Algebra 1

Unit 2 Part 2

Solving Quadratic Equations

Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
February 22nd	February 23rd	February 24th	February 25th	February 26th
Factoring	*Unit 2 Part 1 Test Opens*	*Unit 2 Part 1 Test due at Midnight*	Solving Quadratics by Factoring	Solving Quadratics by Factoring
March 1st	March 2nd	March 3rd	March 4th	March 5th
Simplifying Radicals Solving Quadratics by Square Roots	Solving Quadratics by Square Roots **Unit 2 Part 2 Quiz Opens**	**Unit 2 Part 2 Quiz due at Midnight**	Solving Quadratics by Completing the Square	Solving Quadratics by Completing the Square The Discriminant
March 8th	March 9th	March 10th	March 11th	March 12th
The Discriminant Solving Quadratics by the Quadratic Formula	Solving Quadratics by the Quadratic Formula **Unit 2 Part 2 Test Opens**	**Unit 2 Part 2 Test due at Midnight**		

Solving Quadratic Equations by Factoring

To solve a quadratic equation by factoring, you must…

① ____

② ____

③ ____

④ ____

Note: the solutions to quadratic equations are known as solutions, zeroes, roots, and x-intercepts

Examples:

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

2) $x^2 - 11x = -30$

3) $3x^2 - 75 = 0$

4) $15x^2 - 8x + 1 = 0$

5) $2x^2 + 4x - 20 = 10$

6) $9x^2 - 4 = 0$

7) $4x^2 + 10x + 9 = -3x$

8) $16x^2 - 24x = -9$

Solving Quadratics by Factoring – Matching WS

A: $\{2, 0\}$	B: $\{-1, 4\}$	C: $\left\{\frac{5}{2}, -3\right\}$	D: $\{-3, -4\}$
E: $\{2, 3\}$	F: $\left\{-\frac{4}{3}, 1\right\}$	G: $\left\{\frac{3}{5}, -5\right\}$	H: $\left\{\frac{1}{3}, -1\right\}$

1) $4n^2 - 8n = 0$

2) $x^2 + 7x + 12 = 0$

3) $10a^2 + 5a - 75 = 0$

4) $3k^2 + 2k - 1 = 0$

5) $20a^2 + 88a - 62 = -2$

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

7) $4n^2 - 20n + 25 = 1$

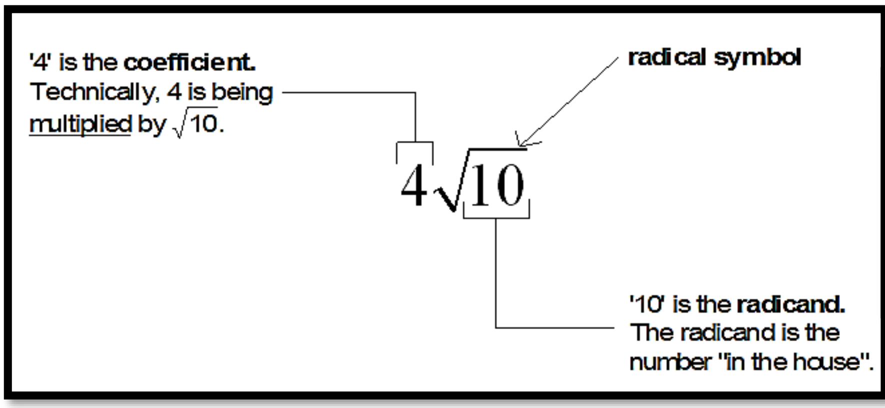
8) $4p^2 - 4 = -p + p^2$

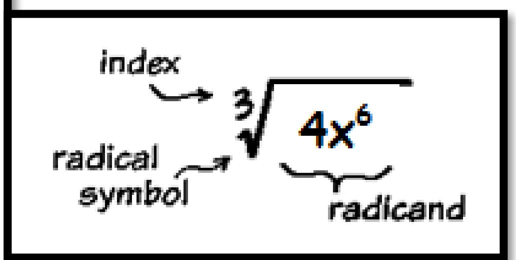
Simplifying Radicals

Perfect Squares	1	4	9	16	25	36	49	64	81	100	121	144
	$\sqrt{1}$	$\sqrt{4}$	$\sqrt{9}$	$\sqrt{16}$	$\sqrt{25}$	$\sqrt{36}$	$\sqrt{49}$	$\sqrt{64}$	$\sqrt{81}$	$\sqrt{100}$	$\sqrt{121}$	$\sqrt{144}$
Square Root	1	2	3	4	5	6	7	8	9	10	11	12

A **radical** is any number with a radical symbol ($\sqrt{\ }$).

