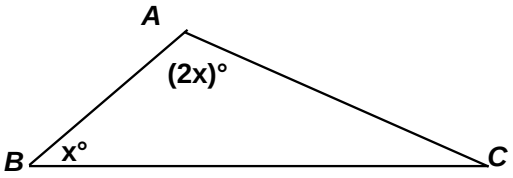
MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 3 - DECEMBER 2015
ROUND 7 TEAM QUESTIONS
ANSWERS

A) _____ D) _____

B) _____ E) (_____ , _____)

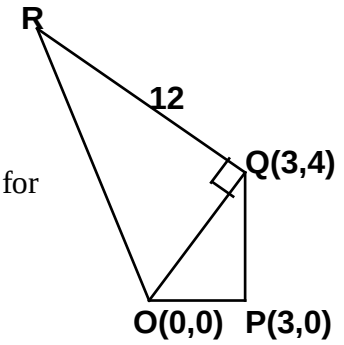
C) (_____ , _____) F) _____

A) In ΔABC, with angles as indicated,
D lies on $\overline{BC}$ such that $\overrightarrow{AD}$ bisects $\angle A$.
$\frac{DC}{DA} = 2$ and $BC = 6$.
Compute the perimeter of ΔABC.



B) Consider the following statements about the integer x.
x and $x + 2$ are prime.
$x - 1$ is a multiple of 5. $x + 3$ is a multiple of 7.
The minimum positive integer value of x for which all of these statements are true is $x = 11$. Determine the next largest value of x for which all of these statements are true.

C) Compute the coordinates of point R.



D) Given: $a, b, m, n > 0$, $a^{b+c} = m$ and $b^{c+a} = n$.
If $\log\left(a^b b^a\right) = 2$, express $(ab)^c$ as a simplified expression in terms of m and n.

E) List the integers from 1 to 100 inclusive in 10 rows as indicated at the right.
Let n be the smallest prime in the list.
Repeat the following pair of statements until $n^2 > 100$.
Cross out every n^{th} number in the list which is larger than n.
Now let n be the smallest integer in the list not crossed out.

1	2	3	…	10
11	12	13	…	20
21	22	23		30
…				
81	82	83	…	90
91	92	93	…	100

Let (a,b) be consecutive un-crossed-out integers, where $b > a$.
The simplified ratio of the number of ordered pairs for which $b - a = 2$ to the number of ordered pairs for which $b - a = 6$ is $k : j$.
Determine the ordered pair of integers (k, j).

F) A polygon with n sides has more than 1,000,000 diagonals. What is the minimum number of sides this polygon could have?