

INSTRUCTIONS: Books, notes, and electronic devices are not permitted. On the front of your bluebook write: (1) **your name**, (2) **instructor's name**, and (3) **"TEST 2/FALL 2009"**. Make a **scoring table** with room for 5 problems and a total score. **Work all problems. Start each problem on a new page. Clearly mark your answers.** A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. **SHOW ALL WORK.**

1. (15 pts) Find the volume of the solid generated by rotating the region in the first quadrant bounded by $y = \sin(x)$, $0 \leq x \leq \pi$ about the line $x = 0$ using the Shell Method.
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2. (16 pts) Solve the differential equation (you may leave your answer in implicit form):

$$(x^2 + x) \frac{dy}{dx} = (y - 9)^2$$

3. (20 pts) Find the anti-derivative of $y = \frac{4x^2}{(1 - x^2)^{3/2}}$
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4. (28 pts) Determine if the following converge or diverge (Justify your answers, show all work):

(a) $a_n = \frac{1 + n(-1)^n}{n!}$ (b) $\left\{ \sqrt[n]{\ln n} \right\}_{n=10}^{\infty}$ (c) $\sum_{n=21}^{\infty} \frac{1}{n(\ln(n))^3}$ (d) $\int_{88}^{\infty} \frac{e^{-t}}{\sqrt{t}} dt$

5. (21 pts) Determine if the series converge or diverge **also** find the sum of the series when possible. Justify your answers. (Note: $e \approx 2.718$)

(a) $\sum_{k=1}^{\infty} \left[\tan^{-1}(k-1) - \tan^{-1}(k) \right]$ (b) $\sum_{n=0}^{\infty} \left[(\ln 2)^n + \frac{1}{(\ln 4)^n} \right]$ (c) $\sum_{j=21}^{\infty} \frac{j}{2j+1}$

THERE ARE SOME USEFUL FORMULAS ON THE OTHER SIDE!