University of British Columbia
Student Name:

# Math 101 Quiz 2

Section 202 - Winter 2014
Instructor: Jose Gonzalez
Date: February 14 / 2014

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**(1)** (*5 points*) Evaluate $\int \frac{\ln(3x)}{x^2}\,dx$.

$$\int \frac{\ln(3x)}{x^2}\,dx = -\frac{\ln(3x)}{x} + \int \frac{1}{x^2}\,dx$$

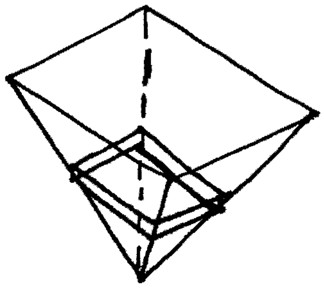
$$= -\frac{\ln(3x)}{x} - \frac{1}{x} + C$$

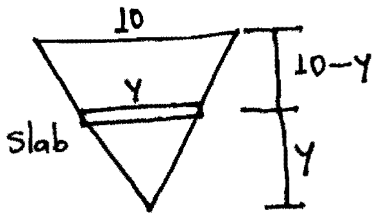
By parts.

$u = \ln(3x)$ $\quad dv = \frac{1}{x^2}$

$du = \frac{1}{x}$ $\quad v = -\frac{1}{x}$

**(2)** (*5 points*) A hole in the ground with the form of an inverted pyramid is full of water. The base of the pyramid (which is the opening of the hole) is a square of side $10\,m$ and its height (which is the depth of the hole) is $10\,m$. Find an integral computing the work required to pump the water out of the hole to ground level (in $J$). Recall that the density of water is $1000\,kg/m^3$. You do **not** need to evaluate the integral.






$\boxed{\text{Work} = \text{Force} \cdot \text{Distance}.}$

$$\begin{aligned}
W_{slab} &= \text{Force}_{slab} \cdot \text{Distance}_{slab} \\
&= \text{Weight}_{slab} \cdot \text{Distance}_{slab} \\
&= \text{Mass}_{slab} \cdot g \cdot \text{Distance}_{slab} \\
&= \text{Volume}_{slab} \cdot \text{Density}_{water} \cdot g \cdot \text{Distance}_{slab}. \\
&= \underbrace{y^2 \cdot dy \cdot 1000 \cdot 9.8}_{\text{Force}} \cdot \underbrace{(10-y)}_{\text{Distance}}
\end{aligned}$$

Therefore:

$$\boxed{W = \int_0^{10} 9.8 \cdot 1000 \cdot y^2 (10-y)\,dy}$$