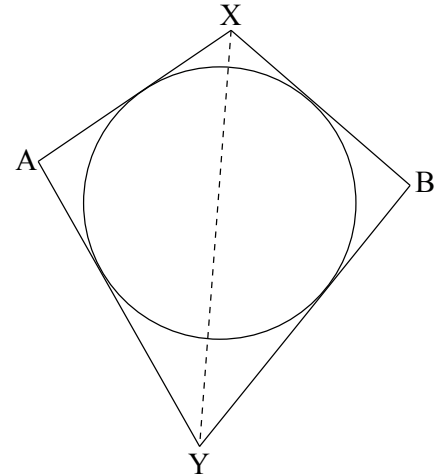


POMONA-WISCONSIN MATHEMATICS TALENT SEARCH

PROBLEM SET I (2009-2010)

OCTOBER 2009

- Given a positive integer N , write N^* to denote the integer obtained by adding N and all the digits of N . Thus $5^* = 10$ and $86^* = 100$. Also, $977^* = 1,000$ and $9968^* = 10,000$. Find an integer N such that $N^* = 1,000,000$, or prove that no such integer exists.
- In the figure, lines \overline{AX} and \overline{AY} are perpendicular tangents to a circle. Also, \overline{BX} and \overline{BY} are perpendicular tangents to the same circle. Prove that line \overline{XY} goes through the center of the circle.
- Let a be a real number, and suppose that two of the three solutions of the cubic equation $x^3 + 3x^2 - 34x = a$ differ by 1. Find all possibilities for a .
- Given a positive integer n , find all polynomials $f(x)$ such that $f(0) = 1$ and $f(x)^2 + 4x^{n+1} = g(x)^2 + 4x^n$ for some polynomial $g(x)$.
- Given a positive integer n other than 2, 3 or 5, show that a cardboard square can be cut into exactly n smaller squares, not necessarily of the same size.



You are invited to submit a solution even if you get just one problem. Please do not write your solutions on this problem page. Remember that solutions usually require a proof or justification.

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