

Practice Problems for Final Exam

1. Evaluate each of the following integrals.

(a) $\int e^{2x} \sinh x \, dx$

(c) $\int_3^{3\sqrt{2}} \frac{\sqrt{x^2-9}}{x^3} \, dx$

(b) $\int \frac{\tan^5(\ln x) \sec^7(\ln x)}{x} \, dx$

(d) $\int \frac{10}{(x-1)(x^2+9)} \, dx$

2. Use Simpson's Rule with $n = 4$ to approximate the area of the surface obtained by rotating the curve $y = 1/x$, $1 \leq x \leq 5$ around the x -axis. Leave your answer as a product/sum of terms.

3. Give parametric equations to describe the motion of a particle that moves in the xy -plane along the circle with center $(4, -5)$ and radius 6 beginning at $(-2, -5)$, traveling 1.5 times around the circle clockwise, and ending at $(10, -5)$.

4. Let C be the curve given parametrically by

$$x = t^3, \quad y = \frac{3t^2}{2}, \quad 0 \leq t \leq \sqrt{3}$$

(a) Find the arclength of the curve C .

(b) Give an equation for the line tangent to C at $(1/8, 3/8)$.

5. An oil truck carries oil with a density of 55 lbs/ft³ in a horizontal cylindrical tank with a 10 ft diameter. Setup *but do not evaluate* a definite integral equal to the hydrostatic force exerted by the oil on one end of the tank when the tank is full.

6. Sketch and find the area of the region that lies inside both of the following polar curves.

$$r = 4 \sin \theta, \quad r = 2$$

7. Determine whether each of the following is convergent or divergent. If it is convergent, find its sum. If it is divergent, explain why.

(a) $\sum_{n=1}^{\infty} (-1)^n \frac{3^{n+2}}{2^{2n}}$

(b) $\sum_{n=1}^{\infty} \ln \frac{n}{n+1}$

8. Determine whether each of the following is convergent or divergent and explain why.

(a) $\int_1^{\infty} \frac{1+x}{x^2 - e^{-x}} \, dx$

(b) $\sum_{n=1}^{\infty} (-1)^n \left(\frac{1}{n^2}\right)^{1/\sqrt{n}}$

9. Consider the power series $\sum_{n=0}^{\infty} \frac{2^n}{\sqrt{n+3}} (x-3)^n$.

(a) Find the radius of convergence.

(b) Find the interval of convergence.