Please use lots of space and explain your answers, showing clearly any work you had to do. Each question is worth 3 points.

(1) A line passes through the points $(8, -2)$ and $(4, 6)$. Give the slope of this line.

(2) Write the equation of the line in the previous question. Give your answer in the form $y = mx + b$.

(3) For the linear function $f(x) = \frac{1}{3}x + 2$

   (a) Find the y intercept of its graph.

   (b) Find the x intercept of its graph.

   (c) Sketch the graph using these intercepts. Make sure to label and mark off numbers on the x and y axes.

(4) We have two lines given by the equations $x + 2y = 5$ and $2x - y = 5$.

   (a) Find the slopes of each line by first writing them in the form $y = mx + b$.

   (b) Are these lines parallel, perpendicular or neither?

   (c) Find the coordinates of the point where the lines meet.

(5) A line ℓ_1 has equation $y = \frac{3}{2}x - 1$.

   (a) Find the equation of the line ℓ_2 that is parallel to ℓ_1 and passes through the point $(6, 2)$.

   (b) Find the equation of the line ℓ_3 that is perpendicular to ℓ_1 and passes through the point $(6, 2)$.

   (The first step is to find the slope of the line ℓ_1. You can just read the m value. Then remember that parallel lines have the same slope...)

(6) For the quadratic function $f(x) = 2x^2 + 8x - 10$

   (a) Give the coordinates (h, k) of the vertex of this parabola.
   (Use the formulas $h = -b/2a$ and $k = f(h)$ to do this.)

   (b) Write $f(x)$ in the standard (vertex) form $f(x) = a(x - h)^2 + k$.

   (c) Give the equation of the axis of symmetry. (Since it is a vertical line, your answer should be $x = $ a number.)

(7) Give the domain and range of the function in the previous question.

(8) Let $f(x) = -x^2 - 2x + 3$

    (a) Find the vertex.

    (b) Find the y intercept.

    (c) Find the two x intercepts.
       (Here you want to solve $f(x) = -x^2 - 2x + 3 = 0$. To make that easier to solve, multiply both sides by -1 to get $x^2 + 2x - 3 = 0$.)

    (d) Use parts (a), (b), and (c) to sketch the graph of $f(x)$.

(9) Find the x intercepts of the graph of $g(x) = x^2 - 6x - 1$ using these steps:

    (a) We want to solve $0 = x^2 - 6x - 1$ but the right side does not factor. Instead first write this side in standard (vertex) form to get $0 = a(x - h)^2 + k$.

    (b) Put the square on one side: $(x - h)^2 = -k/a$

    (c) That means $x - h$ is plus or minus the squareroot of the right side. Then show that the x intercepts are $x = 3 - \sqrt{10}$ and $x = 3 + \sqrt{10}$. (So the graph crosses the x axis at approximately -0.16 and 6.16.)

(10) Find the two real numbers that have the biggest product if their sum is 12. Use these steps:

    (a) To understand what the question is asking you could try some numbers: for example $1 \cdot 11 = 11$ but $3 \cdot 9 = 27$ is bigger.

    (b) Call the two numbers x and y. Then write the equation that means "their sum is 12" and then solve for y.

    (c) Write the product xy as a function $f(x)$ that only depends on x.

    (d) The x we want is the x coordinate of the vertex of the graph of $f(x)$ (since that is where the local maximum is).

    (e) Give the two numbers x and y that solve the problem.

If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes and section in the textbook.

- Check if you get the right answer for a similar odd-numbered question in the textbook (answers at the back of the book).

- Ask me about it after class.

- Come to my office hours: Mon 12:00 - 1:00, Wed 12:00 - 1:00 in CP 317.

- Go to the Math Tutorial Lab in-person in CP 303 or online.