Midterm Review Problems

I. Simplify. (Remember that $i^2 = -1$).

1. $(2-i)(7+i)$
2. $(i-4)(i-10)$

II. Sketch each of the following graphs. Include the coordinates of the y-intercept and any x-intercepts. If the function is a quadratic or an absolute value, include the coordinates of the vertex as well. Your sketches do not need to be drawn to scale, but the basic shape of the graph should be correct. Do all graphs by hand first, then check your answers using your calculator.

1. $f(x) = -(x+3)^2 + 10$
2. $f(x) = 2x^2 - 16x + 30$
3. $f(x) = (x-3)(x-4)$
4. $f(x) = (x+5)(x-7)^2$
5. $f(x) = 7 - \frac{1}{2}x$
6. $f(x) = 3|x+1| - 4$
7. $f(x) = -(x^2 + 8x + 16)$
8. $f(x) = 2x(x-5)$
9. $f(x) = x^4 + 3x^2 - 28$
10. $f(x) = x^2 - 12$
11. $f(x) = 3$
12. $x = -4$
13. $f(x) = 3|x| - 1$
14. $f(x) = x^2 + x - 7$
15. $f(x) = -2x(x-3)^2(x-6)^2$
16. $f(x) = (x+6)(x+6)$
17. $f(x) = x^4 - 2x^3 - 9x + 18$
18. $f(x) = -(x+5)(x^2 + 4x - 5)$

III. Equation solving practice. Find all solution, real and non-real. Try to use the most appropriate method for each problem. Answers should be given in simplified form. Some answers will involve the number *i*.

1. $-3x(5x-7) = 0$
2. $\frac{x^2}{6} - \frac{2x}{3} = 3 + \frac{x}{2}$
3. $(x+4)(x-3)^2(x+8)^4 = 0$
4. $3|x-1| + 4 = 19$
5. $0 = \left(\frac{x}{7} - \frac{2}{3}\right)\left(\frac{3x}{2} + 3\right)$
6. $x^2 + 5x - 7 = 4x - 8 - 2x^2$
7. $(x-4)^2 + (x-1)^2 = (x+2)^2$
8. $-9 = -\frac{1}{2}(x-2)(x-6)$
9. $(x+4)(x-3)^2(x+8)^4 = 0$
10. $x^5 + 24x = 11x^3$
11. $x^3 + 7x = 3x^2 + 2x + 15$
12. $(x^2 - 7x + 6)(x^2 + 4x + 5) = 0$

IV. Divide. If there is a remainder, include it in your answer as a fraction.

1. $\frac{x^3 + 9x^2 + 11x - 24}{x+3}$
2. $\frac{x^3 - 28x + 19}{x-5}$
3. $\frac{x^4 - x^3 - 9x^2 + 4x + 2}{x^2 - 3x - 1}$

V. Solve the following equations. Find all solutions, real and non-real. Hint: Use a combination of graphing on the calculator and long division to get the factoring. Be careful, all of these have some non-real solutions. (Note: If a problem like this is on the midterm, we will provide you with the necessary graph).

1. $x^3 - 5x^2 + 7x - 12 = 0$
2. $x^3 + 12x = 4x^2 + 16$
3. $x^3 = 8$

IV. Carefully answer each of the following.

1. Write the equation of a line going through the points $(-1,2)$ and $(8,-10)$.

2. The x-intercept of a line is 3 and the y-intercept is -7. Write the equation of the line.

3. $f(x)$ is a linear function in which $f(2)=6$ and $f(-3)=-4$. Find $f(-12)$.

4. Find the equation of a line that goes through the point $(-2,1)$ and is parallel to the line $y=\frac{3}{4}x+4$.

5. Find the equation of a line that goes through the point $(-6,-4)$ and is perpendicular to the line $y=-2x+2$.

6. The graph of an absolute value function goes through the point $(3,5)$. The vertex of the graph is $(4,2)$. Write the formula for the function.

7. A quadratic function goes through the points $(2,0)$, $(8,0)$, and $(4,-2)$. Write the equation of the function. Then find its domain and range.

8. The vertex of a quadratic function is $(3,-7)$ and its y-intercept is 11. Write the equation of the function. Then find the coordinates of the x-intercepts.