



**Part I. MULTIPLE CHOICE, NO PARTIAL CREDIT, NO CALCULATORS**  
(5 points each)

1. What is the average value of  $e^{2x}$  over  $[0, 1]$ ?
  - a.)  $e^2 - 1$
  - b.)  $\frac{1}{2}(e^2 - 1)$
  - c.)  $2e^2 - 2$
  - d.)  $e - 1$
  - e.) 1
  
2. Determine the area of the region enclosed by the functions  $f(y) = 8 - y^2$  and  $g(y) = 2y + 5$ .
  - a.)  $16/3$
  - b.)  $22/3$
  - c.) 12
  - d.) 30
  - e.)  $32/3$
  
3. A solid S has a base which is a circular disk of radius  $r$ . Parallel cross sections perpendicular to the base are squares. Find the volume of the solid.
  - a.)  $\frac{16}{3}r^3$
  - b.)  $\frac{8}{3}r^3$
  - c.)  $\frac{4}{3}r^3$
  - d.)  $\frac{2}{3}r^3$
  - e.)  $\frac{3}{2}r^3$

4. Find the volume of the solid of revolution obtained by rotating about the  $y$ -axis the region bounded by the curves  $y = \frac{1}{\sqrt{x}}$ ,  $y = 0$ ,  $x = 1$ ,  $x = 4$ .

a.)  $\frac{\sqrt{8}\pi}{3}$

b.)  $\frac{7\pi}{3}$

c.)  $\frac{28\pi}{3}$

d.)  $\frac{4\pi}{3}$

e.)  $\frac{\sqrt{3}\pi}{4}$

5. Set up, but do not evaluate, a definite integral to find the volume of the solid generated by rotating the region bounded by the curves  $y = \cos x$ ,  $y = -1$ ,  $x = 0$ ,  $x = 2\pi$  about the line  $x = -1$ .

a.)  $2\pi \int_0^{2\pi} x(\cos x + 1) dx$

b.)  $2\pi \int_0^{2\pi} (x - 1)(\cos x + 1) dx$

c.)  $2\pi \int_0^{2\pi} x(\cos x - 1) dx$

d.)  $2\pi \int_0^{2\pi} (x + 1)(\cos x + 1) dx$

e.)  $2\pi \int_0^{2\pi} (x + 1)(\cos x - 1) dx$

6. The work required to stretch a spring 2 feet beyond its natural length is 12 foot-pounds. How much work is needed, in foot-pounds, to stretch the spring from its natural length to 3 feet beyond its natural length?

a.) 54

b.) 13.5

c.) 18

d.) 9

e.) 27

7. Compute the definite integral  $\int_{-1}^1 x \sin(\pi x) dx$ .

a.)  $\frac{2}{\pi}$

b.)  $\frac{1}{\pi}$

c.)  $\frac{2}{\pi} + \frac{2}{\pi^2}$

d.) 0

e.) 2

8. The partial fraction decomposition of  $\frac{3x^2 + 2x + 1}{x(x^2 - 1)}$  contains a term of the form  $\frac{A}{x - 1}$ . Find the value of  $A$ .

a.) 0

b.) 1

c.) 2

d.) 3

e.) 4

9. Evaluate the integral  $\int_0^{\pi/4} \sin^2(x) \cos^2(x) dx$ .

a.)  $\frac{\pi}{32} - \frac{1}{32}$

b.)  $\frac{\pi}{32}$

c.)  $\frac{\pi}{32} + \frac{2}{32}$

d.)  $\frac{\pi}{32} - \frac{2}{32}$

e.) 0

**Part II:** Show all work. Clearly indicate your final answer.

10. Consider the region  $R$  bounded by  $f(x) = x^2 + 1$ ,  $g(x) = 3 - x^2$ ,  $x = 0$  and  $x = 2$ .

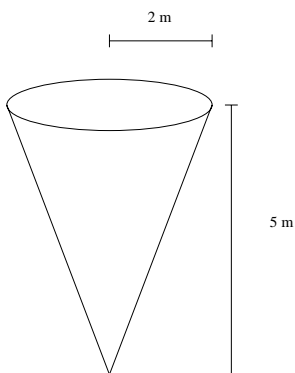
(a) (5 pts) Sketch the region  $R$  that represents the enclosed area. Label coordinates of all intersection point(s).

(b) (5 pts) Find the enclosed area.

11. (9 pts) Find the indefinite integral  $\int \frac{x^2 + 7x - 2}{x^3 + x^2 - 2x} dx$ .

12. (10 pts) The region bounded by  $y = \ln x$ ,  $x = 0$ ,  $y = 0$ ,  $y = 1$  is rotated about the  $y$ -axis. Find the volume of the solid of revolution formed.

13. (8 pts) A tank has the shape of an inverted circular cone with height  $5m$  and base radius  $2m$ . The tank is initially full of water. Find an integral that gives the work required to lower the height of the water level to  $2m$  by pumping the water to the top of the tank. Do not evaluate the integral! The density of water is  $\rho = 1000 \text{ kg/m}^3$  and the acceleration due to gravity is  $g = 9.8 \text{ m/s}^2$ .



14. Compute the following integrals.

a.) (9 pts)  $\int \tan^{-1}(x) dx$

b.) (9 pts)  $\int \frac{1}{\sqrt{x^2 + 4}} dx$