3843. *Proposed by George Apostolopoulos, Messolonghi, Greece.*

Let a, b be distinct real numbers such that

$$a^4 + b^4 - 3(a^2 + b^2) + 8 \leq 2(a + b)(2 - ab).$$

Find the value of the expression

$$A = (ab)^n + (ab + 1)^n + (ab + 2)^n,$$

where n is a positive integer.

3844. *Proposed by Michel Bataille, Rouen, France.*

Find the intersection of the surface with equation

$$(x^2 + y^2)^2 + (y^2 + z^2)^2 + (z^2 + x^2)^2 = (x + y)(y + z)(z + x)$$

with the plane $x + y + z = 2$.

3845. *Proposed by Dao Thanh Oai, Kien Xuong, Thai Binh, Viet Nam.*

Let the six points $A_1, A_2, \dots, A_6$ lie in that order on a circle, and the six points $B_1, B_2, \dots, B_6$ lie in that order on another circle. If the quadruples $A_i, A_{i+1}, B_{i+1}, B_i$ lie on circles with centres C_i for $i = 1, 2, \dots, 5$, then prove that A_6, A_1, B_1, B_6 must also lie on a circle. Furthermore, if C_6 is the centre of the new circle, then prove that lines C_1C_4, C_2C_5, and C_3C_6 are concurrent.

3846. *Proposed by Arkady Alt, San Jose, CA, USA.*

Let r be a positive real number. Prove that the inequality

$$\frac{1}{1 + a + a^2} + \frac{1}{1 + b + b^2} + \frac{1}{1 + c + c^2} \geq \frac{3}{1 + r + r^2}$$

holds for any positive a, b, c such that $abc = r^3$ if and only if $r \geq 1$.

3847. *Proposed by Jung In Lee, Seoul Science High School, Seoul, Republic of Korea.*

Prove that there are no distinct positive integers a, b, c and nonnegative integer k that satisfy the conditions

$$a^{b+k} \mid b^{a+k}, \quad b^{c+k} \mid c^{b+k}, \quad c^{a+k} \mid a^{c+k}.$$

3848. *Proposed by Rudolf Fritsch, University of Munich, Munich, Germany.*

We define an altitude of the plane $(2n + 1)$-gon $A_0A_1 \dots A_{2n}$ to be the line through vertex A_i perpendicular to the *opposite side* $A_{i-n}A_{i+n}$ (where indices are reduced modulo $2n+1$). Prove that if $2n$ of the altitudes are concurrent, then the remaining altitude passes through the point of concurrence.