

The two-square formula

$$(a^2 + b^2)(r^2 + s^2) = (ar - bs)^2 + (as + br)^2.$$

The four-square formula

$$\begin{aligned} & (a^2 + b^2 + c^2 + d^2)(r^2 + s^2 + t^2 + u^2) \\ = & (ar - bs - ct - du)^2 \\ & + (as + br + cu - dt)^2 \\ & + (at - bu + cr + ds)^2 \\ & + (au + bt - cs + dr)^2. \end{aligned}$$