MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 1 - OCTOBER 2011 SOLUTION KEY

Round 6

A) As a difference of perfect square,
$(394387)^2 - (394381)^2 = (394387 + 394381)(394387 - 394381) = (788768)(6) =$ **<u>4732608</u>**.

B) Avoiding solving for x and y, let's try combining the two equations and getting the required expression.
$A(x + y = 5) + B(2x - 3y = 8) \Rightarrow (A + 2B)x + (A - 3B)y = 5A + 8B$,
If $A + 2B = 7$ and $A - 3B = -8$, so we get the required expression $7x - 8y$.
Solving for A and B, $(A, B) = (1, 3)$
The required numerical value is $5(1) + 8(3) =$ **<u>29</u>**.

C) $1-\dfrac{1}{2-\dfrac{1}{3-\dfrac{1}{4}}} = 1-\dfrac{1}{2-\dfrac{1}{\dfrac{11}{4}}} = 1-\dfrac{1}{2-\dfrac{4}{11}} = 1-\dfrac{1}{\dfrac{18}{11}} = 1-\dfrac{11}{18} = \dfrac{7}{18}$

$\left(0.2\overline{3} + +0.0\overline{4}\right) = 0.2\overline{7}$

Converting the repeating decimal,

Let $N = 0.2\overline{7}$. Then: $\begin{cases} 100N = 27.\overline{7} \\ 10N = 2.\overline{7} \end{cases} \Rightarrow 90N = 25 \Rightarrow N = \dfrac{5}{18}$.

Thus, $\dfrac{7}{18} + \dfrac{5}{18} = \underline{\mathbf{\dfrac{2}{3}}}$.