QUEEN'S UNIVERSITY
APSC 171J – Assignment 3
Wesley Burr
Due: February 4, 2013

INSTRUCTIONS

- This assignment is due in-class (3:30-4:20pm) Monday, February 4, 2013.
- Answer all questions, writing clearly on the sheets provided. **You must print this file and hand in a carefully stapled copy!** Unstapled assignments will not be accepted.
- One mark in each question is for **complete** (and mostly correct) work shown
- The second mark is for a **fully** correct solution, which **must** be placed in the box provided
- Whenever possible, simplify your solution.
- There are no part marks: you will receive 0, 1 or 2 on each question.

FOR INSTRUCTOR'S USE ONLY		
Question	Mark Available	Received
1	2	
2	2	
3	3	
4	2	
5	2	
6	2	
7	2	
8	2	
9	2	
10	2	
TOTAL	21	

1. [2 marks] Calculate the limit

$$\lim_{x \to -1} \frac{x^2 + 2x + 1}{x^2 - x - 2}.$$

Final Answer:

2. [2 marks] Calculate the limit

$$\lim_{x \to 0} \frac{1}{x} - \frac{1}{e^x - 1}.$$

Final Answer:

3. [3 marks] Find the local minima and maxima of the function $y(x) = 2x^3 - 9x^2 + 12x - 3$, using the Second Derivative Test to classify your critical points. Use this information to show that the equation $y(x) = 0$ has precisely one real root. Use the solution box only for your critical points, and be neat in your development.

Final Answer:

4. [2 marks] The pressure P in kilopascals, volume V in litres, and temperature T in degrees Kelvin, of a mole of an ideal gas have relationship

$$PV = 8.31 \cdot T.$$

Find the rate at which the pressure in a container of this gas is changing when the temperature is $300°K$ and is increasing at a rate of $0.1°K$/sec, and (at the same time) the volume is 100 litres and increasing at a rate of 0.2 litres/second.

Final Answer:

5. [2 marks] A drinking cup is to be manufactured in the shape of an upright cylinder (with no top, so you can drink from it). If the volume is fixed (but not given), we wish to use the minimum possible material to make the sides and bottom of the cup. Under this constraint, what will the ratio of the height of the cup be to the diameter of the cup?

Final Answer:

6. [2 marks] The cost of operating a truck is $30 + 1.04 \cdot 10^{-3}v^2$ cents/km, when operating at v km/hr. If a truck driver earns $\$20$/hour, what is the cheapest speed at which to operate over a 1000km trip.

Final Answer:

7. [2 marks] Solve the following indefinite integral:

$$\int x^2 \cos(x) dx.$$

Final Answer:

8. [2 marks] Solve the following definite integral:

$$\int_0^1 \frac{t^5}{\sqrt[5]{t^3+1}}.$$

Final Answer:

9. [2 marks] Solve the following indefinite integral:

$$\int x^3 \cos(2x) dx.$$

Final Answer:

10. [2 marks] Solve the following definite integral:

$$\int_0^{\pi/4} \frac{\cos^3(x)}{\sin^3(x)} dx.$$

Final Answer: