Math 35300 **HANDOUT ON COMPLEX NUMBERS**

Although in most of the course we will be dealing with real numbers, when we get to eigenvalues, we will be forced to consider complex numbers. When complex numbers arise, I will use them without apology. If you are unfamiliar with complex numbers, you may wish to learn a little about them. Any source is acceptable; some possiblities are high school algebra texts, "engineering math" texts, complex analysis texts (for example, Churchill's *Complex Variables* is on reserve in the Math library), there are even a few pages in Strang (pages 217-219). The ability to solve the following problems indicates adequate knowledge for this course. These problems are for practice only, they will not be handed in.

Practice Problems

1. Let $z = 4 - 5i$.
Find: (a) $\mathrm{Re}(z)$ (b) $\mathrm{Im}(z)$ (c) $|z|$ (d) $\bar{z}$.

2. Compute:

(a) $(3+2i)(2-i)+i(-2+i)$ (b) $(2-3i)^2(4+2i)$

(c) $(2-i)^2+(1+3i)^2$ (d) $\left(\overline{(2-i)}\right)^2+\left(\overline{(1+3i)}\right)^2$ *see (c)*

(e) $\dfrac{1}{3+4i}$ (f) $\dfrac{4-2i}{1+i}$

(g) $\dfrac{2+3i}{(2-i)^2}+\dfrac{i}{1+i}$ (h) $\left|\dfrac{1+3i}{(2-i)}\right|$.

3. Find all (3) roots of the equation

$$z^3 - 3z^2 + 7z - 5 = 0.$$

Answers:

1. (a) 4 (b) -5 *(not $-5i$!)* (c) $\sqrt{41}$ (d) $4+5i$.

2. (a) $7-i$ (b) $4-58i$ (c) $-5+2i$ (d) $-5-2i$ *[i.e. the conjugate of (c)]*
(e) $\frac{3}{25}-\frac{4}{25}i$ (f) $1-3i$ (g) $.26+1.18i$ (h) $\frac{|1+3i|}{|2-i|}=\frac{\sqrt{10}}{\sqrt{5}}=\sqrt{2}$

3. The roots are 1, $1+2i$, and $1-2i$.