A **radical expression** is an expression (coefficients and/or variables) with radical.





When are Radical Expressions in Simplest Form?

A ________________ expression is in **simplest form** if:

- No perfect square factors other than 1 are in the radicand
  Example: $\sqrt{11}$

- What if there is a perfect square factor in the radicand? According to the Product Properties of Radicals, we can split the radical into the product of two radicals. Then we can evaluate the square root of the perfect square factor. It becomes the coefficient of the radical.
  Example: $\sqrt{20}$

Simplifying Radicals

Guided Example: Simplify $\sqrt{108}$.

Step 1: Begin by finding perfect square factors of the radicand.	
Step 2: Split the radical into the product of two radicals. *Look for the biggest perfect square factor of the radicand*	
Step 3: Evaluate the square root of the perfect square factor, and place it in the front of the radical as a coefficient. Leave the remaining factor inside the radical.	
Step 4: Repeat steps 1-4 until radical cannot be simplified further.	

Practice:

a. $\sqrt{32}$

b. $\sqrt{48}$

c. $\sqrt{28}$

d. $\sqrt{14}$

e. $3\sqrt{96}$

f. $4\sqrt{20}$

g. $6\sqrt{120}$

h. $2\sqrt{36}$

i. $\sqrt{24}$

Perfect Square	1	4	9	16	25	36	49	64	81	100	121	144	169
$\sqrt{}$	1	2	3	4	5	6	7	8	9	10	11	12	13

Simplify each radical expression, if possible. Find the correct answer below.
Write the letters in the boxes below to answer the riddle.

1) $\sqrt{100}$	2) $\sqrt{24}$	3) $\sqrt{18}$	4) $\sqrt{4}$
5) $\sqrt{7}$	6) $\sqrt{98}$	7) $\sqrt{16}$	8) $\sqrt{8}$
9) $\sqrt{20}$	10) $\sqrt{63}$	11) $\sqrt{32}$	12) $\sqrt{12}$
13) $\sqrt{121}$	14) $\sqrt{45}$	15) $\sqrt{48}$	16) $\sqrt{10}$
17) $\sqrt{50}$	18) $\sqrt{72}$	19) $\sqrt{300}$	20) $\sqrt{75}$

Answer Choices:

$3\sqrt{10}$?	$7\sqrt{2}$ A	$2\sqrt{6}$ A	$\sqrt{4}$!	9 R	$3\sqrt{7}$ E	$5\sqrt{3}$!	$4\sqrt{3}$ S	$4\sqrt{6}$ S	$2\sqrt{5}$ V
2 W	$\sqrt{7}$ H	$2\sqrt{7}$ O	$\sqrt{3}$ T	10 E	$16\sqrt{2}$ J	$2\sqrt{2}$ E	6 V	12 R	$9\sqrt{8}$ O
$3\sqrt{5}$ G	$3\sqrt{2}$ T	$8\sqrt{3}$ E	$4\sqrt{2}$ R	$9\sqrt{2}$ Q	3 U	$\sqrt{12}$ W	$6\sqrt{2}$ E	1 C	$\sqrt{10}$ T
7 P	25 R	11 U	$8\sqrt{2}$ W	$24\sqrt{2}$ H	$2\sqrt{3}$ B	$5\sqrt{2}$ H	8 A	$10\sqrt{3}$ M	4 T

Why are frogs so happy?

THEY																				

Solving Quadratics by Square Roots

Without using a calculator, see how many of the first 12 perfect squares you can name.

