

Math 120 D, E - Autumn 2006  
Mid-Term Exam Number Two  
November 16, 2006

Name: \_\_\_\_\_

Section: \_\_\_\_\_

1	10	
2	10	
3	10	
4	10	
Total	40	

- Complete all questions.
- You may use a calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 50 minutes to complete the exam.

1. Let  $g(x) = |3x - 12|$  and

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

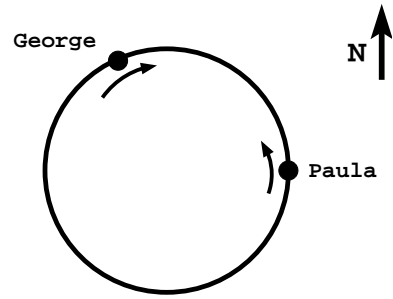
Find the multipart rule for the function  $h(x) = 5f(x) + g(x)$ .

2. The tire on Jacques' unicycle is leaking air. This causes the air pressure in the tire to decrease. The pressure will never drop below 1 atmosphere (abbreviated **atm**). When the tire started leaking, the pressure in the tire was 9 atm. One minute later it was 6 atm.

Suppose the pressure in the tire is a linear-to-linear rational function of the time since the leak started.

What is the pressure in the tire after it has been leaking for 5 minutes?

3. Paula and George are running at constant speeds around a circular track. They started running at the same time. Paula started at the easternmost point, and runs counter clockwise. George started from a point a bit to the west of the northernmost point and runs clockwise. Paula runs at a speed of 5 meter per second and takes 80 seconds to complete a lap of the track. George takes 3 seconds to reach the northernmost point of the track for the first time. He reached the easternmost point of the track for the first time when he had been running for 25 seconds.



a. How long will they have been running when they pass each other for the first time?

b. How far east or west of his starting point will George be after running for 10 minutes?

4. Gen is measuring the angle to the top of a tree that has grown vertically in a large horizontal field. From a point some distance away from the base of the tree, she measures the angle to be 67 degrees.

One year later, she returns and measures the angle from a point twice as far from the base of the tree. This time the angle is 43 degrees. She also learns that, due to a lightning strike, the tree is ten feet shorter than it was a year ago.

How tall is the tree now?