

Name: \_\_\_\_\_

4-digit code: \_\_\_\_\_

- Write your name and the last 4 digits of your SSN in the space provided above.
- The test has eight (8) pages, including this one, and the scratch paper in page 8.
- Enter your answers in the boxes provided.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, notes or calculators may be used on this test.

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Page	Max. points	Your points
2	20	
3	15	
4	20	
5	20	
6	15	
7	10	
<b>Total</b>	100	

**Problem 1** (5 pts). Evaluate the integral  $\int t^2 e^t dt$ .

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**Problem 2** (5 pts). Evaluate the integral  $\int (x-3)\sqrt{x^2-6x+5} dx$ .

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**Problem 3** (5 pts). Evaluate the integral  $\int \frac{1}{x^3 e^{1/x}} dx$ .

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**Problem 4** (5 pts). Evaluate the integral  $\int \frac{x^3+1}{(x+1)^2(x^2+4)} dx$ .

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**Problem 5** (5 pts). Evaluate the following integral, or indicate if it is divergent:  $\int_0^\infty \frac{x \tan^{-1} x}{(1+x^2)^{3/2}} dx$ .

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**Problem 6** (5 pts). Find the volume of the solid obtained by rotating the region bounded by  $y = x^2$  and  $y = 2 - x$  around the line  $x = 1$ .

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**Problem 7** (5 pts). Find the volume of the solid obtained by rotating the region bounded by  $y = e^{-x}$ ,  $y = 1/e$ , and  $x = 0$  around the line  $y = 0$ .

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**Problem 8** (5 pts). Find the general term of the sequence  $\left\{3, 2, \frac{5}{3}, \frac{3}{2}, \frac{7}{5}, \frac{4}{3}, \dots\right\}$ , and compute its limit.

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**Problem 9** (5 pts—all or nothing). Compute the limit of the sequence  $\left\{\frac{n^2 + 5n + 2}{\sqrt{n^4 + 1}}\right\}_{n=1}^{\infty}$

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**Problem 10** (5 pts—all or nothing). Compute the limit of the sequence  $\{\tan(\pi - 1/n)\}_{n=1}^{\infty}$

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**Problem 11** (5 pts—all or nothing). Compute  $\lim_{n \rightarrow \infty} \left(1 - \frac{2}{n}\right)^n$

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**Problem 12** (8 pts). Study the convergence of the series  $\sum_{n=2}^{\infty} \frac{3^n + 4^n}{5^n}$ . If convergent, evaluate the sum.

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**Problem 13** (5 pts). Classify the series  $\sum_{n=1}^{\infty} \frac{\cos(\pi n)}{n^{2/3}}$  as absolutely convergent, conditionally convergent, or divergent.

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**Problem 14** (7 pts). Classify the series  $\sum_{n=1}^{\infty} \frac{(-1)^n n}{e^n}$  as absolutely convergent, conditionally convergent, or divergent.

**Problem 15** (8 pts). Find the interval of convergence of the series  $\sum_{n=0}^{\infty} \frac{(-3)^n x^n}{\sqrt{n+1}}$ .

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**Problem 16** (7 pts). Express the function  $f(x) = \frac{2x}{x^3 + 8}$  as a power series.

**Problem 17** (10 pts). Express the function  $f(x) = \frac{1}{\sqrt{2x - x^2}}$  as a Taylor series expanded about  $a = 1$ . [Hint: complete the square first, and then use the Taylor expression for  $(1 + x)^r$ .]



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Scratch paper

Scratch paper