Def: A **quadratic function** is any function of the form where a,b,c.

Ex: Give an example of a quadratic function, one that is and one that is not. Show a Q.F. can have at most 3 terms but can have less than 3 as well.

Every function can be represented by its graph. All points on the graph will be solutions to your function/equation. The solution set for the function will be all points on the graph.

So functions and their graphs are really two ways of looking at the same thing!!!

Ex: See graph on this site:

(Standard form of a quadratic equation with variable constants):

<http://www.mathopenref.com/quadraticexplorer.html>

Same graph but from wolfram demonstrations project

<http://demonstrations.wolfram.com/AnnotatedQuadraticPolynomial/>

Graph of quadratic with variable constants in vertex form:

<http://demonstrations.wolfram.com/QuadraticInVertexFormOrTurningPointForm/>

Show connections between roots and factors of the quadratic equation

Graph showing the roots and factored form of a quadratic with variable constants

<http://demonstrations.wolfram.com/QuadraticEquationWithFactoredForm/>

Show connections between roots and factors of the quadratic equation

Ex: Given . Find the values of when (I.E. Find the zeros/roots of the function)

## The Principle of Square Roots.

The Principal of Square Roots

For any real number k, if then

Ex: Solve the quadratic equation

Then check to see if this is a root to the function

Ex: if a) and b) then find x.

*Ex:*

*Ex:* If find all values of x for which

## Completing the Square

Click [here](http://www.mathportal.org/calculators/solving-equations/quadratic-equation-solver.php) for a link to a webpage that shows step by step method of completing the square.

Consider the following examples. They are intended to lead you through the evolution of how you come about discovering the process of completing the square:

Solve the following for x:

1. See Previous problem
3. See previous problem
4. See previous problem

Recall how a perfect square is F.O.I.L.ed.

Lets practice this backwards

3

9

\_\_\_\_\_\_

4

16

\_\_\_\_\_\_

5

25

\_\_\_\_\_\_

Knowing that if a polynomial does not factor nicely we are forced to search for a new method, we seek what we have just been learning.

Click [here](http://www.mathportal.org/calculators/solving-equations/quadratic-equation-solver.php) for **a step by step quadratic equation solver** (using completing the square or quad. formula!)

1. (imaginary solutions)

# **Now to through a wrench in this process,** try solving:

Factors nicely, no completing the square necessary

[Solution](#_Solve:_3,𝑥-2.+9𝑥+7=0)

[Solution](#_Solve__3,𝑥-2.+7𝑥−2=0)

Graph with work for completing the square for varied constant values:

<http://demonstrations.wolfram.com/CompletingTheSquare/>

or

<http://www.mathportal.org/calculators/solving-equations/quadratic-equation-solver.php>

We are now almost masters of completing the square. There is only one thing left to prove our skills are ready…we have to generalize the process.

Solve the quadratic equation: (for help, look back to an example that used actual numbers)

where

Notice what we have just created!!!

# Solve:

**The solutions are:**

**Explanation**

**STEP 1: Divide equation by whatever is multiplied on the squared term.** In this case we will divide with 3.

**STEP 2: Keep all terms containing x on one side. Move the constant to the right.**

**STEP 3: Take half of the x-term coefficient and square it. Add this value to both sides**. In this example we have:

The x-term coefficient = 3

The half of the x-term coefficient =

After squaring we have

When we add to both sides we have:

**STEP 4: Simplify right side**

**STEP 5: Write the perfect square on the left.**

**STEP 6: Take the square root of both sides.**

**STEP 7: Solve for x.**

that is,

[Go back](#_Now_to_through) to the problems

# Solve

**The solutions are:**

**Explanation**

**STEP 1: Divide equation by whatever is multiplied on the squared term.** In this case we will divide with 3.

**STEP 2: Keep all terms containing x on one side. Move the constant to the right.**

**STEP 3: Take half of the x-term coefficient and square it. Add this value to both sides**. In this example we have:

The x-term coefficient

The half of the x-term coefficient

After squaring we have

When we add to both sides we have:

**STEP 4: Simplify right side**

**STEP 5: Write the perfect square on the left.**

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that is,

[Go back](#_Now_to_through) to the problems