3)^2 + 3$	**Write $t^2 - 6t + 9$ as a binomial squared.**
$y = -16(t - 3)^2 + 147$	**Solve for y.**

The vertex is (3, 147), so the maximum height of the baseball is 147 feet.

Homework

p. 288: 28-30, 41-43

COMPLETING THE SQUARE **Solve the equation by completing the square.**

28. $2k^2 + 16k = -12$ **29.** $3x^2 + 42x = -24$ **30.** $4x^2 - 40x - 12 = 0$

WRITING IN VERTEX FORM **Write the quadratic function in vertex form. Then identify the vertex.**

41. $y = x^2 - 8x + 19$ **42.** $y = x^2 - 4x - 1$ **43.** $y = x^2 + 12x + 37$

Chapter 4 Part Two Test on Tuesday!

Objective

Students will be able to use the quadratic formula to solve quadratic equations and use the discriminant to determine the number of solutions.

Chapter 4 Test (everything past graphing) Tuesday, November 15th

What do we call polynomials that cannot be factored?

Is there a way to find the solutions to prime polynomials?

The Quadratic Formula

Let a, b, and c be real numbers such that $a \neq 0$. The solutions of the quadratic equation $ax^2 + bx + c = 0$ are:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The quadratic formula gives the solution to *any* quadratic equation

Example:

$ax^2 + bx + c = 0$

$3x^2 - 10x + 6 = 0$ is prime, but we can use the quadratic formula to solve for the solutions/ roots/x-intercepts/zeros.

a = 3, b = -10, c = 6

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(3)(6)}}{2(3)}$$

**simplify the radical!

$$= \frac{10 \pm \sqrt{100 - 72}}{6} = \frac{10 \pm \sqrt{28}}{6} = \frac{10 \pm 2\sqrt{7}}{6} = \frac{5 \pm \sqrt{7}}{3}$$

**simplify fraction!

Discriminant

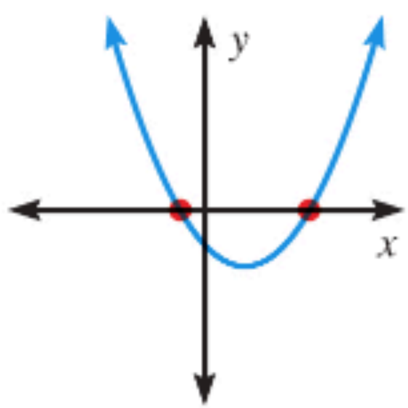
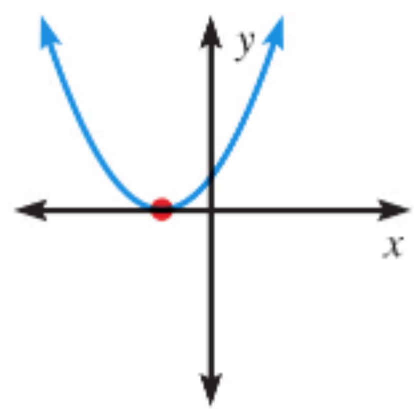
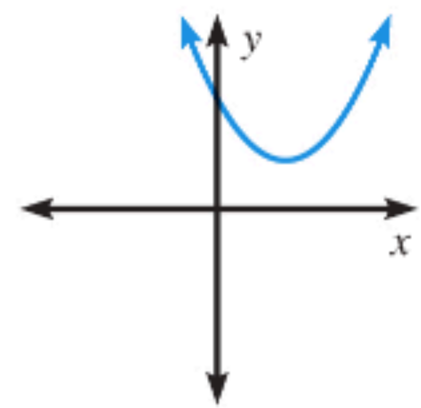
In the quadratic formula, the expression $b^2 - 4ac$ is called the <u>discriminant</u>.

discriminant

$$x = \frac{-b \pm \sqrt{\boxed{b^2 - 4ac}}}{2a}$$

You can use the discriminant of a quadratic equation to determine the equation's number and type of solutions.

Using the Discriminant of $ax^2 + bx + c = 0$

Value of discriminant	$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
Number and type of solutions	Two real solutions	One real solution	Two imaginary solutions
Graph of $y = ax^2 + bx + c$	 Two x-intercepts	 One x-intercept	 No x-intercept

Find the discriminant of the quadratic equation and give the number and type of solutions of the equation.

1) $x^2 - 8x + 17 = 0$

-4; two imaginary solutions

2) $x^2 - 8x + 16 = 0$

0; one real solution

3) $x^2 - 8x + 15 = 0$

4; two real solutions

Homework

p. 296: 4, 9, 17, 31, 32, 38

EQUATIONS IN STANDARD FORM Use the quadratic formula to solve the equation.

4. $x^2 - 6x + 7 = 0$ **9.** $4x^2 - 8x + 1 = 0$

EQUATIONS NOT IN STANDARD FORM Use the quadratic formula to solve the equation.

17. $3 - 8v - 5v^2 = 2v$

USING THE DISCRIMINANT Find the discriminant of the quadratic equation and give the number and type of solutions of the equation.

31. $x^2 - 8x + 16 = 0$ **32.** $s^2 + 7s + 11 = 0$

38. $5x^2 + 16x = 11x - 3x^2$

Chapter 4 Part Two Test on Tuesday!