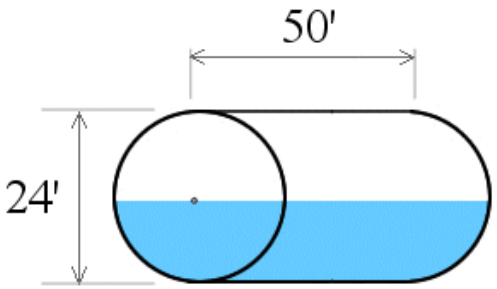
Math 1452-006 Exam II 23 March 2015
Make-up

Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Work carefully. Do your own work. **Show all relevant supporting steps!**

Part I. Do 2 of the following 3 problems. Set up integrals which solve the problems, but do NOT expend time computing the numerical values of these integrals

1. (12.5 pts) A tank at the Boston Aquarium is 45' tall and is filled with seawater (depth 42'). A spiral ramp goes around the aquarium (from bottom to top) so that visitors can see different levels/regions/habitats within the aquarium. There are multiple windows along the ramp which provide visual observation points for visitors, including a circular window with diameter 6' which is located about 1/3 of the way up the ramp. The bottom of this circular window is 12' above the bottom floor of the aquarium. Determine the amount of fluid force which is exerted against this circular window by the seawater within the aquarium.

2. (12.5 pts) A cylindrical holding tank for seawater is laying on its side. It is 50' long and 24' in diameter. It is half full and there is an hole in the center of the circular side of the tank out of which the seawater can be pumped. Determine how much work it will take to pump all of the seawater out of the holding tank through the hole at the center of the circular side.



3. (12.5 pts) Find the coordinates of the centroid of the bounded region in the first quadrant bounded between the curves $y = x^2 + x,\ y = 24 - 8x,\ y = 0$.

Part II. Do 8 of the following 9 problems

For each of the following problems find the value of the integral

4. (10 pts) $\int \frac{5e^{2x}}{\sqrt{1-e^{2x}}}\,dx$

5. (10 pts) $\int (2x+3)e^{-4x}\,dx$

6. (10 pts) $\int \tan^3 2x \sec^4 2x\,dx$

7. (10 pts) $\int \frac{\sqrt{4-x^2}}{x^4}\,dx$

8. (10 pts) $\int \frac{x^3+29x-2}{(x+1)^2(x-3)^2}\,dx$

9. (10 pts) $\int \frac{4x-40}{x^2(x^2+8x+20)}\,dx$

10. (10 pts) $\int x\ln(2x+1)\,dx$

11. (10 pts) $\int_0^{\pi/3} \sin^4(6x)\,dx$

12. (10 pts) $\int_3^6 \frac{3x}{(x-2)^{3/2}}\,dx$