In $\triangle ABC$ the following relationship holds:

$$27\left(\sum_{cyc} a^2\right)^2 - 54\sum_{cyc} a^4 \leq 16s^4$$

Proposed by Neculai Stanciu-Romania

Solution by Tapas Das-India

$$16F^2 = 2\sum a^2 b^2 - \left(\sum a^4\right)$$

$$27\left(\sum a^2\right)^2 - 54\sum a^4 = 27\sum a^4 + 54\sum a^2 b^2 - 54\sum a^4 =$$

$$= 27 \cdot \left(2\sum a^2 b^2 - \left(\sum a^4\right)\right) = 27 \cdot (16F^2) =$$

$$= 27 \cdot 16 \cdot r^2 s^2 \overset{Mitrinovic}{\leq} 27 \cdot 16 \cdot \frac{s^2}{27} \cdot s^2 = 16s^4$$

Equality holds for $a = b = c$.