

Problemath series 1

11 September 2009

(last deadline 2 October 2009, 14:00)

- The level of the problems is that of an advanced 12th grade HS student or a 1st year university student.
 - Every problem should be on a different sheet/document. If you see several ways of solving the same problem, feel free to enclose them in your document.
 - All answers/solutions should be clearly and carefully justified.
 - A new set of problems will appear soon.
 - By the end of the school year those who will have answered at least half of the problems correctly will receive a prize and a diploma.
 - E-mail your answers to Mme Lariviere who will send them to the ULB organizer.
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Problemath 1

What are all the triplets (x, y, z) of real numbers $x, y, z > 0$ such that

$$x^{y/z} = y^{z/x} = z^{x/y} \quad ?$$

Problemath 2

A polynomial $p(x)$, with real coefficients, is said to be **Jovial** if through every point of the R^2 plane there is at least one tangent to the curve of equation $y = p(x)$.

For which whole numbers $n > 0$ is every polynomial a **jovial** polynomial?

Problemath 3

Is the equality below true or false?

$$27\sin^3 9^\circ + 9\sin^3 27^\circ + 3\sin^3 81^\circ + \sin^3 243^\circ = 20\sin 9^\circ$$