1. Determine and state whether each given series is absolutely convergent, conditionally convergent, or divergent. Simply state your conclusion - no other work should be shown. (You may want to do some work on your scratch paper to help you decide your answer.) (3 points each)

\[
\sum_{k=1}^{\infty} \frac{(-1)^k}{k^3} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{(-1)^{1+k} 10^{2-k}}{3^{1-k}} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{\sqrt{k}} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{(-1)^k k^k}{k!} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{\sin(\pi k)}{k} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{\cos(\pi k)}{k} \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \left[ (-1)^k \left( \frac{k}{k+1} \right) \right]^k \quad \text{is} \quad \text{______________________________}.
\]

\[
\sum_{k=1}^{\infty} \frac{(-1)^{k+1} \sqrt[4]{k}}{\sqrt[4]{k}} \quad \text{is} \quad \text{______________________________}.
\]
2. Perform an absolute ratio test on the series \( \sum_{k=1}^{\infty} \frac{(-2)^k \cdot k!}{k^k} \) and state an appropriate conclusion.

Make sure that you present your work in a manner consistent with that exemplified during lecture. (12 points)
3. Several derivative values (at $-3$) are shown in Table 1 for an unknown function we shall refer to as $f$. Determine the Taylor Series (centered at $-3$) for $f$. Make sure that you show enough work to fully support your formula. **If you do not remember Taylor’s Formula you can “buy it” from me for a couple of points.** (12 points)

Please note that if your final answer does not begin with a series symbol then you are not answering this question correctly.

**Table 1:** Derivative values for $f$

<table>
<thead>
<tr>
<th>$k$</th>
<th>$f^{(k)}(-3)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$-\frac{1}{2}$</td>
</tr>
<tr>
<td>1</td>
<td>$\frac{1}{4}$</td>
</tr>
<tr>
<td>2</td>
<td>$-\frac{1}{4}$</td>
</tr>
<tr>
<td>3</td>
<td>$\frac{3}{8}$</td>
</tr>
<tr>
<td>4</td>
<td>$-\frac{3}{4}$</td>
</tr>
<tr>
<td>5</td>
<td>$\frac{15}{8}$</td>
</tr>
</tbody>
</table>
4. Use the binomial series formula to come up with a sixth degree Taylor polynomial for the function \( f(x) = \sqrt[3]{1 - 2x^2} \); make sure that you completely simplify each coefficient. (10 points)
1. Find the interval of convergence for the given power series. Make sure that you show work consistent with that exemplified in lecture. This problem continues on page 2. (25 points total)

a. \[ \sum_{n=0}^{\infty} \frac{(x - 2)^n}{4^n} \]
b. \[ \sum_{n=1}^{\infty} \frac{4^n (x - 2)^n}{\sqrt{n}} \]
2. Use an appropriate Taylor Series template from your "cheat sheet" to help you determine a series representation for \( \int_{1/2}^{0} x \sin(3x^2) \, dx \); to earn full credit, you must completely simplify the formula. Make sure that you present your work in a manner consistent with that exemplified during lecture. (10 points)
3. Use partial sum analysis to determine the value of \[ \sum_{k=0}^{\infty} \frac{(-1)^k \cdot 4^{2k+1}}{(2k+4)(2k+1)!} \] accurate to the nearest 1,000,000th. Make sure that you present your work in a manner consistent with that exemplified during lecture. To earn full credit you must correctly identify the first two consecutive partial sums that round to the desired accuracy. (10 points)

You may assume that the series satisfies the conditions of the Alternating Series Remainder Theorem. It can be shown that the sequence generated by the absolute value of the terms becomes strictly decreasing at \( k = 2 \) and limits to 0 as \( k \to \infty \).