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2/2/2010
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Clinical Interview I

The topic for my clinical interview is factoring quadratic equations. Factoring is a useful technique to know because it can be applied in many different situations. Factoring a polynomial can help one to simplify things and to find the roots of a polynomial, which can be a much more efficient way to find roots as opposed to completing the square, or using the quadratic formula. We know that by the distributive property we can change an expression from a product to a sum. When we factor, we simply reverse that order. We take a whole and break it into two parts that are equivalent to the original whole. A quadratic is a specific type of polynomial that has a distinct appearance; therefore, when one recognizes a quadratic, they should make sure that it is in the following form, and if it is not, then they should manipulate it to make it be in the following form. Quadratic equations are of the form: "$ax^2 + bx + c$" where *a, b* and *c* are simply arbitrary constants. When an equation is factorable there will be two numbers that when added will equal *b* and when multiplied will equal *c*. Therefore, when one tries to factor a given quadratic, one should think of the different factors of the *c* term. They want to find two factors of the *c* term that also add up to equal the *b* term. The signs (plus and minus) within the quadratic determine the signs that will be required for the factorization. Whether the *c* value is positive or negative determines if the signs within the factorization will be the same. When the *c* value is positive the factorization will have the same two signs, when the c value of the quadratic is negative, then the two signs that make up the factorization are different; one will be positive and one will be negative. This analysis can be taken a step further when we look at the *b* value to see whether it is positive or negative. By observing both of the signs in the quadratic we know exactly the two signs that make up the factorization. All that is left to do then is to choose the values. Sometimes one may stumble upon a quadratic where *a* is a prime and in which case our factorization will look slightly different. In other cases, one might find that an expression is not factorable. This happens when no two factors of the *c* value add to equal the *b* value. In this case the quadratic is in an irreducible form and cannot be broken down any further.

The Sunshine State Standard for factoring is the following:

Benchmark Number	Benchmark Description
MA.912.A.7.2	Solve quadratic equations over the real numbers by factoring and by using the quadratic formula.

My Clinical Interview participant is a second year Political Science, History double major who has minimal mathematics experience since high school. Her only math course since high school was a Math for Liberal Arts majors course.

In order to really understand a concept one should be able to represent it both algebraically and geometrically. With that said, during this clinical interview I will seek to elicit information from my interviewee as to what she knows about factoring and how she expresses what she knows in both an algebraic fashion as well as a geometric fashion. Factoring is somewhat like a game to see if one can figure out the factorization, if there even is a factorization. When a student is first taught how to factor, many times they don’t understand the process and believe that the factorization is too difficult to come up with, though upon further explanation and practice factoring becomes rather simple and fun. The quadratic expressions provided in this clinical interview will all be ‘simple’ quadratic expressions which may or may not actually factor. To begin I will try to make the interviewee as comfortable as possible with the situation and make sure she feels calm and relaxed. I will then introduce the topic and observe what the interviewee has to say, whether she remembers anything specific about the topic, whether she offers to share her knowledge of the topic, as well as how her overall body language and mannerism changes, if at all. I will then explain that I have Algeblocks® for her to use if she would like to and I will then explain to her what each of the different blocks represents, such as an x-rod is a representation for x, if we have two x-rods then we have 2x and so on. I will explain that she will need to gather the corresponding Algeblocks® as they are listed in the quadratic, she will then try to make a rectangle by using each piece. If a rectangle can be made then the quadratic is factorable and its dimensions make up the two different factors for the original expression. The quadratics will begin with all the coefficients begin positive and then after awhile some will be negative. Once the interviewee has completely factored multiple expressions I will then ask her the following questions, "What relationship do you see may exist between *p, q* and the number *c*? Explain." As well as, "Is there a relationship between *p, q* and the number *b*? Explain." Following this inquiry I will proceed by giving the interviewee a quadratic expression where *a* is a prime number. I will question about the relationships between *p, q* and the number *c* as well as the relationship between *a, p, q* and the number *b.* I will then introduce expressions that include a negative coefficient and explain how to use negative numbers with the Algeblocks®. With each question I will encourage the interviewee to elaborate on her responses and to not be timid and to have confidence in herself and her answers. The following are some examples of the different types of quadratic expressions I will include.

$x^2 + 6x + 5$	$x^2 + 2x$	$2x^2 + 5x + 3$
$x^2 + 6x + 7$	$x^2 - 2x + 1$	$2x^2 - 13x + 15$

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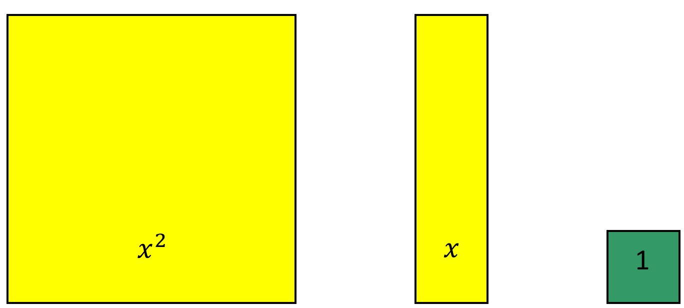
Clinical Interview Student Worksheet

Please describe what you know about area, and draw a diagram of a plot of land and show its area.

What are the two dimensions you chose?

How do those two dimensions relate to the total area of your plot of land?

Are we able to measure things in ways besides numbers? List some other ways one could measure something in?



Use the Algeblocks to try factoring the first one.

$x^2 + 6x + 5$ ________________________________

What do you notice about the given expression and its factored form?

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How does this relate to our area model you drew in the beginning?

Using the Algeblocks try to factor the following expressions.

$x^2 + 2x$ ______________________________

$x^2 + 6x + 7$ ______________________________

$2x^2 + 5x + 3$ ______________________________

$x^2 - 2x + 1$ ______________________________

$x^2 - 3x + 2$ ______________________________

With your new knowledge of how to factor quadratic expression now factor each of the following expressions without using the Algeblocks.

$x^2 + 7x + 12$ ______________________________

$2x^2 + 9x + 4$ ______________________________

$x^2 - 5x + 6$ ______________________________

$x^2 + 2x + 3$ ____________________________________

$2x^2 - 7x + 6$ ____________________________________

What is area?

If we know that the area of a plot of land is 80 ft.2 What does that mean?

What does that mean as far as the dimensions?

So how are the side lengths and the area related?

Okay, so we are going to keep this area model in mind when working with these blocks. You are going to use these blocks to help us represent different expressions.

Do you know what a quadratic equation is?

$$ax^2 + bx + c =$$

Using your blocks, how might you factor this?

Do you know what factoring is? Factor tree……..Breaking it down into smaller parts, it's multiples that when multiplied together you will get the whole, like with area of 80 we can factor it into 20 x 4, 40 x 2, etc.

(Want to work backwards, it's like I'm giving you the number 80 and you need to factor it, how might you go about doing that using your blocks?)

The expressions and their factors seem to be of the following form, where x is a variable and b, c, p and q are constants:

$$ax^2 + bx + c = (x + p)(x + q)$$

Do you notice any relationships between the constants?

Why didn't $x^2 + 6x + 7$ factor? How do you know? You weren't able to make a rectangle. So can it be factored?

When there is an expression and it has a subtraction sign in it, we first want to place all the positive stuff together and place the negative stuff on top. Then look at the rectangle that remains.

AFTER EACH FACTORED EXPRESSION EXPLAIN WHAT YOU NOTICE.