MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 4 - JANUARY 2010
ROUND 7 TEAM QUESTIONS
ANSWERS

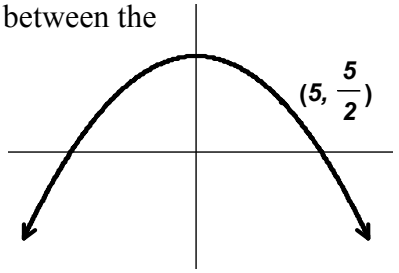
A) _____ D) _____

B) (_____ , _____ , _____) E) _____ : _____

C) _____ F) _____ yards

******* CALCULATORS ARE PERMITTED IN THIS ROUND *******

A) The maximum height of a parabola above the x-axis is twice the distance between the vertex of the parabola and its focus. If the parabola contains the point (5, 5/2) and has an axis of symmetry on the y-axis, compute the distance between its zeros.

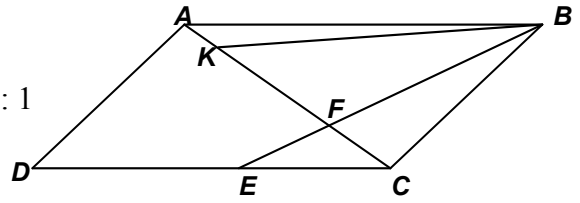


B) A, B, C and D are positive integers.
$(2x+3y+A)(Bx+Cy+D) = C_1x^2 + C_2xy + C_3y^2 + C_4x + C_5y + C_6$
All coefficients in this expansion are either 1 or prime.
Determine all possible ordered triples (C_4, C_5, C_6)

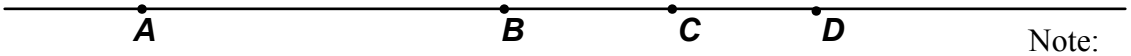
C) Given: $(\cos^4 4x - \sin^4 4x)(1 - 2\sin^2 x) = 0$, where $0 \le x < \pi$.
Let (p, q) denote the smallest and eighth largest solutions respectively over the specified interval. Compute $\frac{q}{p}$.

D) A rectangular pane of stamps would contain 48 fewer stamps if it consisted of three more rows each containing 5 fewer stamps.
There are N^2 stamps on the original pane.
Compute the smallest possible integer value of N.

E) Given: parallelogram $ABCD$, $AK : KF = 2 : 7$, $DE : EC = 2 : 1$
Compute the ratio $\frac{area(FADE)}{area(ABCD)}$.



F) A treasure is located at a point along a straight road with landmarks A, B, C and D located (in the given order) as indicated on the map below:



Note:
Relative distances are rarely accurate on these old pirate maps.
The following instructions were included:
(1) Start at A and go 1/2 of the distance to C
(2) Then go 1/3 of the distance to D
(3) Then go 1/4 of the distance to B and dig!
If AB = 120 yards and BC = 80 yards and the treasure is buried midway between A and D, compute the distance from B to D.