Do your work on separate paper, provided. Put your answers *with* your work. All I want on this cover sheet is your *name*. Leave plenty of room before, after, and during your work! Leave a margin. Only write on one side of each page. I'm not grading the backs. Include scratch work *with* your work. I'm taking off 10% for those who can't follow the formatting instructions or write too faintly for me to read.

1. (10 pts) Form a polynomial of *minimal 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: $x = 13$, multiplicity 1; $x = 3 - 7i$, multiplicity 1; $x = -5$, multiplicity 3.

2. (10 pts) Use synthetic division to find $P(3)$ if $P(x) = x^6 - 7x^4 + 3x^3 - 10x^2 + 5x - 5$.

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 $f(x) = (x-1)^2(x+5)^2(x-4) = x^5 + 4x^4 - 26x^3 - 64x^2 + 185x - 100$.

   a. (5 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) $(x-1)^2(x+5)^2(x-4) > 0$

      ii) (5 pts) $\dfrac{(x-1)^2(x+5)^2}{(x-4)} \geq 0$

5. (10 pts) Find the *real* zeros of $f(x) = 4x^5 - 12x^4 - x^3 + 28x^2 - 9x - 22$. Then factor *f* over the set of **real numbers**. This should involve an irreducible quadratic factor.

6. (5 pts) Find the remaining (nonreal) zeros of *f* and factor *f* over the set of **complex numbers**. (Some/most of this work may be done, above. If you're clear where it kicks in, I'll see it.)

7. (10 pts) Sketch the graph of $R(x) = \dfrac{x^2 - 3x - 10}{x^2 - x - 6}$, showing all asymptotes, intercepts, and any holes.

8. (5 pts) Multiply and simplify $(x - (3 + 2i))(x - (3 - 2i))$

Answer up to 2 bonus questions for up to 10 points:

Bonus: (5 pts) What is the domain of $R(x) = \sqrt{\dfrac{(x-1)^2(x+5)^2}{(x-4)}}$? (See #4!)

Bonus: (5 pts) Solve the absolute value inequality $|-2x+3| > 5$

Bonus: (5 pts) Let $f(x) = \sqrt{x+1}$ and $g(x) = \dfrac{x-2}{x+5}$. Find the domain of f and g. Then form the composite function $f \circ g$ and *its* domain!

Bonus: (5 pts) Solve the quadratic equation $2x^2 - 3x - 4 = 0$ by completing the square.

Bonus: (5 pts) Prove that $g(x) = \dfrac{x-2}{x+5}$ is a 1-to-1 function.

Bonus: (5 pts) It takes Jim 10 hours to finish a job, working alone, and it take Jenny 8 hours to finish the same job, working alone. If Jenny starts 3 hours early, and Jim joins right in, after he gets there, how many hours does Jenny end up working, and how many hours does Jim end up working?

Notice how bonus questions tend to show up over and over? That's why you really need to figure out every question on every test, after you get it back.