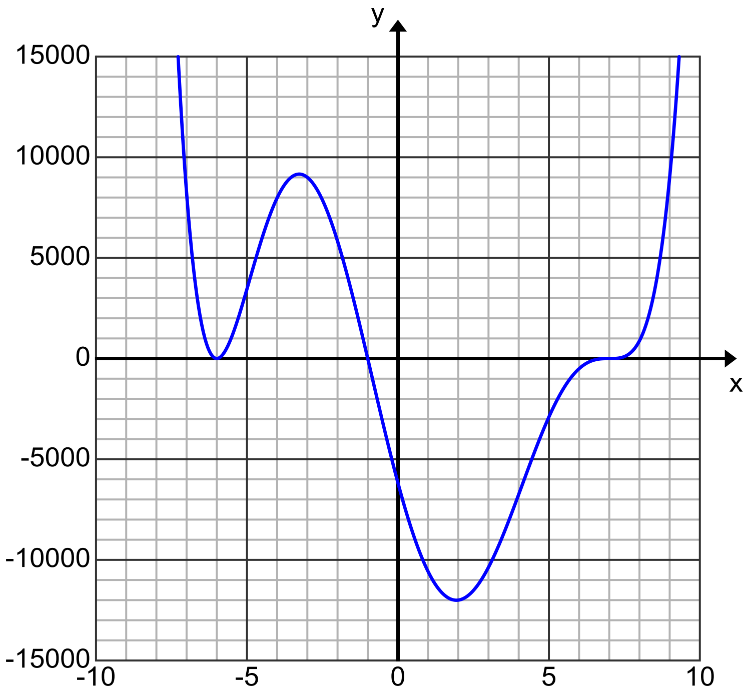
Name: ___________________________ Period: _____ Date: __________

Consider the following graph of a polynomial function whose equation is unknown



1. Can you identify the zeros of the polynomial function? Write them as equations in *x*.

2. What polynomial theorem relates the zeros of a polynomial function to its corresponding factors?

   Use this theorem to write the zeros of the polynomial function as corresponding factors.

3. Examine the shape of the graph of the polynomial function close to the zeros. (Note that the degree of the polynomial is the same as the multiplicity of its zero!)

   What conclusions can you draw?

   What do you think the minimum multiplicities of the zeros of the given polynomial function are? Write a polynomial equation in factored form from the factors you have identified and their (least) multiplicities

4. What is the degree of the polynomial equation you have written?

If the multiplicities of the factors of the polynomial function are in fact higher than those you have chosen, what difference would this make to the degree of the polynomial function you obtain? Would an odd degree polynomial remain of odd degree? Would an even degree polynomial remain of even degree? Explain.

Using the degree of the polynomial function, consider the end behavior of the function. ($x \to -\infty, and\ x \to +\infty$). Do you need to correct the leading coefficient by changing its sign so that the end behavior matches the degree of your polynomial equation?

Change the sign of the leading coefficient of your polynomial equation if necessary to meet the demonstrated end behavior. Write the equation you obtain.

(If you cannot make the end behavior match the graph, even with a change in sign of the leading coefficient, then you have either made a mistake assigning a correct multiplicity to each factor, or you have not correctly calculated the degree of the polynomial!)

5. Calculate the constant term of your polynomial equation (you do not need to convert your polynomial equation to standard form; you only need to multiply all the factor constants together making sure that you are using their correct multiplicities).

What does this constant term represent? (hint: it is the value of the polynomial function when $x = 0$)

Does the value of the constant term equal the value of the y-intercept from the graph

What does it mean if it doesn’t equal the value of the y-intercept? Obviously we haven’t quite finished!

Did you realize that you can multiply your polynomial equation by any arbitrary positive constant and the resulting graph will have the same basic shape and the same zeros! Does this help? What would you have to do to calculate the value of an additional constant positive factor that would modify the constant term so that it became equal to the y-intercept you obtained directly from the graph? Make this adjustment to your polynomial equation.

Now enter your polynomial equation into your graphing calculator and compare the result with the original graph. Is it the same? If not, list where it differs and look for an explanation. What might you have not done correctly?

(You will definitely have to change the window settings on your calculator. A good idea is to use the same scale as is used on the graph you were given. That way, you are making an apples to apples comparison and any differences between the graphs should be easy to spot!)

Well done! You have now completed all the steps necessary to write an equation of a polynomial function from its graph.

6. Do you get the same result if you enter the coordinates of the zeros and the y-intercept into a list and find a best-fit regression (polynomial) model? Explain why this does not work for this polynomial function. What constraints of your calculator prevent you from successfully generating a suitable regression model?

7. On your own, use your calculator to graph another polynomial from its factored form. Sketch its graph. Give the graph to your partner and let him or her attempt to write its equation.