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. Bătineţu-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:

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

Proposed by D.M. Bătineţu-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. Bătineţu-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. Bătineţu-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:

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

Proposed by D.M. Bătineţu-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