***5.3 Solving Quadratic Equations by Factoring***

$$f\left(x\right)=ax^{2}+bx+c$$

$$k=ax^{2}+bx+c$$

What are factors?

Factors of numbers:

$6=3×2$; 2 and 3 are factors of 6

Factors of variables:

$x^{2}=x∙x$ ; x is a factor of $x^{2}$ and it is factor twice

Factoring an expression (need to find the greatest common factor)

$$x^{2}+x=x(x+1)$$

Above, *x* is the greatest common factor of the two first items. So we can factor it out and leave what is left inside. Check by expanding back

$$8x^{2}+4x^{3}=4x^{2}\left(2+x\right)$$

Above, $4x^{2}$ is the greatest common factor of the first two items.

Something different: $x^{2}+3x+2$ (Look for two numbers that multiply to make 2 and add to make 3... 1 and 2 multiply to make 2 and add up to 3. Put as follows:

: $x^{2}+3x+2=\left(x+1\right)(x+2)$

Question: *Solve the equation* or *find* *the solutions of the equation* or *find the roots of the equation*:$ x^{2}+3x+2=0$

What do the 3 questions want? Wants the x that makes the equation true. Find by isolating x

$$x^{2}+3x+2=0$$

$$\left(x+1\right)\left(x+2\right)=0$$

Now when two unknown numbers multiply and equal zero we know that the first number must equal zero or the 2nd number must equal zero. So we can separate the two numbers above and have them equal to zero (then solve for x)

$$x+1=0 or x+2=0$$

$$x=-1 or x=-2$$

Now that we have isolated x, we know that the solutions/roots of the original equation, $x^{2}+3x+2=0$, is -1 and -2 (Can sub into equation to check).

Question: *Find the zeros of the function* or *find the x-intercept of the function*:

$$f\left(x\right)=2x^{2}+9x+4$$

What does the question want? The zeros of the function are the x-values that make the function, *f(x)*, zero. Same for the x-intercept *(x,0) = (x, f(x))*

Make *f(x)* zero and then factor:

$$0=2x^{2}+9x+4$$

Factor this equation is harder: Think of the factors of the first number, 2: 2&1. Think of the factors of the last number, 4: 2&2 or 1&4. Now does 2&1 go with 2&2 or does 2&1 go with 1&4. Multiply the set of numbers together and add the multiplies to see if you get, the middle number, 9:

Try 2&1 and 2&2: $2×2=4 \& 1×2=2 but 4+2 does not equal 9$

Try 2&1 and 1&4: $2×1=2 \& 1×4=4 but 2+4 does not equal 9$; try in reverse:

Try 2&1 and 4&1:$ 2×4=8 \& 1×1=1 AND 8+1 does equal 9$; therefore:

$$0=2x^{2}+9x+4$$

$$0=\left(2x+1\right)(1x+4)$$

$$2x+1=0 or x+4=0$$

$$x=\frac{-1}{2} or x=-4$$

Therefore, the zeros/x-intercept of the function, $f\left(x\right)=2x^{2}+9x+4$, is $\frac{-1}{2} and-4$

\*\*note: class notes from peers might be easier to understand since they added arrows to make things simpler... cannot put arrows in word document.