7.5. Advanced Algebra
Roots and Zeros

DATE: 2/28

7B. Write a polynomial function in standard form given its roots

You previously learned that solutions of quadratic equations that contain imaginary numbers come in pairs. This also applies to zeros of polynomial functions. For any polynomial function, if an imaginary number is a zero of that function, its conjugate is also a zero. This is called the **Complex Conjugates Theorem**.

Complex Conjugates Theorem
Suppose a and b are real numbers with $b \neq 0$. If $a + bi$ is a zero of a polynomial function with real coefficients, then $a - bi$ is also a zero of the function.

Write a polynomial function of least degree with integral coefficients whose zeros include the following:

1. 3 and $2 - i$

5. $2i, 3i$, and 1

Factored form:

$2i, -2i, 3i, -3i, 1$

$f(x) = (x - 2i)(x - -2i)(x - 3i)(x - -3i)(x - 1)$

START $x^2 + 4$

START $x^2 + 9$

	x^2	$+9$
x^2	x^4	$9x^2$
$+4$	$4x^2$	36

$x^4 + 13x^2 + 36$

	x	-1
x^4	x^5	$-x^4$
$13x^2$	$13x^3$	$-13x^2$
$+36$	$36x$	-36

Standard Form

$x^5 - x^4 + 13x^3 - 13x^2 + 36x - 36$

Recall: $i^2 = -1$

6. 6 and $2i$

Factored form

$6, 2i, -2i$

$f(x) = (x - 6)(x - 2i)(x \overset{+}{=} -2i)$

START

$-2i \cdot 2i$

$-4 \cdot i^2$

$-4 \cdot -1$

4

	x	$2i$
x	x^2	$2ix$
$-2i$	$-2ix$	4

$x^2 + 4$

	x	-6
x^2	x^3	$-6x^2$
$+4$	$4x$	-24

Standard Form:

$x^3 - 6x^2 + 4x - 24$

1. 3 and $2 - i$

3, $2-i$, $2+i$

Factored form:

$f(x)=(x-3)(x-(2-i))(x-(2+i))$

Don't worry about standard form here. :)

2. 4 and $-4i$

4, $-4i$, $+4i$

Factored form:

$f(x)=(x-4)(x-(-4i))(x-4i)$

$(x-(-4i))(x-4i)$: $+$, x^2+4

	x^2	$+4$
x	x^3	$4x$
-4	$-4x^2$	-16

$f(x)=x^3-4x^2+4x-16$

3. -4, 1, and 5

You try it!

$f(x)=(x-(-4))(x-1)(x+5)$

Write in std form.