MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 1 - OCTOBER 2006 SOLUTION KEY

Round 6

A) $(0.5) \clubsuit 4 = 2(.5)(3-4) = \ = -1$
$4 \clubsuit (0.5) = 2(4)(3 - .5) = 24 - 4 = 20 \rightarrow 20 - (-1) =$ **21**

B) Let $n = 0.\overline{42}$ Then $100n = 42.\overline{42}$ Subtracting $99n = 42 \rightarrow n = \dfrac{14}{33}$

The error (i.e. the difference) is $\dfrac{14}{33} - \dfrac{2}{5} = \dfrac{14(5) - 2(33)}{33(5)} = \dfrac{4}{5(33)}$

The percent error is $\dfrac{\text{difference}}{\text{original}} \cdot 100\%$. $\dfrac{4/(5\cdot 33)}{14/33} = \dfrac{2}{35} \approx 0.05714+ \rightarrow$ **5.7%**

C) Any traversal (path) from the house H to the playground P is simply an arrangement of the letters *SSSEEEE*. If the letters were distinct, they could be arranged in 7! ways. But since they are not, the number of arrangements must be divided by 3!, since there would be 3! = 6 ways of arranging S_1, S_2 and S_3, if they were distinguishable. ($S_1S_2S_3$, $S_1S_3S_2$, $S_2S_1S_3$, $S_2S_3S_1$, $S_3S_1S_2$, $S_3S_2S_1$ are indistinguishable, if the subscripts are dropped.)
Similarly, we must divide by 4! = 24, because the 4 E's are indistinguishable.
Thus, the number of distinct paths is $\dfrac{7!}{3!\cdot 4!} = \dfrac{7\cdot 6\cdot 5}{3\cdot 2\cdot 1} =$ **35**