University of British Columbia
Student Name:

Math 101 Quiz 2

Section 203 - Winter 2014
Instructor: Jose Gonzalez
Date: February 14 / 2014

(1) (*5 points*) Evaluate $\int (\ln(x))^2\, dx$.

$$\int (\ln x)^2\, dx = x\cdot(\ln x)^2 - x\cdot\ln x - \int(\ln x - 1)\,dx$$

By parts

$u = \ln x \quad dv = \ln x$

$du = \frac{1}{x} \quad V = x\cdot\ln x - x$

$$= x\cdot(\ln x)^2 - 2x\cdot\ln x + 2x + C$$

(2) (*5 points*) A leaky $10\,kg$ bucket is lifted from the ground to a height of $12\,m$ at a constant speed. Initially, the bucket contains $36\,kg$ of water, but the water leaks at a constant rate and finishes draining just as the bucket reaches the $12\,m$ level. Write an integral that computes the amount of work to lift the bucket and the water (in J). You do **not** need to evaluate the integral.

The work dW to lift the bucket and the water from height y to height $y+dy$ is:

$$\begin{aligned} dW &= \text{Force}\cdot\text{Distance} \\ &= \text{Weight}\cdot\text{Distance} \\ &= \text{Mass}\cdot g\cdot\text{Distance} \\ &= (10 + 36 - 3y)\cdot 9.8\cdot dy \end{aligned}$$

Then, the total work is:

$$W = \int_0^{12} (46 - 3y)\cdot 9.8\, dy$$