

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a+b+c)(-a+b+c)(a-b+c)(a+b-c)$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = \\ -(a+b+c)(-a+b+c)(a-b+c)(a+b-c)$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

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$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ = & a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \end{aligned}$$



$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \\ &= \{a^2 - (b^2 + 2bc + c^2)\}\{a^2 - (b^2 - 2bc + c^2)\} \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \\ &= \{a^2 - (b^2 + 2bc + c^2)\}\{a^2 - (b^2 - 2bc + c^2)\} \\ &= \{a^2 - (b + c)^2\}\{a^2 - (b - c)^2\} \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \\ &= \{a^2 - (b^2 + 2bc + c^2)\}\{a^2 - (b^2 - 2bc + c^2)\} \\ &= \{a^2 - (b + c)^2\}\{a^2 - (b - c)^2\} \\ &= \{a + (b + c)\}\{a - (b + c)\}\{a + (b - c)\}\{a - (b - c)\} \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \\ &= \{a^2 - (b^2 + 2bc + c^2)\}\{a^2 - (b^2 - 2bc + c^2)\} \\ &= \{a^2 - (b + c)^2\}\{a^2 - (b - c)^2\} \\ &= \{a + (b + c)\}\{a - (b + c)\}\{a + (b - c)\}\{a - (b - c)\} \\ &= (a + b + c)(a - b - c)(a + b - c)(a - b + c) \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

$$\begin{aligned} & a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^4 - 2b^2c^2 + c^4) \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 - c^2)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + \{(b + c)(b - c)\}^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b + c)^2(b - c)^2 \\ &= a^4 - (2b^2 + 2c^2)a^2 + (b^2 + 2bc + c^2)(b^2 - 2bc + c^2) \\ &= \{a^2 - (b^2 + 2bc + c^2)\}\{a^2 - (b^2 - 2bc + c^2)\} \\ &= \{a^2 - (b + c)^2\}\{a^2 - (b - c)^2\} \\ &= \{a + (b + c)\}\{a - (b + c)\}\{a + (b - c)\}\{a - (b - c)\} \\ &= (a + b + c)(a - b - c)(a + b - c)(a - b + c) \\ &= -(a + b + c)(-a + b + c)(a - b + c)(a + b - c) \end{aligned}$$

$$a^4 + b^4 + c^4 - 2a^2b^2 - 2b^2c^2 - 2c^2a^2 = -(a + b + c)(-a + b + c)(a - b + c)(a + b - c)$$

Github:

<https://min7014.github.io/math20200327001.html>

Click or paste URL into the URL search bar, and you can see a picture moving.