

Math 120 Winter 2001 Midterm 1

*Read all questions carefully; if a question is not clear, ask your TA.*

*Write clearly and legibly. Show all your work. You must justify all your answers to receive credit, unless stated otherwise.*

*This exam contains 7 pages and is worth a total of 50 points.  
You have 45 minutes. Good luck*

By signing below you understand that we may photocopy exams prior to returning.

Signature\_\_\_\_\_

NAME:\_\_\_\_\_

PROBLEM 1 \_\_\_\_\_

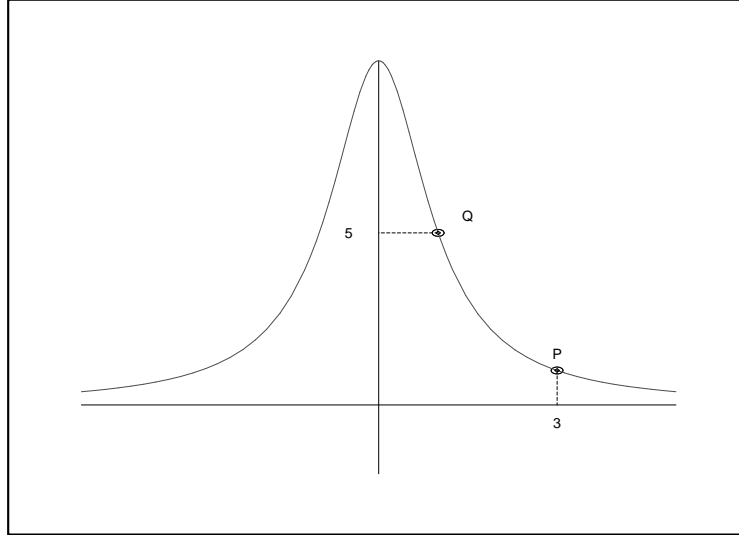
PROBLEM 2 \_\_\_\_\_

PROBLEM 3 \_\_\_\_\_

PROBLEM 4 \_\_\_\_\_

Total \_\_\_\_\_

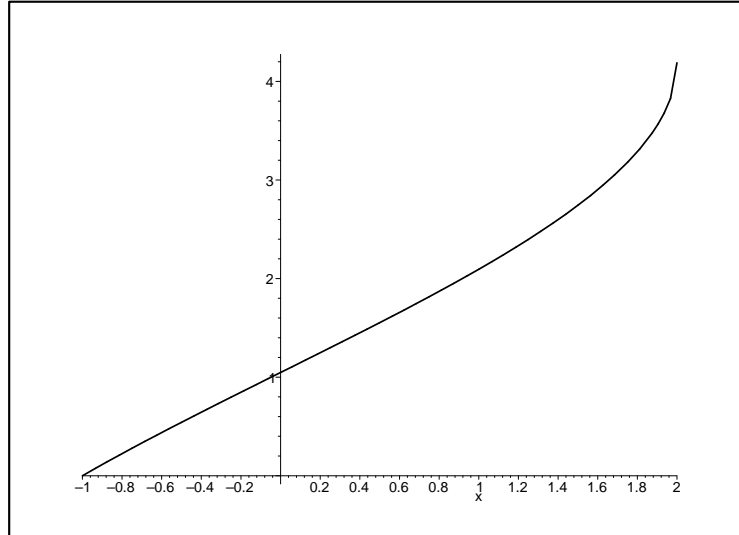
**Problem 1:** Let  $f(x) = \frac{10}{x^2+1}$ . Below is the graph of  $f(x)$ .



a) (5 points) Find the distance between the points P and Q in the graph above.

b)(4 points) Compute  $f(h + 2)$ . Simplify as much as possible

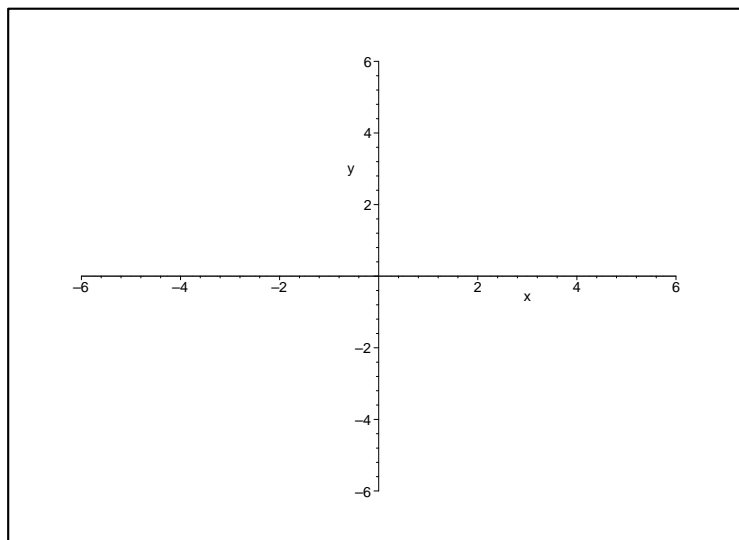
**Problem 2:** Below is the graph of a function  $f(x)$ .



