MPM 2D Handout
Discovering Faster Ways to Factor

Spring 2020 **Name:**

Over the course of two days, you are going to look at some special cases that you will encounter when you are factoring. **Decomposition will always work**, but sometimes there are shortcuts that will make the process faster. Once you have used decomposition to factor a few questions, you should start to see a pattern. Try to put the pattern in to your own words in the space provided. When you are doing your textbook work afterwards, try to use shortcuts when you can. You will never lose marks for doing things the long way, but you'll finish tests faster if you can save time!

Day 1 - Case 1: What happens when a = 1?

For all of the questions below, the value of 'a' is 1, so the expression looks like this:

$$\mathbf{x^2 + bx + c}$$

1. Factor the expressions provided using decomposition.
   a. $x^2 - 4x + 4$ b. $x^2 - x - 12$ c. $x^2 + 9x + 18$

   d. $x^2 - 4x - 21$ e. $x^2 + 2x - 24$ f. $x^2 - 15x + 56$

2. Look at your answers from question 1. Do you see a pattern? Write down a shortcut that you can see for factoring expressions when a = 1.

3. Try your shortcut on the three expressions below to make sure that it works. You can check by multiplying them back out.
   a. $x^2 + 6x + 9$ b. $x^2 - 8x - 20$ c. $x^2 - 2x + 1$

Day 2 - Case 2: What happens if b = 0 ($ax^2 - c$)?

A perfect square is any number that has a whole number square root (1, 4, 9, 16, 25, 36, etc.). When b is zero (so there is no term with an x on it) and a and c are both perfect squares that are being subtracted from each other, we call it a "difference of squares". (Note: If b = 0 and there is a plus sign between the two terms, it cannot be factored. Why?)

Ex/ $4x^2 - 9$ is a difference of squares

If you notice that something is a difference of squares, there is a quick way to factor it.

1. Factor each of the expressions below using decomposition (remember that b = 0).
   a. $4x^2 - 1$ b. $x^2 - 25$ c. $4x^2 - 25$

   d. $49x^2 - 1$ e. $x^2 - 49$ f. $x^2 - 144$

2. Do you notice a pattern starting to emerge? Write down a shortcut, in your own words, that will work whenever you have to factor a difference of squares.

3. Use your shortcut to factor $49x^2 - 64$. Why would decomposition be difficult with this question?

Case 3: What happens if I have a perfect square trinomial?

A perfect square trinomial is one where $b = 2\sqrt{ac}$. The values for 'a' and 'c' have to be perfect squares as well.

$9x^2 - 6x + 1$ is an example of a perfect square trinomial

You often won't notice that you are working with a perfect square until you are done factoring, so this shortcut is a little bit less important. It is still helpful if you can save yourself some time and effort though!

1. Factor each of the perfect square trinomials provided using decomposition.
   a. $9x^2 + 12x + 4$ b. $25x^2 - 10x + 1$ c. $4x^2 - 20x + 25$

2. Do you see a pattern emerging? What is it?

3. Try using your shortcut to factor $16x^2 + 56x + 49$. Would you want to try to factor this expression using decomposition? Explain your answer.