

MA 113 CALCULUS I, SPRING 2015

WRITTEN ASSIGNMENT #5

Due **Wednesday, 25 March 2015**, at the beginning of lecture.

Instructions: The purpose of this assignment is to develop your ability to formulate and communicate mathematical arguments. Your complete assignment should have your name and section number on each page, be stapled, and be neat and legible. *Unreadable work will receive no credit.*

You should provide well-written, complete answers to each of the questions. We will look for correct mathematical arguments, careful explanations, and correct use of English. Your solution should be formulated in complete sentences. As appropriate, you may want to include diagrams or equations written out on a separate line. Your textbook provides examples of how we communicate mathematics.

Students are encouraged to use word-processing software to produce high quality solutions. However, you may find that it is simpler to add graphs and equations using pen or pencil.

1. (4 points)
 - (a) Use implicit differentiation to find the equation of the tangent line to the circle $x^2 + y^2 = 169$ at $(x, y) = (12, 5)$.
 - (b) Use the tangent line to estimate the value $y > 0$ so that $(12.2, y)$ lies on the circle.
 - (c) Set $x = 12.2$ and solve the equation $x^2 + y^2 = 169$ to find the value of $y > 0$ so that $(12.2, y)$ lies on this circle. Use a calculator to compute a decimal approximation that is correctly rounded to 3 decimal places.
 - (d) Why is the difference between your answers to part b) and c) small?
2. (6 points) A plane is flying east at 180 kilometers/hour. The plane's altitude is 4 kilometers.
 - (a) Make a sketch showing the observer, the plane and the angle of elevation.
 - (b) Find the angle of elevation one minute after the plane flies directly over an observer. (You will not be able to give an exact answer to this question. Please give your answer correctly rounded to three decimal places.)
 - (c) Find the derivative of the angle of elevation one minute after the plane flies directly over the observer.
 - (d) Find the rate of change of the angle of elevation one minute after the plane flies directly over the observer. Is the angle of elevation increasing or decreasing?
 - (e) Find the distance between the observer and the plane one minute after the plane flies over the observer.
 - (f) Find the rate at which the distance between the plane and the observer is changing one minute after the plane flies over the observer. Is the distance increasing or decreasing?
3. (1 point bonus) The son of the professor's father is talking to the father of the professor's son. Is the professor necessarily speaking? Explain.