

Instructions: Show all work. Answers without work required to obtain the solution will not receive full credit. Some questions may contain multiple parts: be sure to answer all of them. Give exact answers unless specifically asked to estimate.

1. Find the first and second derivatives of $y = \sum_{n=0}^{\infty} a_n(x-2)^n$.

$$y' = \sum_{n=1}^{\infty} a_n (x-2)^{n-1} \cdot n$$

$$y'' = \sum_{n=2}^{\infty} a_n n(n-1) (x-2)^{n-2}$$

2. Rewrite $\sum_{n=1}^{\infty} a_n n x^{n-1} + \sum_{n=0}^{\infty} a_n x^n$ as a single sum.

$$\sum_{n=0}^{\infty} a_{n+1} (n+1) x^n + \sum_{n=0}^{\infty} a_n x^n$$

$$= \sum_{n=0}^{\infty} [a_{n+1} (n+1) + a_n] x^n$$