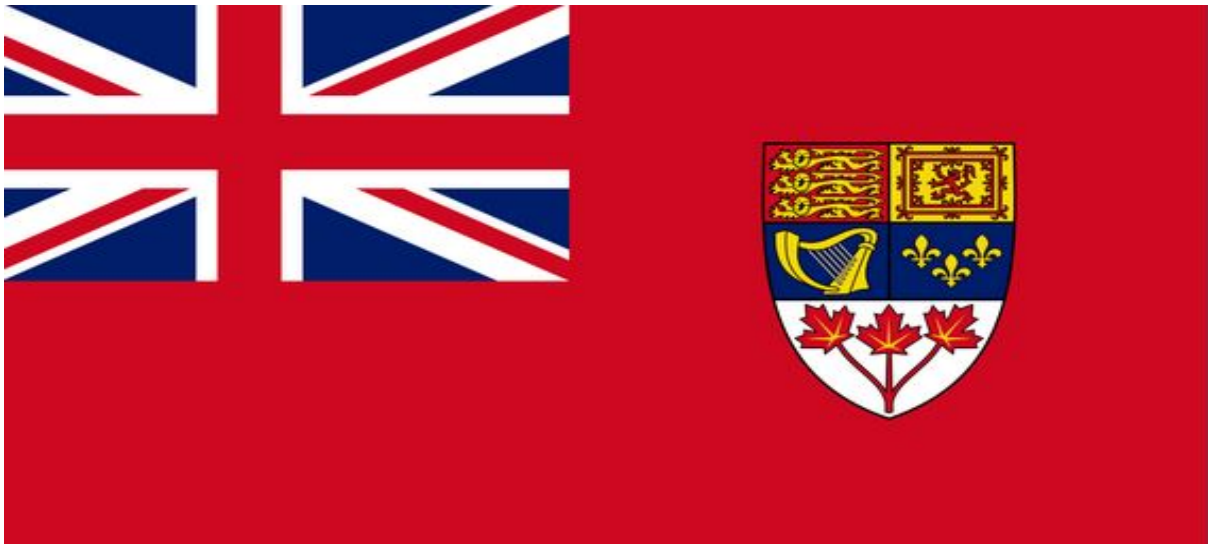


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If  $a, b, c > 0$  then:

$$\frac{3a^2 \sinh(3a) + 3b^2 \sinh(3b) + 3c^2 \sinh(3c)}{(a + b + c)^2} > \sinh(a + b + c)$$

*Proposed by Jalil Hajimir-Toronto-Canada*

*Solution by Daniel Sitaru-Romania*

$$f: (0, \infty) \rightarrow \mathbb{R}, f(x) = x^2 \sinh(3x)$$

$$f'(x) = 2x \sinh(3x) + 3x^2 \cosh(3x)$$

$$f''(x) = 2 \sinh(3x) + 12x \cosh(3x) + 9x^2 \sinh(3x) > 0, \forall x > 0, f \text{ strictly convexe}$$

$$\frac{1}{3} \sum_{cyc} f(a) \stackrel{JENSEN}{\succ} f\left(\frac{a + b + c}{3}\right)$$

$$\frac{1}{3} \sum_{cyc} a^2 \sinh(3a) > \frac{(a + b + c)^2}{9} \sinh\left(3 \cdot \frac{a + b + c}{3}\right)$$

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$$3 \sum_{cyc} a^2 \sinh(3a) > (a + b + c)^2 \cdot \sinh(a + b + c)$$

$$\frac{3}{(a + b + c)^2} \cdot \sum_{cyc} a^2 \sinh(3a) > \sinh(a + b + c)$$

$$\frac{3a^2 \sinh(3a) + 3b^2 \sinh(3b) + 3c^2 \sinh(3c)}{(a + b + c)^2} > \sinh(a + b + c)$$