1. Compute $\sum_{n=1}^{\infty} 3^{(-2n)}$

2. $\sum_{n=1}^{\infty} \frac{n}{\sqrt{n^3 + n^2 + 1}}$ (Apply **limit comparison test** or **comparison test**.)

3. $\sum_{n=1}^{\infty} n^2 \cdot e^{-n}$ Apply **integral test**. (Integration by parts, or tables.)

4. $\sum_{n=1}^{\infty} n! \cdot e^{-n}$ Apply **ratio test**.

5. Classify as **divergent, conditionally convergent** or **absolutely convergent**.
Explanation required.

(a) $\frac{1}{2\sqrt{2}} - \frac{1}{3\sqrt{3}} + \frac{1}{4\sqrt{4}} - \frac{1}{5\sqrt{5}} + \ldots\ldots$

(b) $\sum_{n=1}^{\infty} \frac{(-1)^n n\sqrt{n}}{n^2 + n}$

6. Compute by using power series. $\lim_{x \to 0} \frac{1 - \exp(x^2)}{x^2}$

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7. Find the first four non-zero terms of the Maclaurin series for the following functions.
(Assume removable discontinuities have been removed.)

(a) $$\frac{x^2 - \tan^{-1}(x^2)}{x^4}$$

(b) $(1 - 2x)^{\frac{5}{2}}$

(c) $\sin(e^x - 1)$

8. Suppose a function f has derivatives of all orders, and that
$f(0) = 2$, $f'(0) = 3$, $f''(0) = -4$, $f'''(0) = 0$, $f^{(4)}(0) = 6$, and

$\left|f^{(5)}(x)\right| \le 15$ if $|x| < \frac{1}{2}$.

(a) Find the **4th Maclaurin polynomial**.

(b) Find an **upper bound** on the absolute value of the error in using the 4th Maclaurin polynomial for $f(x)$, $|x| < \frac{1}{2}$.

9. Classify as **divergent, conditionally convergent** or **absolutely convergent**.
Explanation required.

(a) $$\frac{1}{\sqrt{2}} - \frac{1}{4} + \frac{1}{\sqrt{3}} - \frac{1}{8} + \frac{1}{\sqrt{4}} - \frac{1}{16} + \frac{1}{\sqrt{5}} - \frac{1}{32} + \cdots\cdots$$

(b) $$\sum_{n=1}^{\infty} \frac{(-1)^n \sqrt{n}}{n^2 + 1}$$

10. **Estimate** $\int_0^{0.1} \ln(1 + x)\,dx$ accurate to **three decimal places** by using Maclaurin series. What test justifies this accuracy?

(100 points total.)