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Simplifying Non-Perfect Squares: Find a perfect square that goes into the radicand, break into 2 radicals, and simply. Repeat if possible.

$\sqrt{12}$ $\sqrt{20}$ $\sqrt{30}$ $\sqrt{75}$

Taking the Square Root: Using your calculator, calculate the following.

$(-8)^2 =$ $(8)^2 =$ $(5)^2 =$ $(-5)^2 =$

Without using your calculator, take the square root of the following integers.

16 49 100 12 1

We are going to use this information to help us solve quadratic equations by taking the square root.

When solving by square roots, you want to:

① ______________________________

____

② ______________________________

____

③ ______________________________

④ ______________________________

Steps: Isolate whatever is being squared, square root both sides (include +/- and break into two equations), simplify the radicals if possible, solve for x

1) $3x^2 + 7 = 55$

2) $(x - 7)^2 = 81$

3) $x^2 - 16 = 0$

4) $-3x^2 - 6 = -x^2 - 12$

5) $(x+1)^2=50$

6) $4x^2-9=0$

7) $-7(x-10)^2-6=-258$

8) $(x+3)^2-20=7$

Solving Quadratics by Square Roots – Practice

For each of the following questions, find the roots.

1) $x^2 = 25$

2) $2x^2 = 98$

3) $x^2 - 1 = 0$

4) $9x^2 - 16 = 0$

5) $x^2 + 9 = 25$

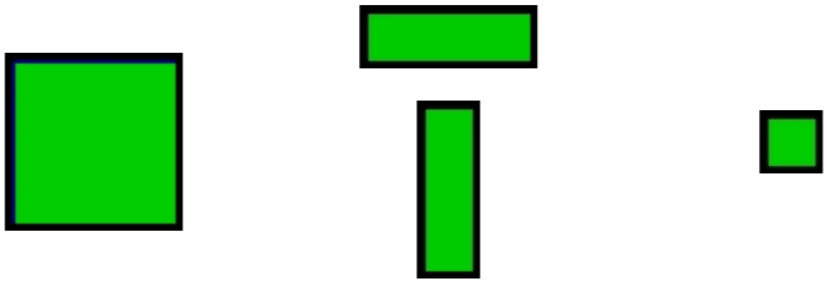
6) $4(x-2)^2 = 100$

7) $(x-2)^2 + 9 = 25$

8) $(4x-2)^2 + 9 = 25$

Solving Quadratics by Completing the Square
(using Algebra tiles)

Algebra tiles are square and rectangular tiles that we use to represent numbers and variables. There are 3 types of tiles…



