The University of British Columbia

MATH 104

Mock Midterm 2

31 October 2011

Time: 50 minutes

FULL NAME: _____ STUDENT # : _____

SIGNATURE: _____

This Examination paper consists of 7 pages (including this one). Make sure you have all 7.

instructions:

No memory aids allowed. No calculators allowed. No communication devices allowed.

marking:

Q1	/10
Q2	/10
Q3	/10
Q4	/10
TOTAL	/40

Names of Instructors:

Q1 [10 marks]

At 1:00 p.m. ship A is 25 km due north of ship B. If ship A is sailing west at a rate of 16 km/h and ship B is sailing south at 20 km/h, find the rate at which the distance between the two ships is changing at 1:30 p.m. (Be sure to draw a diagram.)

Q2 [10 marks]

A used Cesna 172 Skyhawk aircraft is purchased for $56,000. The buyer predicts it will decline continuously in value at a rate of 4% per year.

(a) Write down a function to model the value of the aircraft t years from now.

(b) What is the predicted value of the plane 5 years from now?

(c) In 5 years time, the buyer is forced to sell the plane for $30,000. What constant annual rate of depreciation would have the buyer's $56,000 aircraft worth only $30,000 after 5 years?

Q3 [10 marks]

Suppose that Lindo Cafe. sells 400 half-kilogram bags of Colombian coffee per week when it is priced at \$10 per 500 grams. For every \$1 per bag increase in price, it sells 10 fewer bags of coffee. Recall that the price elasticity of demand is given by $\epsilon(p) = \dfrac{p}{q}\dfrac{dq}{dp}$.

(*a*) Find the demand equation for Lindo's Colombian coffee. Use p for price and q for the demand.

(*b*) Compute $\epsilon(p)$ for this demand function.

(*c*) If the price is \$12 and increases by 4%, what is the percentage change in demand? (Hint: Use the price elasticity of demand to answer this question.) You may leave your answer in the simplest calculator-ready form you can find.

(*d*) Will the Lindo Cafe's revenue increase or decrease as a result of the price change in part (c)? Explain your answer.

Q4 [10 marks]

For the function

$$f(x) = \frac{x^2 - 1}{x^2 - 4}$$

determine all of the following if they are present: (i) critical points (where $f'(x) = 0$ or $f'(x)$ does not exist), local maxima and minima, intervals where $f(x)$ is increasing or decreasing; (ii) inflection points and intervals where $f(x)$ is concave upward or downward; (iii) asymptotes (horizontal, vertical). Sketch the graph of $y = f(x)$, giving the (x, y) coordinates for all of the points of interest above. **Please make your sketch big enough to see clearly all features of interest.**

You may use, without demonstrating it, the fact that $f''(x) = \dfrac{6(3x^2 + 4)}{(x^2 - 4)^3}$.

(Question 4 continued)