Name: ______________________________________

1. Set up but **do not evaluate** an integral that represents the length of the curve $x = 1 + 3t^2$, $y = 4 + 2t^3$, $0 \le t \le 1$.

10 pts

2. Find the EXACT slope of the tangent line to the polar curve $r = 2 - \sin\theta$ at the point $\theta = \pi/3$. (Do not give a decimal approximation.)

10 pts

(OVER)

3. Set up but **do not evaluate** an integral that represents the area of the region enclosed by one loop of the curve $r = 3\cos 6\theta$.

10 pts

4. Determine whether the sequence converges or diverges. If it converges, find the limit: (a) $\{1, -1, 1, -1, 1, -1, \ldots\}$, (b) $\{n^2 e^{-n}\}$. Put boxes around your answers.

10 pts

5. Consider the series $\sum_{n=0}^{\infty} \left(\frac{1}{2}\right)^n$. (a) Write out the first five terms of the series. (b) Find the sum of the infinite series if possible, or determine that it diverges.

10 pts

6. Test the series for convergence or divergence: $\sum_{n=1}^{\infty} \left(\frac{3n}{1+8n} \right)^n$.

10 pts

7. Consider the convergent series $\sum_{n=1}^{\infty} \frac{1}{n^2}$.

10 pts

(a) One can use the third partial sum s_3 to estimate the sum s of the series. Calculate s_3.

(b) Because $f(x) = 1/x^2$ is a positive continuous decreasing function, and $f(n) = 1/n^2$, the remainder R_3 (namely, $s - s_3$) of the convergent series satisfies the inequality

$$\int_4^{\infty} \frac{1}{x^2}\, dx < R_3 < \int_3^{\infty} \frac{1}{x^2}\, dx. \qquad (1)$$

If you evaluate the integrals in (1), you find

$$1/4 < R_3 < 1/3.$$

Use this information to improve the estimate of s.

8. Test the series for convergence or divergence: $\sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{n \ln n}$.

10 pts

9. Test the series for convergence or divergence: $\sum_{n=1}^{\infty} \frac{3^n n^2}{n!}$.

10 pts

10. Test the series for convergence or divergence: $\sum_{n=1}^{\infty} \frac{n+2}{(n+1)^3}$.

10 pts