Name: _____

VIP ID: _____

- Write your name and your VIP ID in the space provided above.

- The test has eight (8) pages, including this one, and one scratch paper (page 8).

- It also has a formula sheet attached. **You may detach this formula sheet only when prompted to do so. Failure to comply will result in losing the privilege to use it.**

- 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, or notes may be used on this test.

- Calculators without a Computer Algebra System (CAS) are allowed.

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

Problem 1 (5 pts). Evaluate the integral $\int xe^x \, dx$.

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

Problem 3 (5 pts). Evaluate the integral $\int \sin^2 x \cos^3 x \, dx$.

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

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

Problem 6 (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 $y = 0$.

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

$$\boxed{}$$

$$\boxed{}$$

Problem 8 (5 pts—all or nothing). Compute the limit of the sequence $\left\{\dfrac{n^2 + 5n + 2}{n^2 + 2n}\right\}_{n=1}^{\infty}$

$$\boxed{}$$

Problem 9 (5 pts). Find a power series representation of the function $f(x) = x^2 \cos(2x)$

$$\boxed{}$$

Problem 10 (10 pts). Study the convergence of the series $\displaystyle\sum_{n=2}^{\infty} \frac{3^n + 4^n}{5^n}$. If convergent, evaluate the sum.

Problem 11 (10 pts). Classify the series $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n n}{e^n}$ as absolutely convergent, conditionally convergent, or divergent.

Problem 12 (10 pts). Find the interval of convergence of the power series $\displaystyle\sum_{n=0}^{\infty} \frac{(-3)^n x^n}{\sqrt{n+1}}$.

Problem 13 (10 pts). Express the function $f(x) = \dfrac{2x}{x^3 + 8}$ as a power series.

Problem 14 (5 pts)**.** Consider the curve with polar equation $r = 2\cos\theta - 2\sin\theta$.

(a) Find a cartesian equation for this curve.

(b) Sketch its graph. Make sure that the sketch carries all relevant information.

Problem 15 (5 pts)**.** Compute the length of the cardioid $r = 1 + \cos\theta$.

Problem 16 (5 pts)**.** Find the area enclosed by one loop of the four-leaved rose $r = \cos 2\theta$.

Scratch paper