x^2 Tile
Area = x • x = x^2 units

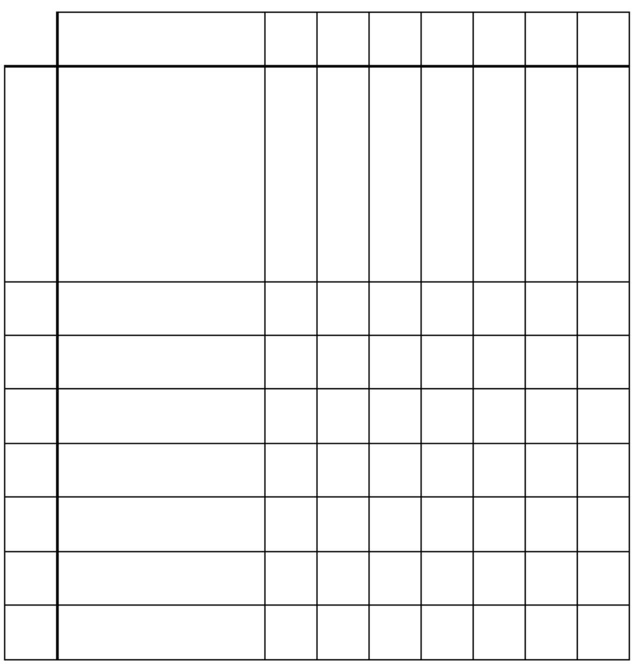
x Tile
Area = 1 • x = x units

Unit Tile
Area = 1 • 1 = 1 unit

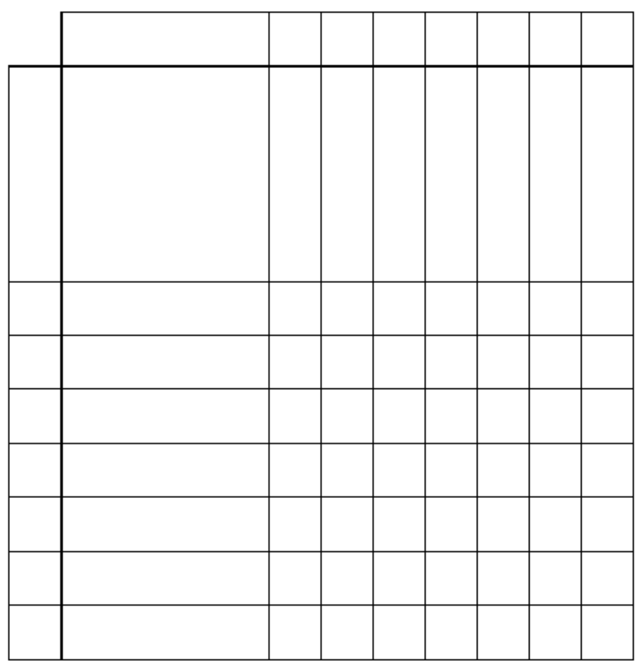
Algebra tiles are often double sided with a green side that represents positive values and red side that represents negative values.

We are going to use the diagram below to model quadratic equations.

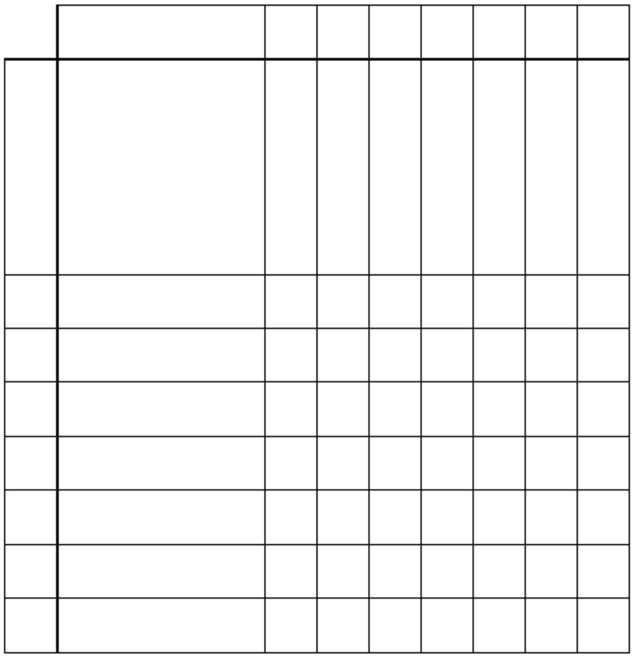
$y = x^2 + 6x + 9$



$y = x^2 - 4x + 4$



Create a partial square with algebra tiles to represent $x^2 + 2x +$ ____



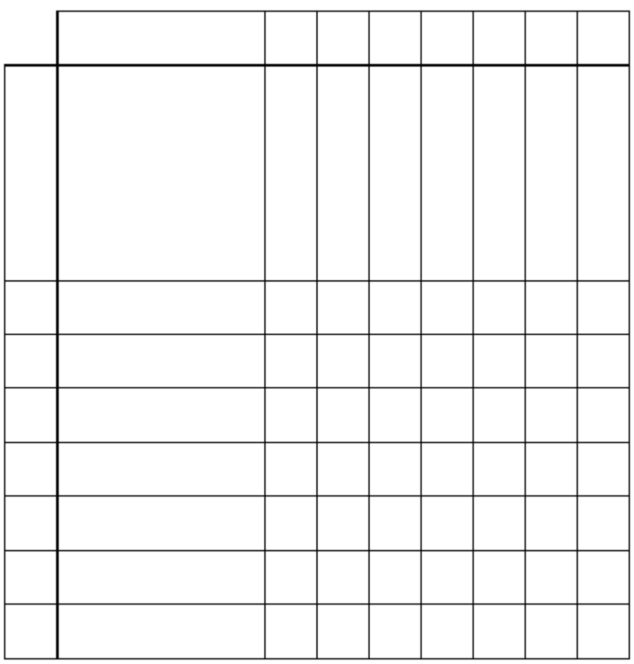
a) How many unit tiles do you need to complete the square?

