Math 120 Practice Exam II

Part I. Multiple Choice

1. Which integral below represents the volume of the surface of revolution obtained be rotating the region bounded by the curves $y = x + \sqrt{x}$, $y = 0$ and $x = 4$ about the line $x = -2$, where the volume is calculated using the shell method.

(a) $2\pi \int_0^4 (x+2)(x+\sqrt{x})dx$ (b) $2\pi \int_0^6 (y+2)(y^2+y)dy$

(c) $2\pi \int_0^4 x(6-x-\sqrt{x})dx$ (d) $\pi \int_0^4 (64-(x+\sqrt{x})^2)dx$

(e) $2\pi \int_0^6 (y-2)(y^2+y)dy$

2. Find the arc length of the graph of the function $f(x) = \frac{1}{3}(x^2+2)^{3/2}$ on the interval $[0,1]$.

(a) 4/3 (b) $9\sqrt{3}/2$ (c) 1 (d) $\sqrt{3}$ (e) 3/4

3. Find the area of the surface of revolution obtained by revolving the region bounded by the curves $y = (1/3)x^3$, $y = 0$, and $x = 2$ about the x-axis.

(a) $\pi(2\sqrt{2}-1)/9$ (b) $4\pi\sqrt{2}/27$ (c) $\pi(2\sqrt{2}-1)/18$

(d) $5\pi/54$ (e) $2\pi/27$

4. A lunar module weighs 15 tons on the surface of the earth. Determine the work done in propelling the module to a height of 1000 miles above the earth. (Hint: Consider the radius of the earth equal to 4000 miles.)

(a) 12,000 mile-tons (b) 30,000 mile-tons (c) 60,000 mile-tons

(d) 15,000 mile-tons (e) 20,000 mile-tons

5. A rectangular tank with a base of 5 feet by 2 feet and a height of 4 feet is full of a liquid with weight density w pounds per cubic foot. How much work is done in pumping the water out of the tank and to a height of 6 feet above the top of the tank?

(a) 320w ft-lbs (b) 240w ft-lbs (c) 400w ft-lbs (d) 40w ft-lbs (e) 600w ft-lbs

6. Point masses are positioned in the plane with a mass of 8 kg at the point $(-1, -3)$, a mass of 6 kg at $(1, 2)$ and a mass of 10 kg at $(3, 5)$. What are the coordinates $(\bar{x}, \bar{y})$ of the center of mass of this system?

(a) $(7/6, 19/12)$ (b) $(7/12, 7/6)$ (c) $(7/6, 7/6)$

(d) $(19/12, 7/6)$ (e) $(28, 38)$

7. The verticle side of a submarine has a porthole which is shaped like a right triangle with height 2 feet and width of the bottom edge 1 foot. (See figure below.) Find the fluid force on the porthole if the top of the window is 4 feet below the surface. Assume that the weight density of seawater is w pounds per cubic foot.

The force is on the porthole is:

(a) $(16/3)w$ pounds (b) $(32/3)w$ pounds (c) $24w$ pounds

(d) $32w$ pounds (e) $(8/9)w$ pounds

8. A 10 foot chain is lying coiled on the ground and weighs 3 pounds per foot of length. In addition, at the end of the chain is a 100 pound weight. What is the work done by lifting the end of the chain that is not attached to the weight to a height of 30 feet?

(a) 2750 ft-lbs (b) 1350 ft-lbs (c) 3900 ft-lbs (d) 2500 ft-lbs (e) 2150 ft-lbs

9. Find

$$\int \frac{2}{3e^x - 2} dx.$$

(a) $\ln|3e^x - 2| - x + C$ (b) $\ln|3e^x - 2| + C$

(c) $\frac{1}{3}(\ln|3e^x - 2| - x) + C$ (d) $3e^x(3e^x - 2)^{-2} + C$

(e) $e^x(3e^x - 2)^{-1} - x + C$

10. Find

$$\int \frac{1}{1 - \sin x} dx.$$

(a) $2\sec x + \tan x + C$ (b) $\cot x - \csc x) + C$ (c) $\sec x - \cos x + C$

(d) $\cos x/(1 + \sin x)^2 + C$ (e) $\tan x - \sin x + C$

11. Find

$$\int_0^1 xe^{-2x} dx.$$

(a) $\frac{1}{4}(1 - 3e^{-2})$ (b) $\frac{1}{2}(1 + 3e^{-2})$ (c) $-e^{-2} - 1$ (d) $-\frac{1}{2}e^{-2}$

(e) $-\frac{1}{4}(1 + e^{-2})$

12. Find

$$\int x^2 \ln x dx.$$

(a) $\frac{x^3}{3}(\ln x - \frac{1}{3}) + C$ (b) $x^3(\ln x - \frac{1}{3}) + C$ (c) $\frac{x^3}{3} \ln x + C$

(d) $2x \ln x + x + C$ (e) $\frac{x^3}{3} \ln x - \frac{x^2}{6} + C$

Part II. Partial Credit Problems

13. Use the shell method to find the volume of the solid generated by revolving the plane region bounded by the curves $y = \sqrt{x}$, $y = 0$, and $x = 4$ about the y-axis.

14. Find the area of the surface of revolution obtained by revolving the the region bounded by the curves $y = \sqrt{9 - x^2}$, $x = -2$, $x = 1$ and $y = 0$ about the y-axis.

15. Find the coordinates $(\bar{x}, \bar{y})$ of the center of mass for the lamina of uniform density ρ bounded by the graphs of the equations $y = x^2$ and $y = x^3$.

16. Evaluate the integral:

$$\int \frac{1}{x(\ln x)^3} dx.$$