MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 3 - DECEMBER 2007 SOLUTION KEY

Round 5

A) Let x denote the sales tax (in cents).

$\frac{20}{1} = \frac{399 - x}{x} \rightarrow 20x = 399 - x \rightarrow 21x = 399 \rightarrow x = 19 \rightarrow$ price = **$3.80**

B) Let A, B denote the 1st and 2nd number respectively. Then $\begin{cases} A = B + x \\ A + B = y \end{cases}$

$\rightarrow 2B + x = y \rightarrow B = \frac{y - x}{2}$ and $A = \frac{y - x}{2} + x = \frac{y + x}{2}$

Thus, $A : B =$ **$(y + x) : (y - x)$**

C) We were given that the pressure varies according to the formula $P = kAv^2$, where k is a proportionality constant to be determined.

Substituting for the first set of conditions, $3 = kA18^2 \rightarrow k = \frac{3}{A \cdot 18^2}$

Substituting for the second set of conditions, $P = \frac{3}{A \cdot 18^2}(2A)(\mathbf{30})^2 = \frac{6 \cdot 30^2}{18^2} = \frac{6 \cdot 5^2}{3^2} = \mathbf{\frac{50}{3}}$