

STEP III, 2014 , Q1 MS

1. The stem results are obtained through algebraic expansion and equating coefficients. Using the expression $(1 + ax)(1 + bx)(1 + cx)$ for $1 + qx^2 + rx^3$, manipulating the logarithm of the product, and the series expansions for expressions like $\ln(1 + ax)$ yields the displayed result. In parts (ii), (iii), and (iv), it is simplest to find $S_2 = -q$, $S_3 = r$, $S_5 = -qr$, $S_7 = q^2r$, and $S_9 = \frac{r^3}{3} - q^3r$ by expanding the series for $\ln(1 + (qx^2 + rx^3))$, and choosing a counter-example, selecting a, b and c so that $r \neq 0$.



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