MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 3 - DECEMBER 2012
ROUND 5 ALG 1: RATIO, PROPORTION OR VARIATION

ANSWERS

A) k = _____

B) (_____ , _____)

C) _____

A) 20% of *A* plus 60% of *B* equals 100% of *B*.
30% of *B* plus 10% of *A* is equivalent to *k*% of *A*. Compute *k*.

B) According to Newton's law of universal gravitation, the force of attraction (*F*) between two bodies varies directly with the product of the masses (m_1 and m_2) and inversely with the square of the distance (*d*) between them. The actual calculations could get quite messy, so here we use some simplistic measurements.
Suppose F_1 = 0.004, when (m_1, m_2, d) = (2, 4, 12).
Let *k* be the proportionality constant.
Let F_2 be the force between two bodies when (m_1, m_2, d) = (3, 6, 8).
Compute the ordered pair (k, F_2).

C) Let *P* be the difference between the cubes of two consecutive integers.
Let *Q* be the difference between the squares of two consecutive integers.
If *P* : *Q* = 13 : 1, compute the <u>smallest</u> possible sum of the larger cube and the smaller square.