NAME: ____________________ INSTRUCTOR: ____________________

**Instructions:** Write clearly. **You must show all work to receive credit.**

Missed: pg1 ______ pg2 ______ pg3 ______ pg4 ______ pg5 ______ pg6 ______ pg7 ______

. pg8 ______ pg9 ______ pg10 ______ pg11 ______ pg12 ______ Total Score ______/300

1. (10 points) Set up the partial fraction decomposition of the following rational function. Do not solve for the coefficients.

$$\frac{5x^2 - 6x + 2008}{(x-1)(5x+3)^2(x^2+4)(x^2+x+1)^2}$$

2. (10 points each) Evaluate the following definite integrals.

   (a) $\displaystyle\int_0^{\pi/2} x^2 \sin(x)\, dx$

(b) $\displaystyle\int_0^3 \frac{5x}{(x^2-1)^{2/3}}\,dx$

3. (10 points each) Compute the following indefinite integrals.

(a) $\displaystyle\int \frac{1}{x^2+2x+2}\,dx$

(b) $\displaystyle\int \frac{x^2}{(1-x^2)^{3/2}}\,dx$

4. (15 points) Compute the arc length of the curve $f(x) = \frac{1}{4}x^2 - \frac{1}{2}\ln(x)$ on the interval $1 \leq x \leq 5$.

5. (5 points each) Complete the following **definitions**:

   (a) The improper integral $\int_a^\infty f(x)\,dx$ is **convergent** if

   (b) The improper integral $\int_a^\infty f(x)\,dx$ is **divergent** if

6. (10 points) Set up, but do not evaluate, an integral to compute the surface area of the solid of revolution generated by revolving the curve $f(x) = \cos(x)$, $0 \le x \le \pi/2$, about the $y$-axis.

7. (5 points each) Find polar coordinates $(r, \theta)$ for the point with Cartesian coordinates $(x, y) = (4, -4)$ such that

   (a) $r > 0$:

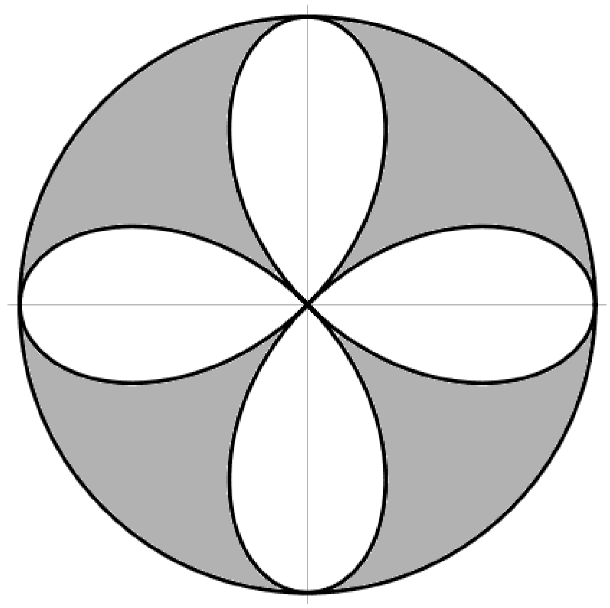
   (b) $r < 0$:

8. Consider the parametric curve defined by the equations $x(t) = \cos^3(t)$, $y(t) = \sin^3(t)$, $0 \le t \le \pi/2$.

   (a) (15 points) Write the equation of the tangent line to the curve at the point where $t = \pi/4$.

   (b) (15 points) Compute the length of the parametric curve.

9. (15 points) Find the area of the shaded region below, inside the polar curve $r = 2$ and outside the polar curve $r = 2\cos(2\theta)$.



10. (15 points each) Evaluate the following double integrals.

(a) $\iint_D xe^y \, dA$ where $D$ is the region bounded by the curves $y = 4 - x$, $y = 0$, and $x = 0$.

(b) $\int_0^1 \int_0^{\ln(3)} xye^{xy^2} \, dx \, dy$

11. (10 points each) Compute the sums of the following infinite series.

(a) $\sum_{n=2}^{\infty} e^{3-2n}$

(b) $\sum_{n=0}^{\infty} \frac{(-1)^n \pi^{2n+1}}{6^{2n+1}(2n+1)!}$

12. (10 points) The letter $k$ is an arbitrary real number that has been fixed ahead of time. Show that the infinite series $\sum_{n=1}^{\infty} n^k 3^{-n}$ converges no matter what value of $k$ has been chosen.

13. (10 points) Determine whether the following infinite series are convergent, or divergent. State which test(s) you use to reach your conclusion. Show all work.

(a) $\displaystyle\sum_{n=2}^{\infty} \frac{n^3}{\sqrt{n^4 - 2n^2 + 1}}$

(b) $\displaystyle\sum_{n=1}^{\infty} \frac{\arctan(n)}{n^2}$

14. (5 points each) Complete the following **definitions**.

(a) The infinite series $\sum_{n=1}^{\infty} a_n$ is **convergent** if

(b) The infinite series $\sum_{n=1}^{\infty} a_n$ is **divergent** if

(c) The infinite series $\sum_{n=1}^{\infty} a_n$ is **absolutely convergent** if

(d) The infinite series $\sum_{n=1}^{\infty} a_n$ is **conditionally convergent** if

15. (15 points) Determine whether the following series is conditionally convergent, absolutely convergent, or divergent. State which test(s) you use to reach your conclusion. Show all work.

$$\sum_{n=241}^{\infty} \frac{(-1)^{n+1}}{n\ln(n)}$$

16. (10 points) Find the interval and radius of convergence of the following power series:

$$\sum_{n=12}^{\infty} e^n(x-2)^n$$

17. (10 points each) Find Taylor series centered at $a = 0$ for the following functions. Simplify your answer. State the radius of convergence.

(a) $f(x) = \dfrac{x}{4 - 2x^3}$

(b) $f(x) = (1 + 2x)^{-2}$

18. (15 points) Find the degree three Taylor polynomial $T_3(x)$ at $a = 4$ for $f(x) = \sqrt{x}$.

19. Write out and sign the Honor Pledge.