

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

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

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

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

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

b.) 2

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

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

e.) 0

4. Determine the area of the region enclosed by the functions $f(y) = 8 - y^2$ and $g(y) = 2y + 5$.
- a.) $22/3$
 - b.) $32/3$
 - c.) $16/3$
 - d.) 12
 - e.) 30
5. 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.) 3
 - b.) 2
 - c.) 0
 - d.) 4
 - e.) 1
6. 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.) $\frac{7\pi}{3}$
 - b.) $\frac{\sqrt{3}\pi}{4}$
 - c.) $\frac{\sqrt{8}\pi}{3}$
 - d.) $\frac{28\pi}{3}$
 - e.) $\frac{4\pi}{3}$

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

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

b.) 0

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

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

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

8. 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.) $\frac{8}{3}r^3$

b.) $\frac{3}{2}r^3$

c.) $\frac{16}{3}r^3$

d.) $\frac{4}{3}r^3$

e.) $\frac{2}{3}r^3$

9. 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.) 13.5

b.) 27

c.) 54

d.) 18

e.) 9

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 $x = 2$.

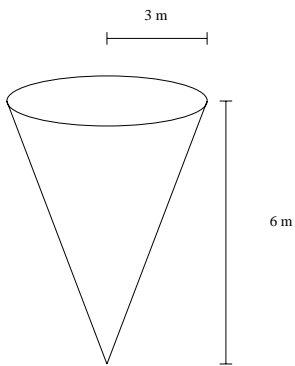
(a) (5 pts) Sketch the region R that represents the enclosed area. Label coordinates of all intersection point(s).

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

11. (9 pts) Find the indefinite integral $\int \frac{x^2 + 8x - 9}{x^3 - 2x^2 - 3x} dx$.

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 $6m$ and base radius $3m$. The tank is initially full of water. Find an integral that gives the work required to lower the height of the water level to $1m$ 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) $\int \frac{1}{\sqrt{x^2+9}} dx$