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

1. (20pts) Let $f(x) = \sqrt{3x+16}$, $g(x) = \dfrac{1}{x} + 4$.

Find the following (simplify where possible):

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

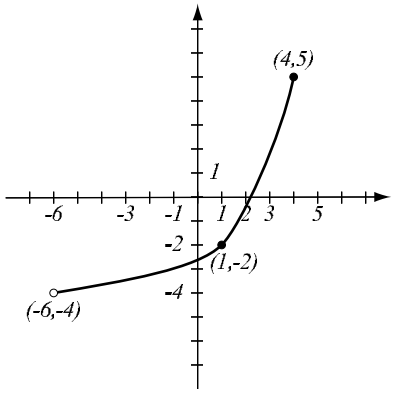
$(f \cdot g)(x) =$

$(g \circ f)(0)$

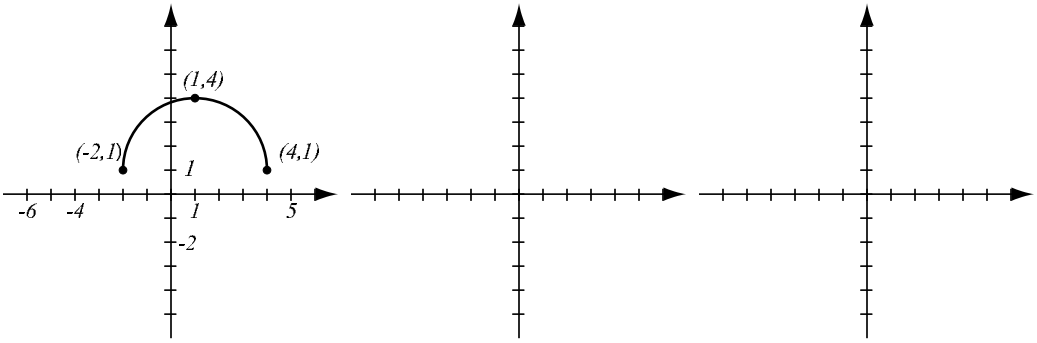
$(f \circ g)(x) =$

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

2. (7pts) The graph of a function f is given.
a) Is this function one-to-one? Justify.
b) If the function is one-to-one, find the graph of f^{-1}, labeling the relevant points.



3. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $f(x-1)+3$ and $f(2x)$ and label all the relevant points.



4. (15pts) The quadratic function $f(x) = -x^2 - 3x + 10$ 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.

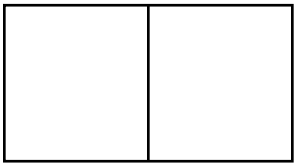
c) Sketch the graph of the function.

d) What is the range of the function?

5. (22pts) Consider the polynomial $f(x) = x^4 - 9x^3 + 18x^2$.
a) Find the y- and x-intercepts algebraically. What are the multiplicities of the zeroes of f?
b) Use your calculator to draw the graph of the function (on paper!).
c) Find all the turning points (4 decimal points accuracy).
d) Describe the end behavior of f.

6. (10pts) Let $f(x) = (3x + 2)^3$.
a) Find the formula for f^{-1}.
b) Show that $(f \circ f^{-1})(y) = y$.

7. (16pts) Farmer Tom has 5000 meters of fencing. He would like to enclose a rectangular area and divide it in half with a fence so that the area is the largest possible. Find the dimensions of the enclosure that will give the greatest area. What is the greatest area?



Bonus. (10pts) Find the point on the line $y = 5 - 3x$ that is closest to the point $(-1, 3)$. Draw a picture. Hints: Set up the expression for the distance d between a generic point (x, y) and the point $(-1, 3)$. Then express d only in terms of x, and minimize d^2 (you will need to simplify d^2).