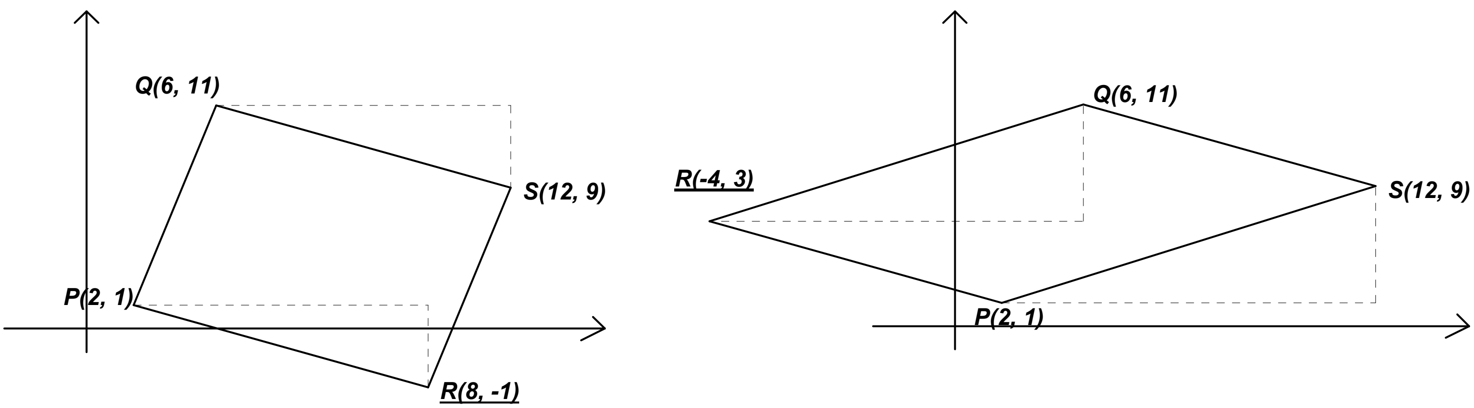
MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 3 - DECEMBER 2009 SOLUTION KEY

Round 3
C) - **continued**

Given three points $P(2, 1)$, $Q(6, 11)$ and $S(12, 9)$ there are in fact three points which could be the fourth vertex of a parallelogram. Besides (16,19) above, $(8, -1)$ and $(-4,3)$ are possible candidates.



In the latter two cases, the quadrilaterals would be *PQSR* and *PRQS* respectively (or a cyclical permutation thereof).
The requested quadrilateral was *PQRS* which implies *P* and *R* must be <u>opposite</u> vertices.
In these other two quadrilaterals, *P* and *R* are <u>consecutive</u> vertices.
Therefore, the only possible position for point *R* is (16, 19) and the above solution is unique.