b) What are the dimensions of the completed square?

c) Fill in the blanks below to make the following true:

$$x^2 + 2x + \_\_\_\_ = (x + \_\_\_\_\_)^2$$

Create a partial square with algebra tiles to represent $x^2 + 8x +$ ____



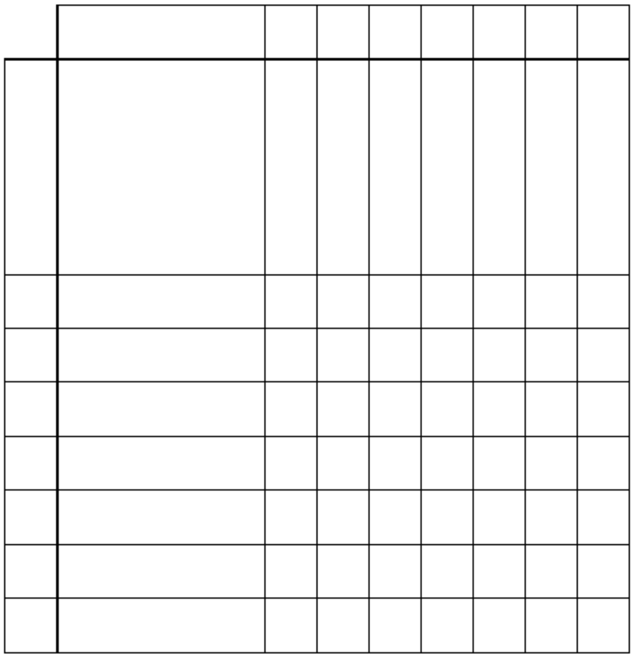
a) How many unit tiles do you need to complete the square?

b) What are the dimensions of the completed square?

c) Fill in the blanks below to make the following true:

$$x^2 + 8x + \_\_\_\_ = (x + \_\_\_\_\_)^2$$

Create a partial square with algebra tiles to represent $x^2 - 6x +$ ____



a) How many unit tiles do you need to complete the square?

b) What are the dimensions of the completed square?

c) Fill in the blanks below to make the following true:

$$x^2 - 6x + \_\_\_\_ = (x + \_\_\_\_\_)^2$$

Using Algebra Tiles to Solve Quadratics

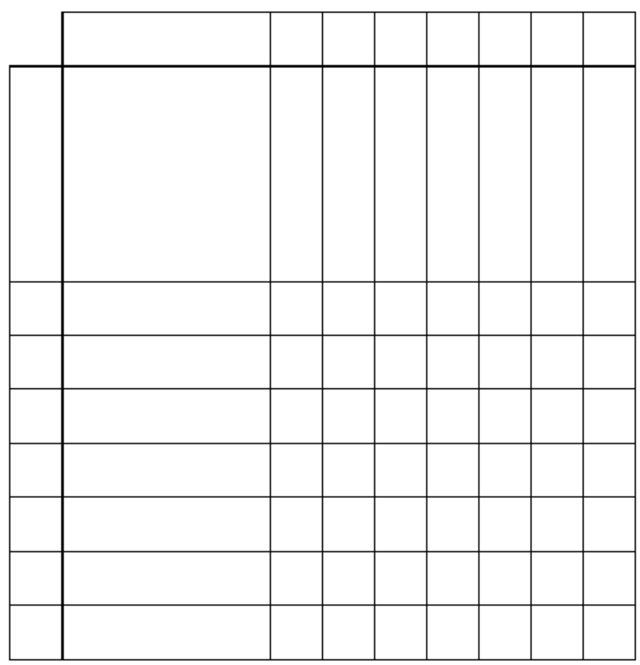
Given the equation $x^2 + 2x + 3 = 0$…

a) How many x^2 tiles do we have?

