Name: ______________________ **Precalculus Unit 4, Lesson 11**

Aim: A Review of Complex Numbers. What is Descartes' Rule of Signs?

I. Do Now:

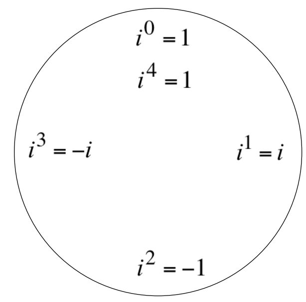
Find all roots (real and imaginary) of $f(x)=x^5+x^3+2x^2-12x+8$. (Note: There may be repeated roots.)

II. Recall:

i. $i=\sqrt{-1}$ and $i^2=-1$

ii. To evaluate i^n, divide n by 4 to get remainder r; $i^n=i^r$

iii. All numbers can be written in $a+bi$ form, i.e. as a complex number.



III. Miscellaneous Applications

1. Evaluate: (a) i^{57} (b) i^{720}

2. Write the conjugate of (a) $3+2i$ (b) $-\sqrt{3}-4i$ (c) 3 (d) $2i$

3. Multiply and write answers in $a+bi$ form:
(a) $(-i)(3i)$ (b) $(2-i)(3+4i)$ (c) $(3+2i)(3-2i)$

4. Divide and write answers in $a+bi$ form:
(a) $\dfrac{1}{1+i}$ (b) $\dfrac{4-2i}{2+3i}$ (c) $\dfrac{2+3i}{4-2i}$

5. Solve for x: $x^2+9=-16$

IV. Descartes' Rule of Signs

René Descartes (1596 – 1650) discovered this rule: Let $f(x)$ be a polynomial with real coefficients. Then:

- The number of positive real roots of $f(x)$ is either equal to the number of variations in sign of $f(x)$ or is less than this number by a positive even integer (i.e., a multiple of 2).
- The number of negative real roots of $f(x)$ is either equal to the number of variations in sign of $f(-x)$ or is less than this number by a positive even integer (i.e., a multiple of 2).

Find the number of possible positive and negative real roots for each polynomial function:

	# of Positive Real Roots	# of Negative Real Roots
6. $f(x)=x^6-3x^4-2x^2+4x-5$		
7. $f(x)=-2x^4+x^3-7x^2+4x+1$		
8. $f(x)=3x^3-4x^2-4x+4$		

HW33
p. 133: 11, 33, 34, 40, 53, 55, 58, 85, 86, 89, 93