

SP.109. If $a, b, c \geq 0$; $\Omega(a) = \int_0^a \sin\left(\frac{x}{x^2+1}\right) dx$ then:

$$e^{\pi(b\Omega(a)+c\Omega(b)+a\Omega(c))} \geq (a^2 + 1)^b (b^2 + 1)^c (c^2 + 1)^a$$

Proposed by Daniel Sitaru - Romania

SP.110. Let $m, x, y, z > 0$ be positive real numbers and F be the area of the triangle ABC . Prove that:

$$\frac{a^{2m+2}x^{m+1}}{(y+z)^{m+1}} + \frac{b^{2m+2}y^{m+1}}{(z+x)^{m+1}} + \frac{c^{2m+2}z^{m+1}}{(x+y)^{m+1}} \geq \frac{2^{m+1}}{(\sqrt{3})^{m-1}} F^{m+1}$$

Proposed by D.M. Bătinețu-Giurgiu - Romania, Martin Lukarevski-Skopje

SP.111. Let $x, y, z > 0$ be positive real numbers and F be the area of the triangle ABC . Prove that:

$$\frac{(y+z)^2 a^4}{x^2} + \frac{(z+x)^2 b^4}{y^2} + \frac{(x+y)^2 c^4}{z^2} \geq 64F^2$$

Proposed by D.M. Bătinețu-Giurgiu - Romania, Martin Lukarevski-Skopje

SP.112. Let $x, y, z > 0$ be positive real numbers and F be the area of the triangle ABC with circumradius R . Prove that:

$$\frac{x}{y+z} \sin^2 \frac{A}{2} + \frac{y}{z+x} \sin^2 \frac{B}{2} + \frac{z}{x+y} \sin^2 \frac{C}{2} \geq \frac{2\sqrt{3}F}{R^2}$$

Proposed by D.M. Bătinețu-Giurgiu - Romania, Martin Lukarevski-Skopje

SP.113. Let $x, y, z > 0$ be positive real numbers and F be the area of the triangle ABC . Prove that:

$$\frac{x}{y+z} a^2 + \frac{y}{z+x} b^2 + \frac{z}{x+y} c^2 \geq 8\sqrt{3}F$$

Proposed by D.M. Bătinețu-Giurgiu - Romania, Martin Lukarevski-Skopje

SP.114. Let $t, u, v, x, y, z > 0$ be positive real numbers, $t \geq \max\{u, v\}$ and $S = x + y + z$. Prove that:

$$\frac{tS - uy - vz}{uy + vz} a^2 + \frac{tS - uz - vx}{uz + vx} b^2 + \frac{tS - ux - vy}{ux + vy} c^2 \geq \frac{4(3t - u - v)\sqrt{3}S}{u + v}$$

Proposed by D.M. Bătinețu-Giurgiu - Romania, Martin Lukarevski-Skopje

SP.115. Let a, b, c be the lengths of the sides of a triangle with inradius r and circumradius R . Let r_a, r_b, r_c be the exradii of triangle. Prove that:

$$1728 \cdot r^5 \leq \frac{a^6}{r_a} + \frac{b^6}{r_b} + \frac{c^6}{r_c} \leq 108R^4(R - r)$$

Proposed by George Apostolopoulos - Messolonghi - Greece