Test 3, Chapter 380 Points
Name $\qquad$
1.(5 pts) Form a polynomial in factored form with real coefficients with the given zeros and degree. Please do not expand the polynomial.

Zeros: $x=2$, multiplicity 2; $x=-1$, multiplicity 2. Degree 4.
2. (10 pts) Expand $(x-(2+i))(x-(2-i))$
3. (10 pts) Use synthetic division to find $P(3)$ if $P(x)=2 x^{4}+x^{3}+3 x^{2}-2 x+5$.
4. (5 pts) Divide $f(x)=x^{4}-3 x^{3}+2 x^{2}+5$ by $d(x)=x^{2}+3$. Then write the result in the form Dividend $=$ Divisor $\cdot$ Quotient + Remainder .
5. Let $f(x)=3 x^{5}-15 x^{4}+21 x^{3}+3 x^{2}-24 x+12$, and suppose its factored form is given by $f(x)=3(x-2)^{2}(x+1)(x-1)^{2}$
a. (10 pts) List each real zero and its multiplicity. Determine whether the graph of $f(x)$ touches or crosses the $x$-axis at the corresponding $x$-intercepts.
b. (5 pts) What power function does $f$ resemble for large values of $|x|$ ? In other words, give the end behavior for $f$, along with a simple diagram.
c. (5 pts) Use your work, above, to help you sketch the graph of $f(x)$, showing all intercepts (including the $y$-intercept).
6. Use your sketch from the previous problem to help you solve the following inequalities. You might want to re-sketch it, below, just to have it on the same page.
a. $(5$ pts $) 3(x-2)^{2}(x+1)(x-1)^{2}>0$
b. (5 pts) $\frac{3(x-2)^{2}}{(x+1)(x-1)^{2}} \geq 0$ (A very different-looking function, but not so very different, when it comes to solving inequalities).
7. Let $f(x)=x^{5}-4 x^{4}+7 x^{3}-10 x^{2}-62 x-40$
a. (10 pts) Find the real zeros of $f(x)=x^{4}-5 x^{3}+15 x^{2}-5 x-26$. Factor $f$ over the set of real numbers. Use scratch paper (the back of page 5) to make your guesses, and then use the correct guesses to break $f$ down in the space, below.
b. (5 pts) Find the remaining (nonreal) zeros of $f$ and factor $f$ over the set of complex numbers.
8. (10 pts) Suppose $R(x)=\frac{2 x^{3}-16 x^{2}+2 x+84}{x^{3}-x^{2}-10 x-8}$ can be factored into $\frac{2(x-3)(x+2)(x-7)}{(x+2)(x-4)(x+1)}$. (It can.) Sketch the graph of $R$ showing all intercepts, asymptotes and holes (if any).

