MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 2 – NOVEMBER 2008 SOLUTION KEY

Round 5

A) $4(\sin\theta + 1) = 3\left(\frac{1}{\sin\theta}\right) \rightarrow 4\sin^2\theta + 4\sin\theta - 3 = (2\sin\theta - 1)(2\sin\theta + 3) = 0$

$\sin\theta = -3/2$ is impossible

$\sin\theta = 1/2 \rightarrow \underline{\boldsymbol{\frac{\pi}{6}, \frac{5\pi}{6}}}$

B) $\cos x = \frac{\cot(1035°)\cdot\tan(135°)}{\sec^2(-45°)} = \frac{\cot(315°)\cdot\tan(135°)}{\sec^2(45°)} = \frac{-1\cdot -1}{2} = \frac{1}{2}$ → 60° family → **<u>±60</u>**

C) $= \left(\left[\sqrt{3}-1\right]\left[\sqrt{3}+1\right]\right)^{70} = 2^{70} = \left(\sqrt{2}\right)^{140}$ → $|b| = \underline{\boldsymbol{\sqrt{2}}}$

Note: The equation $b^{140} = \left(\sqrt{2}\right)^{140}$ has 140 roots, only two of which are real, but the absolute value of all of them is $\sqrt{2}$.