Dawson College: **Calculus I**: 201-NYA-05-S06: Winter 2009

Name: _____
Student ID: _____

Test 3

This test is graded out of 41 marks. No books, notes, graphing calculators or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. Compute the indefinite integral*(1 mark each)*:

a.

$$\int \sec x \, dx$$

b.

$$\int \csc x \, dx$$

c.

$$\int \tan x \, dx$$

d.

$$\int \cot x \, dx$$

e.

$$\int e^x \, dx$$

f.

$$\int \frac{1}{x} \, dx$$

g. *(bonus)*

$$\int \frac{1}{1+x^2} \, dx$$

h. *(bonus)*

$$\int \frac{1}{\sqrt{1-x^2}} \, dx$$

Question 2. Compute the indefinite integral.

a. *(3 marks)*

$$\int \frac{z(z-1)}{\sqrt{z}}\, dz$$

b. *(5 marks)*

$$\int \sin \pi x \, \cos^7 \pi x \, dx$$

c. *(4 marks)*

$$\int \theta e^{\theta^2} \, d\theta$$

d. *(2 bonus marks)*

$$\int \frac{1}{e^x + e^{-x}}\, dx$$

Question 3. *(5 marks)* A ladder us slipping down along a vertical wall. If the ladder is 4 m long and the top of it is slipping at the constant rate of 3 m/s, how fast is the bottom of the ladder moving along the ground when the bottom is 2 m from the wall?

Question 4. Let $f(x) = x(x-4)^3$

a. *(2 marks)* Find the x and y intercepts of $f(x)$.

b. *(2 marks)* Find $f'(x)$ and solve for the critical points.

c. *(2 marks)* On what intervals is $f(x)$ increasing/decreasing?

d. *(1 mark)* Identify the relative minimum and maximum.

e. *(1 mark)* Find $f''(x)$.

f. *(2 marks)* On what intervals is $f(x)$ concave up/down?

g. *(1 mark)* Identify any inflection points.

h. *(2 marks)* Sketch the graph of $f(x)$.

Question 5. *(5 marks)* A rectangular building covering 7 000 m^2 is to be built on a rectangular lot. If the building is to be 10 *m* from the boundary lot on each side and 20 *m* from the boundary in front and back, find the dimensions of the building if the area of the lot is a minimum.

Bonus. *(3 marks)* A light in a garage is 3 m above the floor and 4 m behind the door. If the garage door descends vertically at 0.5 m/s, how fast is the door's shadow moving toward the garage when the door is $\frac{\sqrt{3}}{2}$ above the floor.