VANCOUVER ISLAND
UNIVERSITY

Math 101 Practice Test 3 – Apr 27 2011

name (printed)	*student number*

Instructions:

1. There are **8 pages** (including this cover page) in the test. You will be given **80 minutes** to write the test. Justify every answer, and clearly show your work. Unsupported answers will receive no credit. Read over the test before you begin.

2. You may use a single letter-size "cheat sheet" containing formulae and numerical values. Your cheat sheet must not contain text, definitions or examples. The instructor will have the final decision on what is or is not appropriate for the cheat sheet. Hand in your cheat sheet along with your completed test. **To be considered for grading, your test must include your cheat sheet.**

3. Other than the cheat sheet noted above, no notes or books are to be used during the test. The last page is for scrap work. Put your name on the scrap paper and return it along with your completed test.

4. A basic scientific non-programmable, non-graphing calculator is permitted, however calculators may not be shared.

5. At the end of the test you will be given the instruction to stop writing. **Continuing to write after this instruction is cheating**.

6. **Academic dishonesty:** Exposing your paper to another student, copying material from another student, or representing your work as that of another student constitutes academic dishonesty. Cases of academic dishonesty may lead to a zero grade in the test, a zero grade in the course, and other measures, such as suspension from this university.

question	value	score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
Total	60	

Question 1:

(a)[5] Determine $\displaystyle\int \frac{2e^{1/x}}{x^2}\,dx$

(b)[5] Determine $\displaystyle\int \sec^6 x \tan^2 x\,dx$

Question 2:

(a)[5] Evaluate the improper integral (show all details) $\int_0^1 x \ln x \, dx$

(b)[5] Determine $\int \frac{x^2 + 3x + 2}{x(x^2 + 1)} \, dx$

Question 3:

(a)[5] The region bounded by the curve $y = x^2$, $y = 0$, $x = 0$ and $x = 1$ is rotated about the line $x = 3$. Determine the volume of the resulting solid. The method of cylindrical shells is easiest here.

(b)[5] Find the length of the curve $y = x^{3/2}$ from $x = 1$ to $x = 9$.

Question 4:

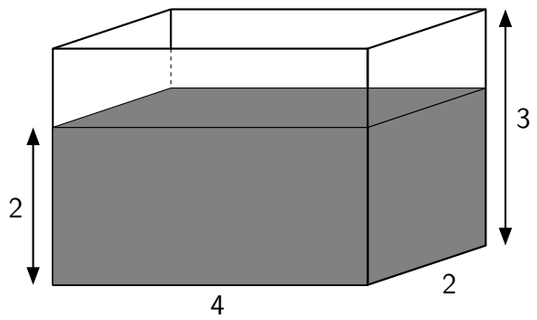
(a)[5] 20 m rope hangs over the side of a building and a 10 kg bucket is tied to the end of the rope. A person at the top of the building pulls the rope and bucket up onto the roof of the building. How much work is done if the rope has a total mass of 2 kg? Recall that the acceleration due to gravity is $g = 9.8$ m/s^2.

(b)[5] Solve the following differential equation:

$$\frac{dy}{dx} = \frac{1+y^2}{\sqrt{x+1}}, \qquad y(0) = 1$$

You may leave your solution in implicit form (it is not necessary to isolate the y variable in your final answer.)

Question 5: A rectangular fish tank of length 4 m, width 2 m and height 3 m contains water to a depth of 2 m. Recall that the density of water is $\rho = 1000$ kg/m^3 and acceleration due to gravity is $g = 9.8$ m/s^2.



(a)[5 points] How much work is required to pump all of the water up and out over the top edge of the tank?

(b)[5 points] What is the hydrostatic force (force due to water pressure) exerted on one of the long sides of the tank? Recall that pressure P as a function of depth h is $P(h) = \rho g h$ where ρ is the density of the liquid and g is acceleration due to gravity.

Question 6:

(a)[5 points] Determine the first three non-zero terms of the Maclaurin series for the function $f(x) = x^3 e^{x^2}$.

(b)[5 points] Use a Maclaurin series (not L'Hospital's Rule) to evaluate the limit

$$\lim_{x \to 0} \frac{1 - \cos(x^2)}{x^3(e^x - 1)}$$