b) How many x tiles do we have?

c) How many unit tiles do we have?

d) Sketch the square. *(You may have extra unit tiles or you may need to borrow unit tiles)*



e) Length of the square:

f) Area of the square:

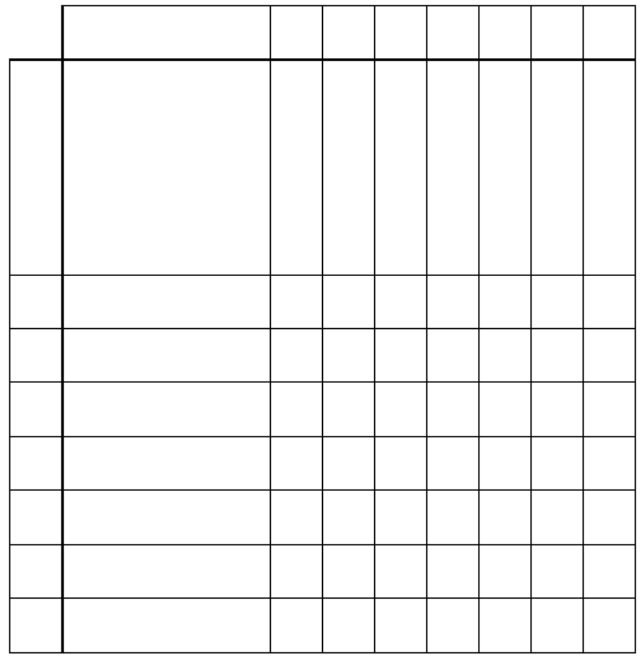
g) Unit tiles left over (+/-) or borrowed (-)

h) New equation:

i) To solve, replace y with 0 and solve.

Given the equation $x^2 + 4x + 1 = 0$…

a) How many x^2 tiles do we have?



b) How many x tiles do we have?

c) How many unit tiles do we have?

d) Sketch the square. *(You may have extra unit tiles or you may need to borrow unit tiles)*

e) Length of the square:

f) Area of the square:

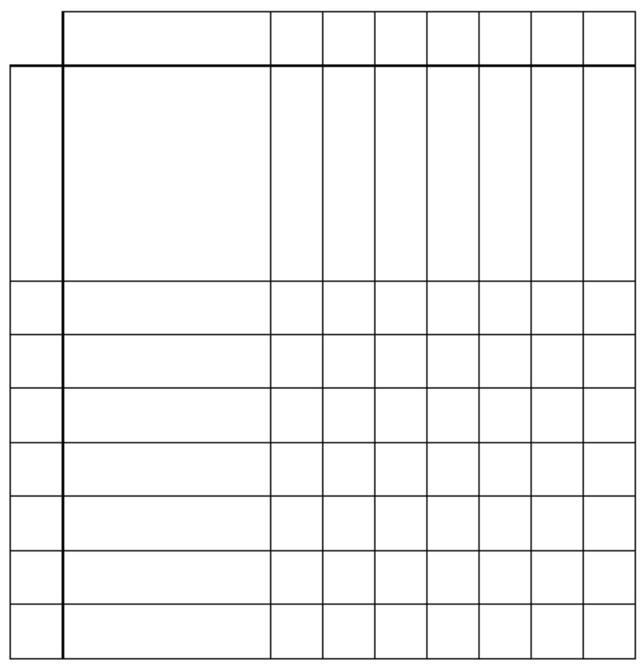
g) Unit tiles left over (+/-) or borrowed (-)

h) New equation:

i) To solve, replace y with 0 and solve.

Given the equation $x^2 + 6x + 4 = -6$…

a) Get the equation equal to zero.



b) How many x^2 tiles do we have?

c) How many x tiles do we have?

d) How many unit tiles do we have?

e) Sketch the square. *(You may have extra unit tiles or you may need to borrow unit tiles)*

f) Length of the square:

g) Area of the square:

h) Unit tiles left over (+/-) or borrowed (-)

i) New equation:

j) To solve, replace y with 0 and solve.

