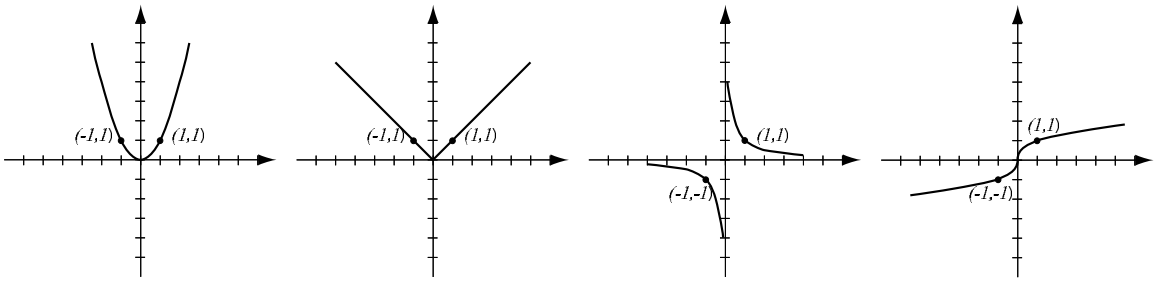
Fall '10/MAT 140/Exam 3 Name: *Show all your work.*

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



2. (10pts) Use the graph of the function f at right to answer the following questions.

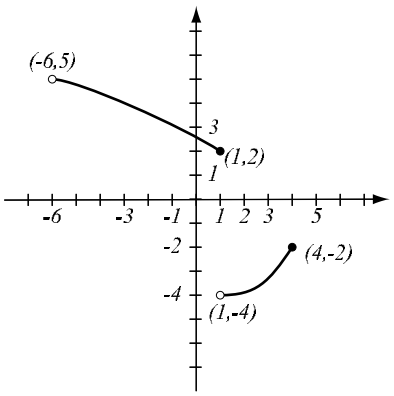
a) Find $f(4)$ and $f(1)$.

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions of the equation $f(x) = 3$?

e) Find all x for which $f(x) \geq 2$.



3. (15pts) The quadratic function $f(x) = x^2 + 2x - 15$ is given. Do the following without using the calculator.

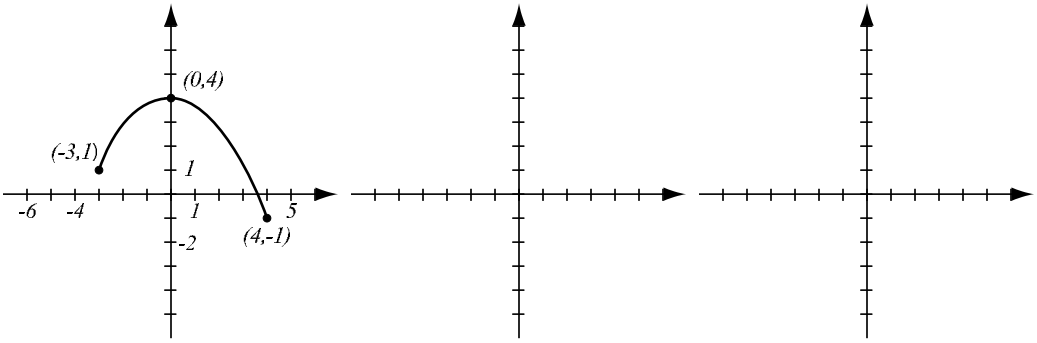
a) Find the x- and y-intercepts of its graph, if any.

b) Find the vertex of the graph.

c) Sketch the graph of the function.

d) Is the function one-to-one? Justify.

4. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $f(-x)-2$ and $2f(x)$ and label all the relevant points.



5. (18pts) Let $f(x)=\dfrac{x-3}{x^2+3x-4}$, $g(x)=x+2$.

Find the following (simplify where possible):

$\dfrac{f}{g}(2)=$ $(f\cdot g)(x)=$

$(g\circ f)(0)$ $(f\circ g)(x)=$

The domain of $(f-g)(x)$

6. (21pts) Let $f(x) = x^3 - 13x$ (answer with 4 decimal points accuracy).
a) Use your graphing calculator to accurately draw the graph of f (on paper!). Indicate scale on the graph.
b) Determine algebraically whether f is even, odd, or neither. Justify your answer further by examining the graph.
c) Algebraically find the x- and y-intercepts.
d) Find where f has a local minimum and maximum.
e) Find the intervals of increase and decrease.

7. (10pts) Let $f(x) = x^2 + 3$, $x \geq 0$.
a) Find the formula for f^{-1}.
b) Find the range of f.

8. (8pts) Sketch the graph of the piecewise-defined function:

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

Bonus. (10pts) Eric has a 50ft long fence that he will use to enclose a rectangular pen for his dog along a wall of his house (there is no fence along the wall). Follow the steps below to find the dimensions of the pen that has the greatest area.

a) Write the area of the pen in terms of x and y. Then use the condition above to help you write the area $A(x)$ as a function only of x.

b) You should have gotten a quadratic function for $A(x)$. Graph it and determine algebraically where it achieves a maximum.

c) What are the dimensions of the pen with the greatest area? What is the greatest area?