MAT 121-G81 Test 3 – Spring, 2014 Name________________
80 Points Covers Chapter 3 NO GRAPHING CALCULATORS!!!

1. (10 pts) Form a polynomial of *minimial degree* in *factored form* that has real coefficients (after expanding) and will have the given zeros. Do *not* expand your polynomial. Leave it factored! If you run out of room, you're doing it wrong!

Zeros: $x = 4$, multiplicity 3; $x = 3 - 7i$, multiplicity 1; $x = -5$, multiplicity 2.

2. (10 pts) Use synthetic division to find $P(3)$ if $P(x) = 2x^5 - 7x^4 + 11x^2 + 4x - 5$.

3. (5 pts) Represent the work you just did on the previous problem by writing $P(x)$ in the form $Dividend = Divisor \bullet Quotient + Remainder$.

4. Suppose $f(x) = (x-2)(x+1)^2(x+2) = x^4 + 2x^3 - 3x^2 - 8x - 4$. I'm showing you both factored and expanded form to help you answer the following:
   a. (10 pts) Provide a rough sketch of *f*, using its zeros, their respective multiplicities and the end behavior of *f*. Include *x*- and *y*-intercepts. Your graph should be smooth. Un-exaggerate the vertical for a better quality graph.

   b. Solve the inequalities (You've done the work. Now, INTERPRET.):
      i) (5 pts) $(x-2)(x+1)^2(x+2) \le 0$
      ii) (5 pts) $\dfrac{(x-2)(x+3)}{(x+1)^2} \ge 0$

5. (10 pts) Find the *real* zeros of $f(x) = x^5 - 3x^4 + 4x^3 + 36x^2 - 77x + 39$. Then factor *f* over the set of **real numbers**. This should involve an irreducible quadratic factor. You may want to use scratch paper to find the zeroes, and then present the breakdown, with a sequence of (neat) synthetic divisions.

6. (5 pts) Find the remaining (nonreal) zeros of *f* and factor *f* over the set of **complex numbers**.

7. (5 pts) Use long division to find the equation of the oblique asymptote of $R(x)=\dfrac{2x^3-5x^2+3x-2}{x^2+4}$

8. (5 pts) Sketch the graph of $\dfrac{x^3-4x^2+x+6}{x^3-8x^2+17x-10}=\dfrac{(x-2)(x+1)(x-3)}{(x-2)(x-1)(x-5)}$

Bonus: (5 pts) Same instructions as #1, only I want your factored polynomial to have *rational* coefficients after expansion:

Zeros: $x = 2 - \sqrt{5}$, multiplicity 1; $x = 2 + 3i$, multiplicity 2; $x = -5$, multiplicity 17.

Bonus: (5 pts) What is the domain of $\Phi(x) = \sqrt{\dfrac{(x-2)(x+3)}{(x+1)^2}}$?