1. Find the coefficient of $x^2$ in the polynomial

$$P(x) = (1 - x)(1 + 2x)(1 - 3x)(1 + 4x) \cdots (1 - 9x)(1 + 10x).$$

**Solution:** □ *Multiplying every consecutive pair we obtain five quadratic factors:*

$$(1 - x)(1 + 2x)(1 - 3x)(1 + 4x) \cdots (1 - 9x)(1 + 10x) = (1 + x - 2x^2)(1 + x - 12x^2)(1 + x - 30x^2) 
\cdot (1 + x - 56x^2)(1 + x - 90x^2)$$

*To find the coefficient of $x^2$ either one takes one $x$ from exactly two of the factors and $1$ from the other three, or one takes the coefficient of $x^2$ from one of the factors and $1$ from each of the other four factors. Thus the coefficient of $x^2$ is

$$\binom{5}{2} - 2 - 12 - 30 - 56 - 90 = 10 - 2 - 12 - 30 - 56 - 90 = -180.$$* □