MAT 137Y: Calculus!
Problem Set 4.
Due in tutorial on November 16–17

Instructions:

• Print this cover page, fill it out entirely, sign at the bottom, and STAPLE it to the front of your problem set solutions. (You do not need to print the questions.)
  Doing this correctly is worth 1 mark.

• Submit your problem set ONLY in the tutorial in which you are enrolled.

• Before you attempt this problem set do all the practice problems from sections 3.6, 3.7, 4.10, 7.1 (see course website).

• Re-read “Important notes on collaboration” on the cover page for Problem Set 1.

Last name .................................................................

First name .................................................................

Student number ...........................................................

Tutorial code ............................................................... 

TA name .................................................................

Please, double-check your tutorial code on blackboard, and double-check your TA name on the course website. Remember that if there is a discrepancy between Blackboard and ROSI/ACORN, then your correct tutorial is the one on Blackboard, not on ROSI/ACORN. See http://uoft.me/137tutorials
1. A cop is trying to catch drivers who speed on the highway. She finds a long stretch of the highway. She parks her car behind some bushes, 400 metres away from the highway. There is a traffic sign at the point of the road closest to her car, and there is a phone by the road 600 metres away from the traffic sign.

(a) The cop points her radar gun at a car and learns that, as the car is passing by the phone, the distance between the car and the cop is increasing at a rate of 80 km/h. The speed limit is 120 km/h. Can she fine the driver?

(b) Why doesn’t the cop point her radar gun at cars as they pass by the traffic sign rather than as they pass by the phone?

2. The equation \(x^5y + x + y^3 = 3\) defines implicitly a function \(y = g(x)\) near \(x = 1\). Compute \(g(1), g'(1),\) and \(g''(1)\).

3. Read Equation 7.1.7 on page 338 of the book and its derivation. Another way to write the same equation is the following. If \(f\) is a differentiable, one-to-one function and \(f(a) = b\), then

\[
(f^{-1})'(b) = \frac{1}{f'(a)}
\]

Obtain (with proof) similar equations for \((f^{-1})''(b)\) and for \((f^{-1})'''(b)\) in terms of \(f'(a), f''(a),\) and \(f'''(a)\).

4. Two ants are taking a nap. The first one is resting at the tip of the minute hand of a cuckoo clock, which is 25 cm long. The second one is resting at the tip of the hour hand, which is half the length. At what rate is the distance between the two ants changing at 3:30?