

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) lecture section (4) your instructor's name, and (5) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, and calculators are NOT permitted. A one-page crib sheet is allowed. SHOW ALL WORK!

1. (30 points) Consider the region R bounded above by the equation $y = \sqrt{2x+2}$, below by the x -axis, on the right by the line $x = 2$, and on the left by the y -axis.

- (a) Find the area of region R.
 (b) Find the volume of the solid formed by revolving region R about the line $x = 4$.

2. (15 points) Find the area enclosed by $r = 1 + \cos \theta$.

3. (10 points) Find the center, foci, vertices and eccentricity of the ellipse $4x^2 + y^2 - 8x - 4y + 4 = 0$.

4. (15 points) Find the length of the curve described by $x(t) = t^3$, $y(t) = \frac{3t^2}{2}$, for $0 \leq t \leq \sqrt{3}$.

5. (30 points) Evaluate the following integrals.

(a) $\int e^{-x} \cos(x) dx$ (b) $\int \frac{x+1}{x^2(x-1)} dx$ (c) $\int \frac{dx}{x^2\sqrt{x^2+1}}$

6. (20 points) Determine whether the integrals converge or diverge.

(a) $\int_1^\infty \frac{\sqrt{x}+5}{x^2-2} dx$ (b) $\int_0^1 \ln x dx$

Hint: you'll need L'Hopital's rule.

7. (20 points) Determine whether the series converge conditionally, absolutely, or diverge.

(a) $\sum_{n=1}^\infty \frac{(-1)^{n+1}}{\sqrt{n^2+5}}$ (b) $\sum_{n=1}^\infty \frac{7(\ln n)^2}{n^5}$

8. (10 points) Find the sum of the series $\sum_{n=1}^\infty \frac{(-1)^{n-1} 4^{n+1}}{5^n}$.

9. (20 points) For what values of x do the series converge absolutely, converge conditionally, diverge?

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

10. (30 points) Let $f(x) = \tan(x)$

- (a) Find the 2nd-order Taylor polynomial $P_2(x)$, built around the point $a = \pi/4$.
 (b) Use $P_2(x)$ to approximate $\tan(\pi/3)$. Leave your answers in terms of π .
 (c) Give an upper bound for the error of the approximation in part (b). Leave your answer in terms of π .