**Sample Exam 1**
Math 19, Spring 2013

1. (6 points) Is the point $(-2, -\sqrt{10})$ on the graph of the equation $y^2 = x - x^3$? Answer YES or NO clearly, briefly (one sentence) **JUSTIFY** your answer, and show all your work.

2. (8 points) Suppose z is proportional to the square of y and inversely proportional to x. Express this relationship as an equation, and given that $z = 17$ when $x = 11$ and $y = 2$, find the constant of proportionality. Round off your answer to 3 decimal places.

3. (10 points) Find the equation of the line that passes through the points $(-7, 13)$ and $(-12, -29)$. No explanation necessary; show all your work. **DO NOT SIMPLIFY** your answer, and leave rational fractions as rational fractions instead of putting them in decimal form.
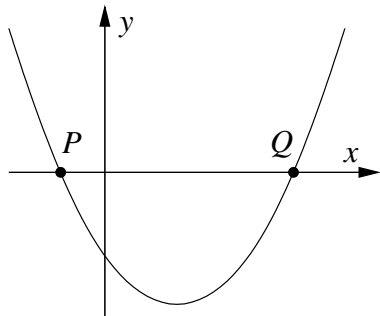
4. (8 points) Let

$$f(x) = x^2 - 2, \qquad\qquad g(x) = \begin{cases} x - 3 & \text{if } x \le 4, \\ 12 - x^2 & \text{if } x > 4. \end{cases}$$

Find the value of $(f \circ g)(5)$. Show all your work.

5. (8 points) Suppose the graph of a function $g(x)$ is shown below. Find the intervals on which $g(x)$ is **increasing**. No explanation necessary.
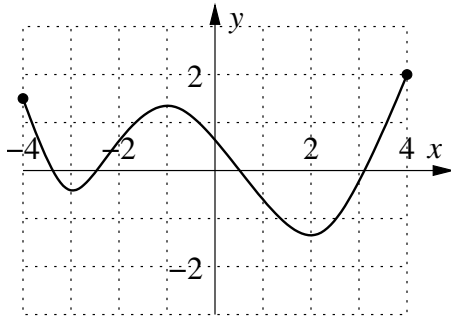
6. (10 points) Suppose the graph of $f(x) = x^2 - 3x - 4$ is shown below (not necessarily to scale). Find the coordinates of the points P and Q. Show all your work.


7. (10 points) Amy and Rory are cleaning up a doctor's office. If it takes Amy 40 minutes to clean up the doctor's office, and it takes Rory 50 minutes to clean up the doctor's office, how long does it take them when they work together?

Show all your work, and write your final answer in the form of a complete sentence, using the correct units.

8. (10 points) Let $f(x) = 11 - 7x - 3x^2$. Find the average rate of change of $f(x)$ between $x = a$ and $x = a + h$, and simplify your answer. Show all your work.

9. (12 points) Suppose $y = f(x)$ is a function whose graph is shown below.
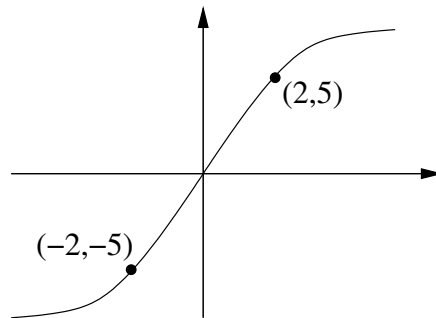
Graph the following functions below.

(a) $y = f(x - 7)$

(b) $y = 4f(x - 7)$

(c) $y = 4f(x - 7) + 3$

Indicate clearly which graph is which, and for each graph, label as many points precisely as you can. (I.e., what happens to the points $(0, 0)$, $(2, 5)$, and $(-2, -5)$ after each transformation?)

10. (6 points) Given $F(x) = \sqrt[3]{x^2 + 1}$, find functions f and g such that $F(x) = (f \circ g)(x)$. (Do not choose $f(x) = x$ or $g(x) = x$.) No explanation necessary.

11. (12 points) Solve the following inequality:

$$\frac{(x - 1)(x - 2)}{(x - 10000)(x - 10001)} < 0.$$

Show all your work.