MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 6 - MARCH 2016 SOLUTION KEY

Round 6

A)

$$\frac{\frac{2+3+4}{36}}{\frac{6+5+4}{36}} = \frac{9}{15} = \underline{\mathbf{\frac{3}{5}}}$$

	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

B) The middle term is the 5th term. The 5th term is $\binom{8}{4}(x^{-1})^4\left(x^3\right)^4 = \binom{8}{4}x^8 = \frac{8\cdot 7\cdot 6\cdot 5}{1\cdot 2\cdot 3\cdot 4}x^8 = \underline{\mathbf{70x^8}}$.

C) Jar #1: 4B and 6W

The two marbles drawn from Jar #1 are either both the same color or one of each.

P(*BB*) = $\frac{{}_4C_2}{{}_{10}C_2} = \frac{6}{45} = \frac{2}{15}$, P(*WW*) = $\frac{{}_6C_2}{{}_{10}C_2} = \frac{15}{45} = \frac{1}{3}$ and P(*BW* or *WB*) = $\frac{{}_4C_1\cdot{}_6C_1}{{}_{10}C_2} = \frac{24}{45} = \frac{8}{15}$

Notice that P(*BB*) + P(*WW*) + P(*BW* or *WB*) = 1.

Jar #2 initially (3, 5) $\Rightarrow \begin{cases} BB \Rightarrow \text{Jar}\#2:(b,w) = (5,5) \\ WW \Rightarrow \text{Jar}\#2:(b,w) = (3,7) \\ BW/WB \Rightarrow \text{Jar}\#2:(b,w) = (4,6) \end{cases}$

Thus, the probability of drawing *B* from Jar #2 is

$\frac{2}{15}\cdot\frac{1}{2} + \frac{1}{3}\cdot\frac{3}{10} + \frac{8}{15}\cdot\frac{2}{5} = \frac{10+15+32}{150} = \underline{\mathbf{\frac{19}{50}}}$ (or **0.38**).