UNIT 4 WORKSHEET 10

Finding the Equation of a Polynomial Function

In this section we will work backwards with the roots of polynomial equations or zeros of polynomial functions. As we did with quadratics, so we will do with polynomials greater than second degree. Given the roots of an equation, work backwards to find the polynomial equation or function from whence they came. Recall the following example.

Find the equation of a parabola that has x intercepts of $(-3,0)$ *and* $(2,0)$.

$(-3,0)$ *and* $(2,0)$.	***Given x intercepts of -3 and 2***
$x=-3 \qquad x=2$	***If the x intercepts are -3 and 2, then the roots of the equation are -3 and 2. Set each root equal to zero.***
$(x+3) \quad (x-2)$	***For the first root, add 3 to both sides of the equal sign. For the second root, subtract 2 to both sides of the equal sign.***
x^2+x-6	***Multiply the results together to find a quadratic expression.***
$y=x^2+x-6$	***Set the expression equal to y, or*** $f_{(x)}$***, to write as the equation of a parabola.***

The exercises in this section will result in polynomials greater than second degree. <u>Be aware, you may not be given all roots with which to work</u>.

Consider the following example:

Find a polynomial function that has zeros of $0,\ 3$ *and* $2+3i$***. Although only three zeros are given here, there are actually four. Since complex numbers always come in conjugate pairs,*** $2-3i$ ***must also be a zero. Using the fundamental theorem of algebra, it can be determined that his is a 4th degree polynomial function.***

Take the zeros of $0,\ 3,\ 2\pm3i$***, and work backwards to find the original function.***

$x=0$	$x=3$	$x=2\pm3i$
		$x=2\pm3i$
	$x=\ \ 3$	$x-2=\pm3i$
$x=0$	$-3 \quad -3$	$x^2-4x+4=9i^2$
	$x-3=0$	$x^2-4x+4=-9$
		$x^2-4x+13=0$
x	$(x-3)$	$(x^2-4x+13)$

The polynomial function with zeros of $0,\ 3,\ 2\pm3i$***, is equal to*** $f_{(x)}=x(x-3)(x^2-4x+13)$***. Multiplying this out will yield the following.***

$$f_{(x)}=x^4-7x^3+25x^2-39x$$

Find a polynomial function that has the following zeros.

1) -3, 2, 1

2) -4, 0, 1, 2

3) $\pm 1, \pm\sqrt{2}$

4) 0, 2, 5

5) $\pm 4, 0, \pm\sqrt{2}$

Complex and radical solutions always come in ____________ __________.

Graph the following polynomial functions. Remember to follow the steps below.

- ***Find all zeros of the function. This will give the x intercepts of the function.***
- ***Write the Polynomial in factored form.***
- ***Plot all x intercepts for the function on the x axis.***
- ***Using the properties of polynomial functions, determine the left and right behaviors of the function, and draw those segments.***
- ***Substitute zero for x, and find the y intercept of the function.***
- ***Using the properties of multiplicity, complete the graph of the function.***

6) $f(x) = x^4 - 5x^3 + 3x^2 + 5x - 4$

7) $f(x) = -x^4 + 6x^3 - 9x^2 - 4x + 12$