Sample Exam 2
Math 31, Spring 2010

1. (24 points) Compute the following. No explanation necessary, but show all your work. Please do not simplify any numerical answers.

(a) $\displaystyle\int \frac{e^{5x}}{\sqrt{1+7e^{5x}}}\,dx$

(b) $\displaystyle\int 3x\cos 2x\,dx$

(c) $\displaystyle\int_7^{11} \frac{x^3}{x^4-1}\,dx$

2. (14 points) Consider the solid obtained by rotating the region bounded by the curves

$$y = 4x - 2x^2, \qquad\qquad y = 2x - x^2,$$

about the y-axis.

(a) Sketch the region, the solid, and a typical cylindrical shell.

(b) Find the volume of the solid, using the method of cylindrical shells.

No explanation necessary, but show all your work, and please do not simplify your final numerical answer.

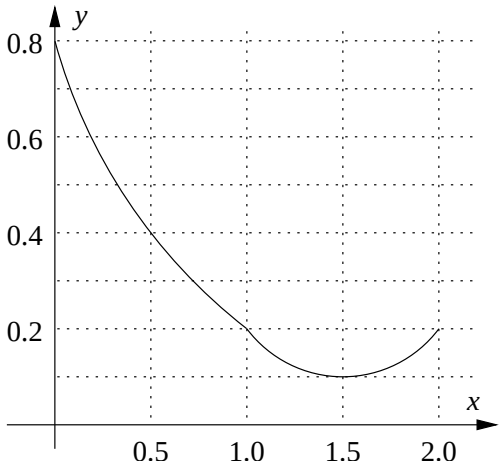
3. (15 points) Compute the following integral. **DO NOT SIMPLIFY** your final answer.

$$\int \frac{2x-7}{(x-1)(x-2)}\,dx$$

4. (15 points) Compute the following integral. **DO NOT SIMPLIFY** your final answer.

$$\int (\cos^6(7x))(\sin^5(7x))\,dx.$$

5. (14 points) Let $f(x)$ be a function with the following graph.

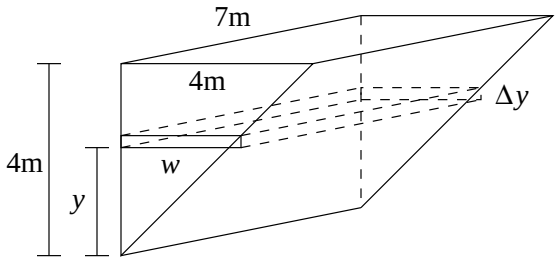


(a) Find the approximation T_4 (Trapezoidal Rule, 4 subintervals, $n = 4$) for $\int_0^2 f(x)\,dx$. No explanation necessary, but show all your work, and round off your final numerical answer to 3 decimal places (if necessary).

(b) Is your answer in part (a) greater than the actual value of $\int_0^2 f(x)\,dx$ or less than the actual value of $\int_0^2 f(x)\,dx$? Briefly **explain** your answer, using the graph of $f(x)$.

(c) Find the approximation S_4 (Simpson's Rule, 4 subintervals, $n = 4$) for $\int_0^2 f(x)\,dx$. No explanation necessary, but show all your work, and round off your final numerical answer to 3 decimal places (if necessary).

6. (18 points) A tank is filled with water, as shown below.



Recall that the density of water is 1000 kg/m^3, that the acceleration due to gravity at the earth's surface is 9.8 m/s^2, the metric unit of force is the newton (N = kg·m/s^2), and the metric unit of work is the joule (1 joule = 1 newton·1 meter).

(a) Find the width w of a rectangular "slice" of water in the tank at height y meters above the bottom of the tank, as indicated in the picture. (If this part doesn't make sense to you, go on the next parts.)

(b) Find the volume and the mass of a rectangular "slice" of water in the tank of thickness Δy at height y meters above the bottom of the tank, as indicated in the picture. (If this part doesn't make sense to you, go on to the last part.)

(c) Find the work required to pump the water out of an outlet at the top of the tank, as indicated. Do not simplify your final numerical answer, and clearly indicate your final answer, using the correct units.