a)(3 points)What is the domain of  $f(x)$  ? *No justification needed.*

b)(5 points)What is the domain of the function  $g(x) = \sqrt{f(2x) - 1}$  ?

c)(5 points) Sketch a graph of  $-f(x - 1) - 2$  below.



**Problem 3:** Peter keeps the thermostat set at  $65^{\circ}F$  in his house. He spends \$ 80 a month for heating. Peter's monthly heating bill would go up of \$ 20 per degree Fahrenheit if he wanted to keep a higher temperature in the house; that is, if he raised the thermostat from  $t$  to  $t + 1$  degrees Fahrenheit, he would have to pay \$20 more a month.

Let  $f(t)$  be the function giving the monthly cost of heating Peter's house to a temperature of  $t$  degrees Fahrenheit.

a)(3 points) How much would Peter spend a month to keep the temperature at  $68^{\circ}F$  ?

b)(5 points) Write a formula for the function  $f(t)$ , valid for  $t \geq 65$ .

Suppose instead that the bill would go up of \$20 per degree to keep a temperature up to  $70F$ , and the bill would go up of \$15 per every degree that raises the temperature above  $70F$ . In other words, raising the thermostat of one degree, from temperature  $t$  to temperature  $t + 1$ , would increase the montly bill of \$20 if  $t$  is less than  $70F$  and of \$15 if  $t$  is  $70F$  or greater .

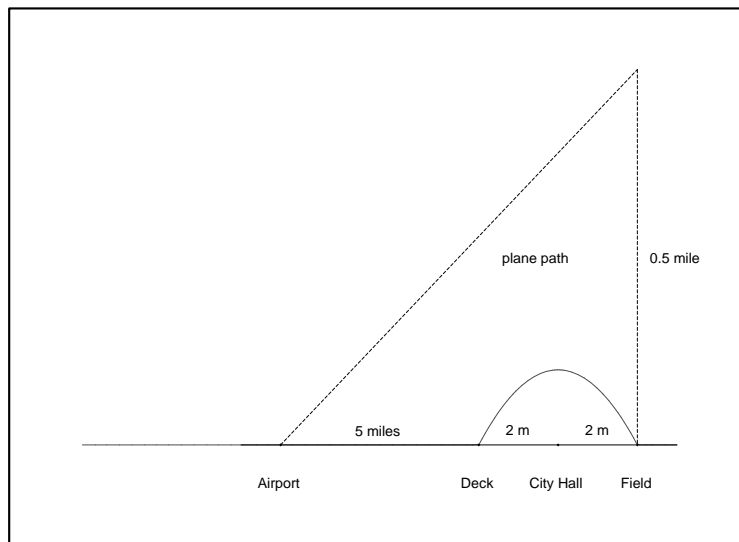
c)(5 points) Write a formula for the function  $f(t)$ , valid in the domain  $65 \leq t \leq 75$  under this new scenario.

d) (5 points) If, under this new scenario, Peter pays a monthly bill of \$ 225. What is his house thermostat set to ?

**Problem 4**

To celebrate the 4th of July, Don is planning to launch a rocket from his house deck. The trajectory of the rocket will be a parabola (whose exact shape will depend on the initial velocity and launching angle). Don wants the rocket to reach its maximum height above the City Hall, and to land on an empty field just outside the city. Don's house is 2 miles West of the City Hall, and the City Hall is 2 miles West of the field. Don's house is also 5 miles East of the airport, and planes land following the path shown in the figure below (not to scale); that is, planes are at a height of 0.5 miles when they are above the field, then they descend straight to the airport.

You may need to remember that 1 mile = 5280 feet.



a)(5 points) What height do landing planes reach above the city hall ?

b)(5 points) Don decides that the rocket should reach a height of 600 feet above the city hall. Write a formula for the function  $h(x)$  that gives the height of the rocket, in feet, as a function of its distance  $x$ , in feet, from Don's house.