MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 2 - NOVEMBER 2011
ROUND 7 TEAM QUESTIONS
ANSWERS

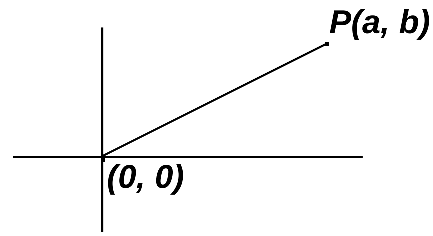
A) ____________________ D) ____________________

B) A B C D E E) ____________________

C) ____________________ F) (__________, __________)

****** NO CALCULATORS IN THIS ROUND ******

A) Given: $z = a + bi$ and $|z| = 7$
The graph of z in the complex plane is represented by the point P.
Compute all possible values of a for which the distance between
$z + (i - 2)$ and $\overline{z} + (1 - i)$ is 5.

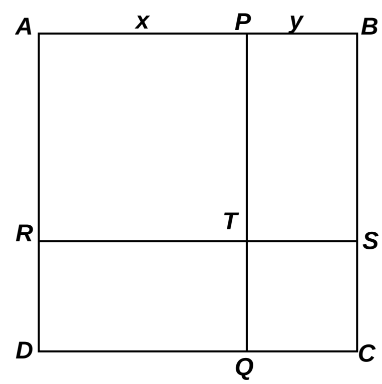


B) Given: $0 < 2x - A < 10$, for integer values of A.
Which of the following statements about the number of integer values of x satisfying the inequality are true? Circle the appropriate letters on the answer blank.

A) As A increases, the number of integer values of x increases.
B) As A decreases, the number of integer values of x decreases.
C) Regardless of the value of A, there are 4 integer values of x.
D) If A is even, there are 4 integer values of x.
E) If A is odd, there are 5 integer values of x.

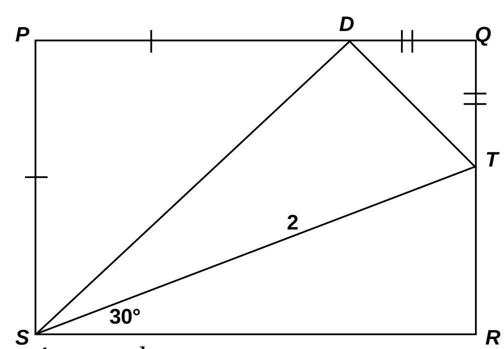
C) Given: a square $ABCD$, subdivided into two squares and two rectangles by $\overline{PQ}$ and $\overline{RS}$ drawn parallel to the sides of the square.
$AP = PT = x$ and $PB = y$, where $x > y > 0$.
The sum of the areas of the two squares is k times the sum of the areas of the two rectangles.

Determine a simplified expression for $\frac{x}{y}$ in terms of k.



D) There are several positive integer values of k for which $\sqrt{k^2 - 96}$ is an integer. Find all of them.

E) Given: Rectangle $PQRS$ with $ST = 2$
$m\angle TSR = 30°$, $PS = PD$ and $QD = QT$
Compute: $\cot(\measuredangle STD)$.



F) Given: $m\measuredangle A$ is an integer, $m\measuredangle B = m\measuredangle A + k°$, for some positive integer k.
For each value of k, $m\measuredangle A$ is as large as possible.
Each angle in a convex polygon P is congruent to either A or B.
There are 10 of the larger angle B and $0 < n < 10$ of the smaller angle A.
Let m and M denote the minimum and maximum possible values of k. Compute (m, M).