Problem 1:  
False  
Because our series passes the Alternating Series Test, we know it is some type of convergent. However we gain no information if the ratio test is inconclusive. For instance:

\[
\frac{1}{n^2} \text{ is decreasing, } \lim_{n \to \infty} \frac{1}{n^2} = 0 \text{ and } \lim_{n \to \infty} \left| \frac{1}{n^2} \right| = \lim_{n \to \infty} \left| \frac{n^2}{(n+1)^2} \right| = 1
\]

Yet \( \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \) converges absolutely

Problem 2:

\[
\sum_{n=1}^{\infty} \frac{n^23^n}{5^{n-1}}
\]

We apply the Ratio Test

\[
\lim_{n \to \infty} \left| \frac{(n+1)^23^{n+1}5^{n-1}}{5^n n^23^n} \right| = \lim_{n \to \infty} \left| \frac{(n+1)^23}{n^2 \cdot 5} \right| = \frac{3}{5} < 1
\]

Therefore by the ratio test, the series converges absolutely.
Problem 3:

Find the radius and interval of convergence of

\[
\sum_{n=2}^{\infty} \frac{(x - 1)^n}{2n - 1}
\]

We apply the Ratio Test

\[
\lim_{n \to \infty} \left| \frac{(x - 1)^{n+1} \cdot 2n - 1}{2n + 1 \cdot (x - 1)^n} \right| = \lim_{n \to \infty} \left| \frac{2n - 1}{2n + 1} \frac{x - 1}{x - 1} \right| = |x - 1| < 1
\]

\[|x - 1| < 1 \Rightarrow -1 < x - 1 < 1 \Rightarrow 0 < x < 2\]

So our radius of convergence: \( R = 1 \). We know check our endpoints \( x = 0 \) and \( x = 2 \)

Letting \( x = 0 \) we see \( \sum_{n=2}^{\infty} \frac{(0 - 1)^n}{2n - 1} = \sum_{n=2}^{\infty} \frac{(-1)^n}{2n - 1} \) and we see

\[\frac{1}{2n - 1}\]

is a decreasing sequence and \( \lim_{n \to \infty} \frac{1}{2n - 1} = 0\)

So the above alternating series converges by the Alternating Series Test.

Letting \( x = 2 \) we see \( \sum_{n=2}^{\infty} \frac{(2 - 1)^n}{2n - 1} = \sum_{n=2}^{\infty} \frac{1}{2n - 1} > \sum_{n=2}^{\infty} \frac{1}{2n} = \frac{1}{2} \sum_{n=2}^{\infty} \frac{1}{n} \)

So the above series diverges by Direct Comparison with the harmonic series.

Therefore our interval of convergence is \([0, 2)\)