MATH 116 - TEAM HOMEWORK 2
WINTER 2016

(1) O-guk learned a lot from his defeat in the 21st World Running Tournament. Now he wants to be the strongest in the world. After three years of hard work, he is participating in the 22nd World Strength Tournament. Again he qualifies for the final round and he is so happy about it. To win this time, he must lift a heavier object than his opponent who is able to lift over 9000 kilograms. During the final O-guk managed to just barely lift a solid object of density 1000 kg/m^3, whose base is an equilateral triangle with side length 4 meters and whose cross-sections are equilateral triangles perpendicular to one of the altitudes of the base. Did O-guk win the tournament?

(2) (a) Let f be a function with $f(0) = 0$. Let

$$\int_0^1 f(x)\,dx = A$$
$$\int_0^1 xf(x)\,dx = B$$
$$\int_0^1 f'(x)\,dx = C$$
$$\int_0^1 xf'(x)\,dx = D$$
$$\int_0^1 x^2 f'(x)\,dx = E$$

Find D, E in terms of A, B, C.

(b) Suppose that $g(5) = a$ and $\int_1^5 g'(x) \ln x\,dx = b$. Find

$$\int_0^2 \frac{g(2x+1)}{2x+1}\,dx$$

in terms of a, b.

(3) Compute the following integrals *by hand*.

(a)
$$\int e^{e^x+x}\,dx$$

(b)
$$\int e^x\left(\ln x + \frac{1}{x^2}\right)dx$$

(c)
$$\int_0^1 x^3\sin^2 x + (1-x)^3\cos^2(1-x)\,dx$$

(Hints: For (a), try substitution. As a first step for (b) and (c), think about writing them as more than one integral.)

(4) Maize and Blue Jewelry Company is trying to decide on a design for their signature Go Blue! Ring. There are two possible designs, type V, and type H. The company has done research and the two ring designs are equally pleasing to customers. The company wants to save money on cost of materials by producing the ring that has the smallest volume. The design for both rings starts with the function $S(x) = 1 - x^2$ where all units are in millimeters. Let R be the region enclosed by the graph of $S(x)$ and the graph of $-S(x)$. The type V ring is in the shape of the solid formed by rotating R around the line $x = 7$. The type H ring is in the shape of the solid formed by rotating R around the line $y = 7$. Find the volume of each ring and decide which ring the company should produce.