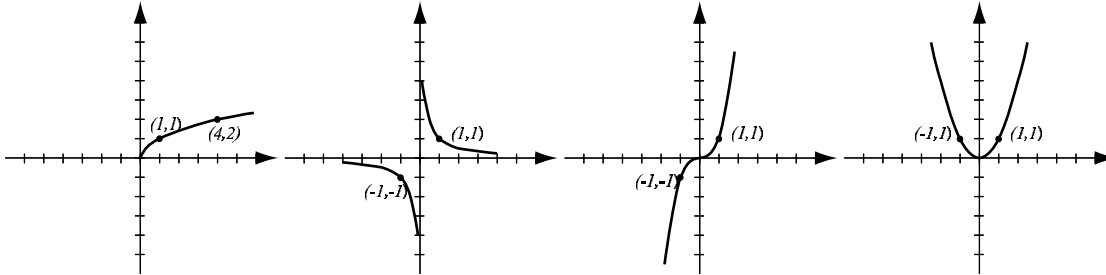**1.** (8pts) The following are graphs of basic functions. Write the equation of the graph under each one.

2. (20pts) Let $f(x) = x^2 - x - 12$, $g(x) = \sqrt{2x + 5}$.

Find the following (simplify where possible):

$(f - g)(0) =$ $\dfrac{f}{g}(2) =$

$(fg)(-1) =$ $(g \circ f)(x) =$

$(f \circ g)(x) =$

The domain of $\dfrac{g}{f}$ in interval notation

3. (6pts) Consider the function $h(x) = \sqrt{x^2 + 3}$ and find **two** different solutions to the following problem: find functions f and g so that $h(x) = f(g(x))$, where neither f nor g are the identity function.

4. (6pts) Write the equation for the function whose graph has the following characteristics:
a) shape of $y = x^3$, stretched horizontally by factor 4.
b) shape of $y = \sqrt{x}$, reflected over the x-axis, then shifted up 2 units.

5. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $f(-x) - 2$ and $2f(x - 3)$ and label all the relevant points.
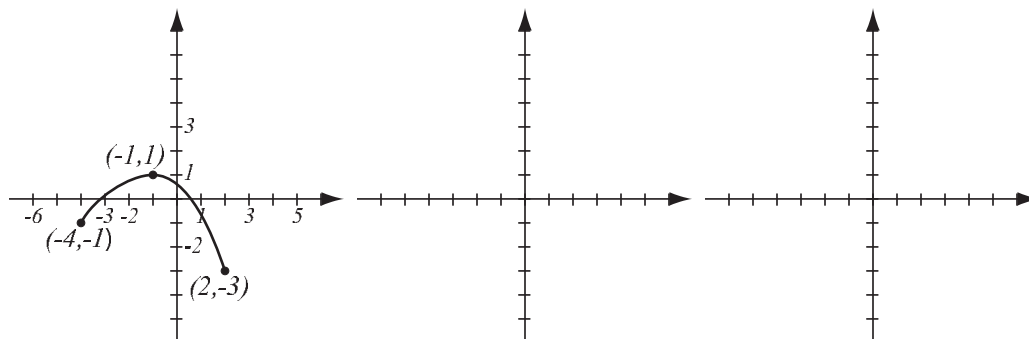
6. (8pts) Sketch the graph of the piecewise-defined function:

$$f(x) = \begin{cases} -3x - 5, & \text{if } x \leq -1 \\ x - 2, & \text{if } -1 < x \leq 3 \end{cases}$$

7. (8pts) Find the values of the piecewise-defined function.

$$g(x) = \begin{cases} x^2 - 1, & \text{if } -7 < x \leq -2 \\ |x|, & \text{if } -2 < x < 2 \\ \sqrt{3x + 1}, & \text{if } x \geq 2 \end{cases}$$

$g(16) =$ $g(-1) =$

$g(-2) =$ $g(-10) =$

8. (20pts) Let $f(x) = \dfrac{4x}{x^2 + 5}$ (answer with 6 decimal points accuracy).

a) Use your graphing calculator to accurately draw the graph of f (on paper!). Indicate units on the axes.

b) Determine algebraically whether the function is odd, even, or neither.

c) Verify your conclusion from b) by stating symmetry.

d) Find the local maxima and minima for this function.

e) State the intervals where the function is increasing and where it is decreasing.

9. (14pts) Entrepreneur Edmund is building a block of six self-storage units, with total area 1500 square feet. They are open on one side to accommodate a garage door. Edmund's goal is to minimize building cost, same as minimizing the total length of the walls.

a) Express the total wall length as a function of the length of one of the sides x. What is the domain of this function?

b) Graph the function in order to find the minimum. What are the dimensions of the block that has the smallest total wall length and what is the smallest total wall length?
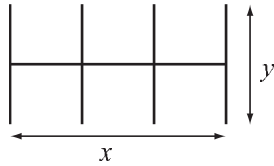
Bonus. (10pts) Let $f(x) = x^2 - 6x - 1$ and $g(x) = 3 - \sqrt{x + 10}$. Find the functions $(f \circ g)(x)$ and $(g \circ f)(x)$.