** If the equation is originally set equal to a number other than 0, get it equal to 0 first ** If a is not 1, you will need to factor out a first **

1) $x^2 + 12x + 30 = 2$

2) $x^2 + 8x - 20 = 0$

3) $x^2 - 6x + 8 = 1$

Completing the Square Practice

Complete the square to find the roots of the following functions.

1) $x^2 + 12x + 32 = 0$

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

draw your own diagram

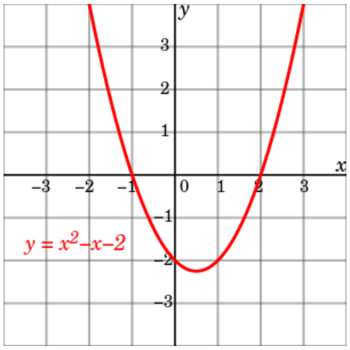
3) $x^2 - 6x - 10 = 6$

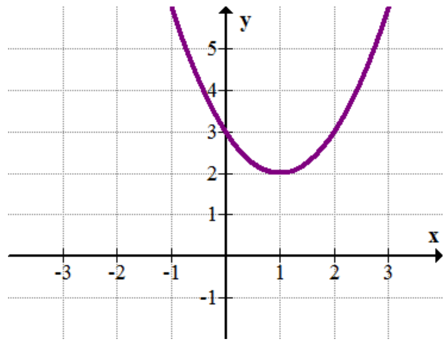
4) $x^2 - 9 = 4x$

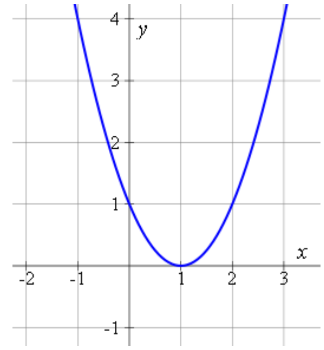
Quadratic Formula and the Discriminant

Remember, solutions to quadratic functions are also known as **zeroes, roots, and x-intercepts.**

How many solutions does each graph below have? *(think about the sentence above)*







The Discriminant

The discriminant is part of the quadratic formula. When you simplify the discriminant, it becomes a number that will tell you the number of solutions a quadratic function has.

Before finding the discriminant, you must make sure your equation is equal to zero

discriminant: $\boldsymbol{b^2 - 4ac}$

If the discriminant is negative, there is/are ____

If the discriminant is zero, there is/are ____

If the discriminant is positive, there is/are ____

For each equation below, determine the number of solutions.

1) $x^2 + 6x + 4 = 0$

2) $-3x^2 + 17x - 2 = 3$

3) $3x + 7 = -5x^2 - 4$

4) $x^2 - 5x - 34 = 0$

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

6) $9x^2 + 24x + 10 = -6$

The Quadratic Formula

You can use the quadratic formula anytime that a quadratic equation is in general form. The quadratic formula is one method that will always work when solving quadratics.

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

Example: $4x^2 - 13x + 3 = 0$

Steps	Example
1) Find a, b, and c **make sure equation is set equal to zero**	
2) Plug a, b, and c into the quadratic formula	
3) Simplify the discriminant and denominator	
4) Separate into two equations and simplify	

Practice:

1) $x^2 + 11x + 10 = 0$

Discriminant: ___________ which means ________________________

Root(s): ______________________

2) $7x^2 + 8x + 1 = 0$

Discriminant: ___________

# of solutions: ______________________

Root(s): ______________________

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

Discriminant: ___________

# of solutions: ______________________

Root(s): ______________________

4) $9x^2 + 6x + 1 = 0$

Discriminant: ___________

# of solutions: ______________________

Root(s): ______________________

5) $y = 9x^2 + 14x + 3$

Discriminant: ___________

# of solutions: ______________________

Root(s): ______________________

What is a Metaphor?

Solve each equation below using the quadratic formula. Cross out the box that contains the solution set. When you finish, print the letters from the remaining boxes in the spaces at the bottom of the page.

