• The presence of calculators, cell phones, iPods and other electronic devices at this exam is strictly forbidden. IF YOU HAVE YOUR PHONE WITH YOU, YOU MUST TURN IT IN TO A PROCTOR BEFORE STARTING THE EXAM. FAILURE TO DO SO WILL BE TREATED AS AN ACADEMIC HONESTY VIOLATION.

• Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.

• Put your answers in the space provided at the bottom of each page or half page.

• You are responsible for checking that this exam has all 11 pages.
1. (20 points) Consider the curve

\[ f(x) = \frac{x^4}{16} + \frac{1}{2x^2}. \]

(a) Calculate the arc length function \( s(t) \) starting at \( x = 1 \), that computes the length of the curve from \((1, f(1))\) to \((t, f(t))\).

**ANSWER:**
(b) Calculate the arc length from $x = 2$ to $x = 4$. 

ANSWER:
2. (20 points)

(a) Find the area of the surface of revolution obtained by rotating the curve \( y = x^2 \), for \( 0 \leq x \leq 2 \), about the \( y \)-axis.

ANSWER:
(b) Find the area of the surface of revolution obtained by rotating the curve \( x = 1 + |y| \), for 
\(-1 \leq y \leq 1\), about the \( y \)-axis.
3. (20 points) Determine whether the following series converge or diverge. Justify your answers, making sure to name the convergence test(s) that you are using.

(a) \[ \sum_{n=1}^{\infty} \frac{3^n + 1}{2^n - 1} = 4 + \frac{10}{3} + \frac{28}{7} + \frac{82}{15} + \cdots \]
(b) 

\[ \sum_{n=2}^{\infty} \frac{1}{n \ln(n)^3} = \frac{1}{2 \ln(2)^3} + \frac{1}{3 \ln(3)^3} + \frac{1}{4 \ln(4)^3} + \cdots \]
4. (20 points)

(a) Find the area of one petal of the polar rose $r = 2\cos(4\theta)$ pictured below.
(b) The parametric curve given by \( x = 4t^3 - 3t, \ y = t^2 + 1 \) intersects the \( y \)-axis at 3 different values of \( t \). What are the equations of the tangent lines to the curve at each of these points?

**ANSWER:**
5. (20 points) Find the sum of each of the following series.

(a) \[
\sum_{n=2}^{\infty} \frac{2}{n^2 - 1} = \frac{2}{3} + \frac{2}{8} + \frac{2}{15} + \frac{2}{24} + \frac{2}{35} + \cdots
\]

**Hint:** Use partial fractions.

**Answer:**
(b) 
\[ \sum_{n=0}^{\infty} \left( \frac{1}{6 + (-1)^n} \right)^n = 1 + \frac{1}{5} + \frac{1}{7^2} + \frac{1}{5^3} + \frac{1}{7^4} + \cdots \]

**Hint:** Consider the evenly and oddly indexed terms separately.

**Answer:**