

Title: Completing the Square

Class: Math 107 or Math 120

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Instructions to tutor: Read instructions and follow all steps for each problem exactly as given.

Keywords/Tags: perfect square trinomials, solving quadratic equations, completing the square

Completing the Square

Purpose:

This activity is intended to facilitate your learning and understanding of completing the square as a method for solving quadratic equations.

Activity: Work through the following activity/problems. You may use your textbook and notes to help you, but do not consult a tutor until you have completed through problem #6 on this activity.

1. Expand:

(a) $(x + 2)^2$ _____

(b) $(x - 4)^2$ _____

(c) $\left(x + \frac{1}{3}\right)^2$ _____

These trinomials are called **perfect square trinomials** because they are the result of squaring a binomial.

Notice that these trinomials are in standard form of a quadratic ($ax^2 + bx + c$). Also, there is a relationship

between b and c . That relationship is that $\left(\frac{b}{2}\right)^2 = c$. Verify that for the above expressions.

Also, notice that the binomial is in the form $\left(x + \frac{b}{2}\right)^2$. Verify that for the above expressions.

2. Find c so that the expressions below are perfect square trinomials.

(a) $x^2 + 5x + c$ $c =$ _____

(b) $x^2 - 14x + c$ $c =$ _____

(c) $x^2 - \frac{1}{7}x + c$ $c =$ _____

3. For each of the previous three trinomials, rewrite as a binomial squared.

(a)

(b)

(c)

You have just done a process called **completing the square**. You first determined what needed to be added in order to have a perfect square trinomial. Then, you rewrote the trinomial as a binomial squared.

So far, to solve a quadratic equation in standard form, I can either use the factoring method or I can rewrite it in vertex form and use the square root method. Factoring does not always work and rewriting the equation in vertex form can be very time-consuming.

We can use completing the square to solve ANY quadratic equation in standard form.

4. Solve by completing the square: $x^2 - 2x = 10$

(a) Determine what constant c should be added to the left side so that it will be a perfect square trinomial. Then add this c to BOTH sides (we must do this in order to preserve the equation).

(b) Now, complete the square of the left side (rewrite as a binomial squared).

(c) Solve using the square root method.

5. Solve by completing the square: $x^2 - 10x - 2 = 0$

- (a) First, move the constant (-2) to the other side (so that you will be able to complete the square of the left side).

- (b) Determine what constant c should be added to the left side so that it will be a perfect square trinomial. Then add this c to BOTH sides.

- (c) Rewrite the left side as a binomial squared.

- (d) Solve using the square root method.

6. Solve by completing the square: $6x^2 - 7x + 8 = 0$

- (a) This is different from the previous problems because the coefficient of x^2 is not 1. In order to solve by completing the square, we must first make the coefficient of x^2 equal to 1. We can do this by dividing everything by 6.

- (b) Move the constant to the other side.

- (c) Determine what constant c should be added to the left side so that it will be a perfect square trinomial. Then add this c to BOTH sides.

- (d) Rewrite the left side as a binomial squared.

- (e) Solve using the square root method.

After you go over the previous problems with a tutor, try the following on your own, then check with a tutor to make sure you did them correctly.

7. Use completing the square to solve: $2x^2 - 8x - 3 = 0$

Review: Meet with a tutor to verify your work on this worksheet and discuss some of the areas that were more challenging for you. If necessary, choose more problems from the homework to practice and discuss with the tutor.

For tutor use: Please check the appropriate box.

- Student has completed worksheet but may need further assistance. Recommend a follow-up with instructor.
- Student has mastered topic.