1) $x^2 + 4x + 3 = 0$

2) $x^2 - 7x + 10 = 0$

3) $x^2 + 5x + 6 = 0$

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

5) $y^2 + 2y - 8 = 0$

6) $x^2 - 5x + 2 = 0$

7) $d^2 + 3d - 7 = 0$

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

9) $2n^2 - 3n - 5 = 0$

10) $3x^2 + 5x + 1 = 0$

11) $3y^2 - 2y - 8 = 0$

ONE $\{5, 2\}$	ATH $\left\{\frac{-5 \pm \sqrt{13}}{6}\right\}$	TOK $\left\{-4, \frac{1}{2}\right\}$	ING $\left\{\frac{5}{2}, -1\right\}$	ICK $\left\{\frac{-3 \pm \sqrt{37}}{2}\right\}$
ASL $\{-2, -3\}$	EEP $\left\{\frac{3 \pm \sqrt{15}}{2}\right\}$	MET $\{2, -4\}$	BOW $\left\{2, -\frac{4}{3}\right\}$	COW $\left\{\frac{2 \pm \sqrt{30}}{6}\right\}$
BOY $\left\{2, \frac{1}{2}\right\}$	RIT $\{-1, -3\}$	SIN $\{6, 1\}$	GLE $\left\{\frac{5 \pm \sqrt{17}}{2}\right\}$	ING $\{4, -1\}$

Remaining Letters:

Picking the "Best" Method to Solve Quadratic Equations

Method	**Page**	**When You Can Use It**	**Advantages**	**Disadvantages**
Factoring		whenever the quadratic is factorable	▪ good method to try first ▪ straightforward (if the quadratic is factorable)	▪ not all quadratics are factorable
Square Roots		whenever the *b* term is *0x*	▪ quick	▪ cannot use when the *b* term is anything but *0x*
Completing the Square		when a = 1 and b is even	▪ will always work if a = 1 and b is even	▪ longer process ▪ multiple steps
Quadratic Formula		always works	▪ always works	▪ other methods may be "easier" or quicker

Solve the following quadratic equation by the methods listed.

$$x^2 - 8x + 10 = -5$$

Factoring | **Completing the Square** | **Quadratic Formula**

Solving Quadratic Equations – Matching Worksheet

Solve the following by any method. Then, match the equation to the answer(s) on the right.

____ 1) $x^2 - 16x + 63 = 0$

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

____ 3) $5x^2 = 45$

____ 4) $x^2 - 2x - 14 = -4$

____ 5) $4x^2 + 20x - 20 = 4$

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

____ 7) $2x^2 - 3x = 0$

____ 8) $x^2 - 4x - 18 = -x$

____ 9) $x^2 + 14x - 30 = 8$

____ 10) $3x^2 - 2x = 8$

____ 11) $x^2 - 9 = 0$

____ 12) $5x^2 + 9 = 134$

____ 13) $x^2 - 8x + 3 = 0$

____ 14) $2x^2 + x - 10 = 0$

____ 15) $2(x-3)^2 - 12 = 4$

____ 16) $2x^2 + x - 10 = 5$

____ 17) $x^2 - 8x - 33 = 0$

____ 18) $x^2 - 4x - 12 = 0$

____ 19) $x^2 - 10x - 8 = 0$

____ 20) $2(x-3)^2 = 8$

one answer will be used twice

a) $x = 3, x = -3$

b) $x = -3 \pm \sqrt{11}$

c) $x = 2, x = -\frac{5}{2}$

d) no real solution

e) $x = 1 \pm \sqrt{11}$

f) $x = -2, x = 6$

g) $x = \pm 5$

h) $x = 7, x = 9$

i) $x = 0, x = \frac{3}{2}$

j) $x = 3 \pm 2\sqrt{2}$

k) $x = -3, x = 6$

l) $x = 4 \pm \sqrt{13}$

m) $x = 5 \pm \sqrt{33}$

n) $x = -3, x = 11$

o) $x = 1, x = 5$

p) $x = 2, x = -\frac{4}{3}$

q) $x = -7 \pm \sqrt{87}$

r) $x = -3, x = \frac{5}{2}$

s) $x = -6, x = 1$