1. (12 points) Is the series \( \sum_{n=1}^{\infty} \frac{1}{2n^2 - \sqrt{n}} \) absolutely convergent, conditionally convergent, or divergent?

2. (14 points) Describe how one can compute \( \sum_{n=1}^{\infty} \frac{1}{n^3} \) to within 0.00005. (You do not need to actually carry out the computation, but if your answer involves, say, the \(n^{th}\) partial sum, then you should say what \(n\) is.)

3. (12 points) Is the series \( \sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2} \) absolutely convergent, conditionally convergent, or divergent?

4. (12 points) Is the series \( \sum_{n=1}^{\infty} a_n \), where \( a_n = \begin{cases} \frac{1}{n + \sqrt{n}}, & \text{if } n \text{ is odd, or} \\ -\frac{1}{n}, & \text{if } n \text{ is even} \end{cases} \) absolutely convergent, conditionally convergent, or divergent? Explain. [Fewer than 10% of the students even got so far as to approach the main difficulty of this problem.]

5. (18 points) (a) Find the Taylor polynomial, \( T_3(x) \), for \( f(x) = xe^x \) (centered about \( a = 0 \)).
   (b) Use Taylor’s Inequality to find an upper bound for the error in using your answer to (a) to compute \( f(1) \).

6. (20 points) (a) Show that the series \( \sum_{n=0}^{\infty} \frac{x^{2n+1}}{1 \cdot 3 \cdot 5 \cdots (2n+1)} \) is a solution of the differential equation \( y' = 1 + xy \).
   (b) Over what interval is it a solution?

7. (12 points) Find the curve through the point \((1, 1)\) that is everywhere orthogonal to the family of curves \( y = Cx^3 \).