Day 1: Factoring Review and Solving For Zeroes Algebraically

Warm-Up:

Use FOIL to help distribute

1. Write an equivalent expression for each of the problems below:
   a. $(x+2)(x+4)$ $x^2+4x+2x+8 = x^2+6x+8$ (F O I L)
   b. $(x-5)(x+8)$ $x^2+8x-5x-40$ $x^2+3x-40$
   c. $(x-9)^2 = (x-9)(x-9) = x^2-9x-9x+81$ $x^2-18x+81$
   d. $(x+10)^2 = (x+10)(x+10) = x^2+10x+10x+100$ $x^2+20x+100$
   e. $(x-8)(x+8) = x^2+8x-8x-64 = x^2-64$

2. Using the equation expression $5 + 30x - 16x^2$:
   a. Explain what each part of the equation represents.
   b. Write a story that relates to the function.
   c. What is the maximum? When does it occur? What does this mean in the context of your story?
   d. Solve for the zeros of the expression and explain what they mean in the context of your story.

Solving Quadratics Algebraically Investigation

Instructions: Today we will find the relationship between 2 **linear binomials** and their **product**, which is a **quadratic** expression represented by the form $ax^2 + bx + c$. First we will generate data and the look for patterns.

Part I. Generate Data

Use the distributive property to multiply and then simplify the following binomials.

1. $(x+3)(x+5)$
   $x^2+5x+3x+15$
   $x^2+8x+15$

2. $(x+4)(x-2)$
   $x^2-2x+4x-8$
   x^2+2x-8

3. $(x-1)(x-2)$
   $x^2-2x-1x+2$
   x^2-3x+2

2. Where do you expect each of the above equations to "hit the ground"?

   $x=-3,-5$ $x=-4,2$ $x=1,2$

Part II. Organize Data

Fill in the following chart using the problems from above

FACTORS	PRODUCT ax^2+bx+c	a	b	c
$(x+3)(x+5)$	$x^2+8x+15$	1	8	15
$(x+4)(x-2)$	x^2+2x-8	1	2	-8
$(x-1)(x-2)$	x^2-3x+2	1	-3	2

Part III. Analyze Data

Answer the following questions given the chart you filled in above

1. Initially, what patterns do you see?

   #s in factors added together = b

   #s in factors multiplied together = c

2. How is the value of "a" related to the factors you see in each problem?

   discuss

   it's the value of the coefficients on each x multiplied together

3. How is the value of "b" related to the factors you see in each problem?

   discuss

   b = the constant #s in each factor added together

4. How is the value of "c" related to the factors you see in each problem?

   discuss

   c = the constant #s in each factor multiplied together

BEFORE COMPLETING PART IV, DISCUSS WITH THE GROUP YOUR ANSWERS TO PART III

Part IV: Application

Knowing this, fill out the values for a, b, and c in the following chart. Work backwards using your rules from part III to find 2 binomial factors for each product. Put these in the first column.

FACTORS	PRODUCT ax^2+bx+c	a	b	c	Hint: list factors of "c"
$(x+4)(x+2)$	x^2+6x+8	1	6	8	1, 2, 4, 8
$(x+3)(x+4)$	$x^2+7x+12$	1	7	12	1, 2, 3, 4, 6, 12
$(x+12)(x+1)$	$x^2+13x+12$	1	13	12	1, 2, 3, 4, 6, 12
$(x+5)(x-2)$	$x^2+3x-10$	1	3	-10	$\pm1, \pm2, \pm5, \pm10$
$(x-5)(x+2)$	$x^2-3x-10$	1	-3	-10	$\pm1, \pm2, \pm5, \pm10$
$(x-9)(x-6)$	$x^2-15x+54$	1	-15	54	$\pm1, \pm2, \pm3, \pm6, \pm9, \pm18, \pm27, \pm54$

For each of the quadratics above, use your graphing calculator to inspect where the quadratic "hits the ground", or touches the x-axis.

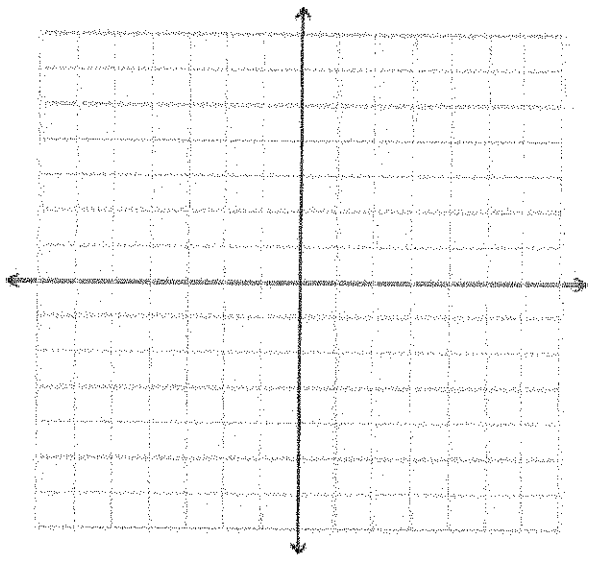
1. What do you notice about the relationship between the factors and the x-intercepts?

   factor's opposite sign # = x-intercept x-value OR set factor = 0 & solve to get x-intercept

2. Why is factoring a useful skill to learn?

   solve real life applications like when objects hit the ground, maximizing or minimizing values

3. Choose one of the quadratics above and create a rough sketch of the graph using all the information you know about quadratic equations.



❖ **Summary: Factoring Polynomials**

- ALWAYS factor out the greatest common factor ( ) FIRST!!!
- A polynomial that can not be factored is prime.
- A polynomial is considered to be completely factored when it is expressed as the product of prime polynomials.

A. Factoring out the GCF:

a. $16m^2n + 12mn^2$ GCF = $4mn$

$4mn(4m+3n)$

b. $14a^3b^3c - 21a^2b^4c + 7a^2b^3c$ GCF = $7a^2b^3c$

$7a^2b^3c(2a - 3b + 1)$

B. Factor by grouping—for polynomials with 4 or more terms

a. $3x^3 + 2xy - 15x^2 - 10y$

GCF of 1st two = x; GCF of back two = -5

$x(3x^2+2y) - 5(3x^2+2y)$

$(x-5)(3x^2+2y)$

Can check with FOIL distributing

b. $20ab - 35b - 63 + 36a$

$5b(4a-7) + 9(-7+4a)$

$5b(4a-7) + 9(4a-7)$

$(5b+9)(4a-7)$

C. Factoring trinomials into the product of two binomials

a. When leading coefficient is one.

i. x^2+5x+4 $4 \cdot 1 = 4$; $4+1=5$

bust the b

factor by grouping

$x^2 + 4x + 1x + 4$

$x(x+4) + 1(x+4)$

$(x+1)(x+4)$

ii. $x^2+6x-16$ $8 \cdot -2 = -16$; $8+-2=6$

$x^2 + 8x - 2x - 16$

$x(x+8) - 2(x+8)$

$(x-2)(x+8)$

D. Difference of "Two Squares"

i. $x^2 - 25$ $5 \cdot -5 = -25$; $5+-5=0$

$x^2 + 0x - 25$

$x^2 + 5x - 5x - 25$

$x(x+5) - 5(x+5)$

$(x-5)(x+5)$

ii. $16x^4 - z^4$ $4 \cdot -4 = 16$; $4+-4=0$

$16x^4 + 4x^2z^2 - 4x^2z^2 - z^4$

$4x^2(4x^2+z^2) - z^2(4x^2+z^2)$

$(4x^2-z^2)(4x^2+z^2)$