To earn full credit for any given problem, your work must be presented in a manner consistent with that illustrated and discussed in class; you must also get the correct answer to earn full credit for any given problem. No notes nor other references may be used. No calculator may be used.

1. Find the sum of the telescoping series \( \sum_{k=1}^{\infty} \left( \frac{1}{2k-1} - \frac{1}{2k+1} \right) \). Make sure that you present your solution in a manner consistent with that illustrated in class. (14 points)
2. Formally establish that the series \( \sum_{k=1}^{\infty} \frac{(-3)^{-k} + 4}{5 \cdot 2^{1-3k}} \) is geometric by simplifying the ratio of successive terms. Determine and state whether the series is convergent or divergent (include a statement as to the basis for your determination). If the series is convergent, do not find the sum. Make sure that you present your solution in a manner consistent with that illustrated in class. (12 points)
3. Find the value of \( \sum_{k=1}^{\infty} \left[ 6 \cdot \left( \frac{2}{3} \right)^k + 3 \cdot \left( \frac{1}{4} \right)^{k-2} \right] \). Make sure that you show all relevant calculations. You do not need to be formal in your presentation, but you do need to include all relevant details that go into your determination. (12 points)

4. Circle T for true and F for false. Assume that \( a_k > 0 \ \forall \ k \). (2 points each – 8 points total)

- \( \sum_{k=1}^{\infty} k^2 \) is a \( p \)-series. T or F
- \( \sum_{k=1}^{\infty} \left( \frac{3^k}{2^k} \right)^2 \) is a geometric series. T or F
- If \( b_k = \frac{1}{k} \) and \( \lim_{k \to \infty} \frac{a_k}{b_k} = 0 \), then it is correct to conclude that \( \sum_{k=1}^{\infty} a_k \) must diverge. T or F
- If \( b_k = \frac{1}{k} \) and \( \lim_{k \to \infty} \frac{a_k}{b_k} = 0 \), then it is correct to conclude that \( \sum_{k=1}^{\infty} a_k \) must converge. T or F
5. Find the third partial sum for the series $\sum_{k=1}^{\infty} a_k$ where 
\[ a_k = \begin{cases} 
8 & \text{if } k = 1 \\
3 - \frac{a_{k-1}}{2} & \text{if } k > 1 
\end{cases} \]

Show all relevant work and make sure that your thought process and conclusion are both clear. (6 points)

6. The sequence $a_k$ converges. Find the exact value to which the sequence converges. Show all relevant work and make sure that your thought process and conclusion are both clear. (8 points)
7. For each series state whether the series is convergent or divergent and state a test you could perform to establish the convergence/divergence. **Do not perform the test.**

A correct answer for the first series has already been supplied to help you understand the directions. (20 points total)

<table>
<thead>
<tr>
<th>Series</th>
<th>Con/Di- verge?</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sum_{k=1}^{\infty} \frac{3}{2 + 5k} )</td>
<td>Diverge</td>
<td>Limit Comparison Test with the p-series ( \sum_{k=1}^{\infty} \frac{1}{k} )</td>
</tr>
<tr>
<td>( \sum_{k=1}^{\infty} \frac{\sqrt{k}}{\sqrt{k} + 3} )</td>
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<tr>
<td>( \sum_{k=1}^{\infty} \frac{1}{\sqrt{k^3 + \left(\frac{1}{2}\right)^k}} )</td>
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<tr>
<td>( \sum_{k=1}^{\infty} \frac{k^{10}}{2^k} )</td>
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<tr>
<td>( \sum_{k=1}^{\infty} \frac{1}{k^{10} 2^k} )</td>
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<td></td>
</tr>
<tr>
<td>( \sum_{k=1}^{\infty} \frac{1}{k!} )</td>
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</tbody>
</table>
8. Find the specific solution to the equation \( xy' = y \) that lies entirely in Quadrant I and that passes through the point \((5, 10)\). Show all of the relevant work in a manner consistent with that illustrated in class and make sure that your conclusion is clear. Also, make sure that your function formula is simplified as much as possible. (15 points)

9. A slope field is shown in Figure 1. Sketch onto the slope field the solution curve that passes through the point \((2, 4)\). (5 points)