Classroom Examples for Pre-Calculus #5

***talk about slope and derivatives and limits for $\frac{f(x+c)-f(x)}{c}$ as c goes to 0

1) Construct and simplify $\frac{f(x+c)-f(x)}{c}$ if $f(x)=4x^2-7x-5$

Cover functions and fog and gof problems

2) If $f(x)=4x^2-2x+1$ and $g(x)=-3x+5$ find: $(f+g)(x)$, $(f-g)(x)$, $(f\cdot g)(x)$, $f\circ g(x)$, $g\circ f(x)$ and then evaluate $f\circ g(-2)+(f-g)(4)$

3) Solve the inequality $\frac{6}{x^2-25}\geq\frac{4}{x^2+2x-15}$ and graph your final answer on a number line.

4) Solve the inequality $\frac{3}{x^2-4x}<\frac{9}{x^2+2x-24}$ and graph your final answer on a number line.

Completing the square

- Get the *x* guys on one side and the plain numbers on the other.

$$3x^2-18x=5$$

- Leave a space before the equal sign. We will be filling that space in with a number.

$$3x^2-18x\quad\quad=5$$

- Get rid of the number in front of the squared guy by dividing that number by the all the *x* guys but NOT on the other side. The number we divided by should put on the outside of a set of parenthesis and then simplify the fractions we made by dividing.

$$\frac{3}{3}x^2-\frac{18}{3}x\quad=5\qquad 3\left(x^2-6x\quad\right)=5$$

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- To fill in the space, take the number in front of *x* including the sign and divide it by 2, **save this number by putting a box around it because you will need it later,** and then square it. The new number will go in the space. But remember what you do to one side you have to do to the other. If you put a number inside a parenthesis, it's really being multiplied by the number on the outside. So the number you put in the space has to multiplied by the number outside the parenthesis, and that is the number that goes on the other side of the equal sign.

$$\frac{-6}{2}=\boxed{-3} \qquad 3\left(x^2-6x+9\right)=5+18$$
$$\left(-3\right)^2=9$$

- The whole point of completing the square is that it will factor perfectly with the number we boxed. So go ahead and factor the left side and do the math on the right side.

$$3\left(x-3\right)\left(x-3\right)=23$$

- Remind students that anything that is exactly the same being multiplied can be written with a square.

$$3\left(x-3\right)^2=23$$

- Then have students solve for *x* like they did in their algebra classes.

5) Solve $4x^2-8x=9$ by completing the square and then verify your solutions using the quadratic formula.

6) Solve $2x^2+10x=5$ by completing the square and then verify your solutions using the quadratic formula.

7) Solve $3x^2+4x=8$ by completing the square and then verify your solutions using the quadratic formula.

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The following are just word problems that need to find by completing the square and using the vertex to answer the questions.

8) Rob throws a baseball into the air with an initial velocity of 60 feet per second from a height of 7 feet off the ground. Find the equation of the flight path of the baseball where x stands for the time, in seconds, after he releases the ball and y stands for the height, in feet, of the ball. Use completing the square to determine how many seconds after the ball is released that it got to its maximum height AND determine the maximum height of the baseball.

9) Emily wants to build a fence around part of her backyard so that her dog can go outside without running away. Emily has 210 feet of fence and will use the back of her house as one side of the rectangular enclosure. Use completing the square to determine the dimensions (length and width) of the enclosure in order to maximize the area AND determine how much area this new fence provides for her dog.

10) Silas launches a model rocket with an initial velocity of 340 feet per second from a platform 5 feet off the ground. Find the equation for the flight path of the rocket where x stands for the time, in seconds, after launch and y stands for the height, in feet, of the rocket. Use completing the square to determine how many seconds after launch the rocket got to its maximum height AND determine the maximum height of the rocket.

11) Joshua wants to create an open, rectangular box out of a piece of paper that is 16 inches wide by cutting square pieces out of each corner of the paper and folding up the sides so that the length of the bottom of the box is 20 inches long. Use completing the square to determine how large she should make each square (the length of the side of each square) in order to maximize the volume inside the box AND determine what the volume of that box would be.