Fall '09/MAT 140/Exam 3 Name: *Show all your work.*

1. (19pts) Let $f(x) = x^2 + 5x + 4$, $g(x) = \dfrac{2x+7}{x-1}$, $h(x) = \sqrt{5x-2}$.

Find the following (simplify where possible):

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

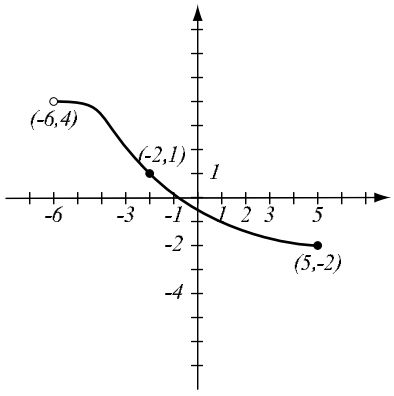
$(f - h)(1) =$

$(f \circ g)(2)$

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

The domain of $(g \cdot h)(x)$

2. (8pts) 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.



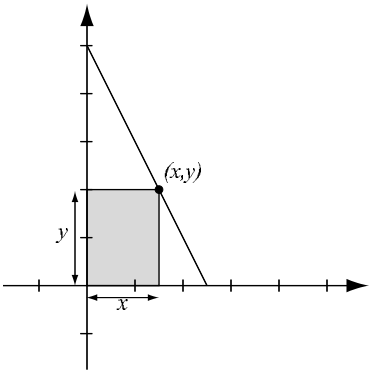
3. (10pts) Let $f(x) = 5x - 4$.
a) Find the formula for f^{-1}.
b) Show that $(f^{-1} \circ f)(x) = x$.

4. (14pts) The quadratic function $f(x) = x^2 - 7x + 11$ 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.

5. (24pts) Consider the polynomial $f(x) = x^3 - 8x^2 + 16x$.
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.
e) What is the range of f?

6. (10pts) Suppose you are fencing in a rectangular area for your goat. The width of the rectangle is 10 feet less than its length. Let P be the length (in feet) of fencing you bought.
a) Express the length l of the rectangle as a function of P.
b) Express the area A of the enclosure first as a function of length l, then as a function of P.

7. (15pts) A rectangle in the first quadrant is positioned as in the picture, so that two of its sides are along the axes, and one of its vertices is on the line $y = 5 - 2x$.
a) Draw two more such rectangles.
b) Express the area of the rectangle as a function of x and sketch a graph of the area function.
c) What dimensions of the rectangle give you the largest area, and what is this area?



Bonus. (10pts) Let $f(x) = \dfrac{4x^2 - 8x - 140}{x^2 + 6x + 9}$.
a) Find the domain of f and the vertical asymptotes, if any.
b) Find all the x- and y-intercepts.
c) Use your calculator to draw the graph of the function (on paper!).
d) Find all the turning points.
e) Find the horizontal asymptote, if any.