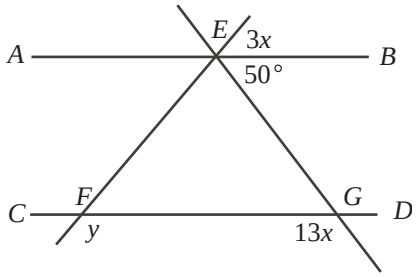
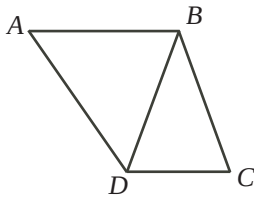
Intermediate Math Circles
October 27 2021
Problem Set 1

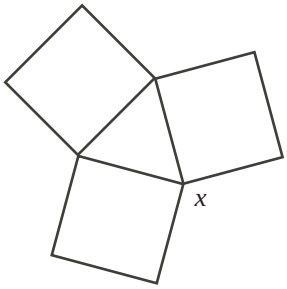
1. In the diagram, AB is parallel to CD. Determine the values of x and y.



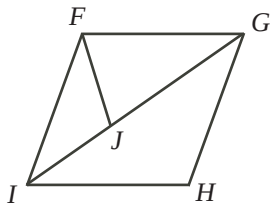
2. In the diagram, AB is parallel to DC and $AB = BD = BC$. If $\angle A = 52°$, determine the measure of $\angle DBC$.



3. The diagram shows three squares of the same size. What is the value of x?

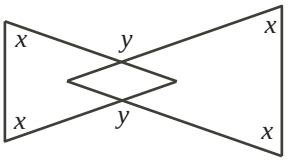


4. The diagram shows a rhombus $FGHI$ and an isosceles triangle FGJ in which $GF = GJ$. Angle FJI equals $111°$. What is the measure of angle JFI?

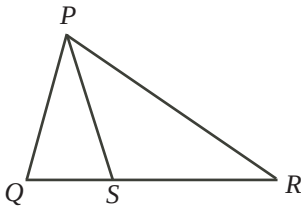


5. $ABCD$ is a square. The point E is outside the square so that CDE is an equilateral triangle. Determine the measure of angle BED.

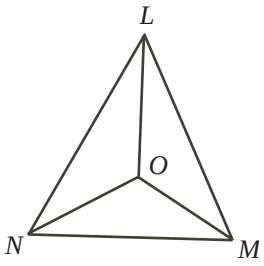
6. The diagram shows two isosceles triangles in which the four angles marked x are equal. The two angles marked y are also equal. Find an equation relating x and y. (Note: The sum of the angles in a quadrilateral is $360°$)



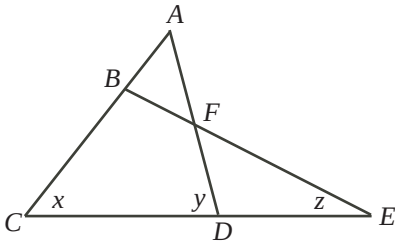
7. In the diagram, QSR is a straight line. $\angle QPS = 12°$ and $PQ = PS = RS$. What is the measure of $\angle QPR$?



8. The three angle bisectors of triangle LMN meet at a point O as shown. Angle LNM is $68°$. What is the size of angle LOM?

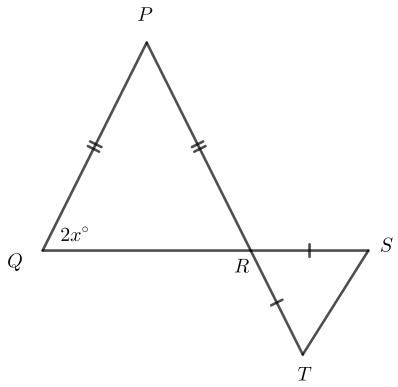


9. In the figure shown, $AB = AF$ and ABC, AFD, BFE, and CDE are all straight lines. Show that $x - y + 2z = 0$.



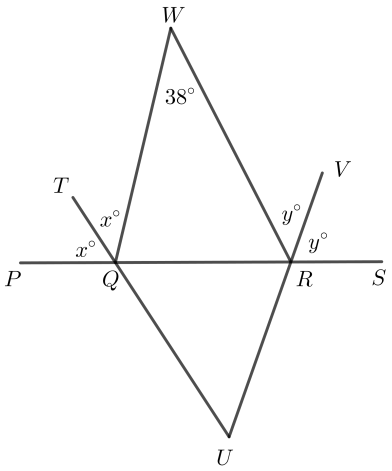
10. Triangle ABC has a right angle at B. AC is extended to D so that $CD = CB$. The bisector of angle A meets BD at E. Prove that $\angle AEB = 45°$.

11. In the diagram, R is the point of intersection of PT and QS, $PQ = PR$, and $RS = RT$. If $\angle PQR = 2x°$, what is the measure of $\angle RST$, in terms of x.

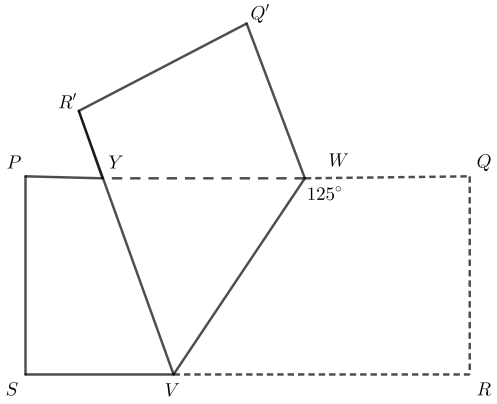


12. In $\triangle PQR$, $PQ = PR$. PQ is extended to S so that $QS = QR$. Prove that $\angle PRS = 3(\angle QSR)$.

13. In the diagram, points Q and R lie on PS and $\angle QWR = 38°$. If $\triangle TQP = \angle TQW = 0°$, $\triangle VRS = \triangle VRW = y°$, and U is the point of intersection of TQ extended and VR extended, then what is the measure of $\angle QUR$?

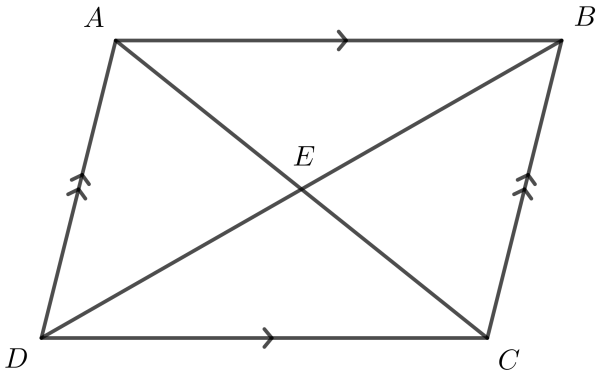


14. In the diagram, $PQRS$ represents a rectangular piece of paper. The paper is folded along a line VW so that $\angle VWQ = 125°$. When the folded paper is flattened, points R and Q have moved to points R' and Q' respectively and $R'V$ crosses PW at Y . What is the measure of $\angle PYV$?



15. Prove that the diagonals of a parallelogram bisect each other. (You will need to use a congruent triangle postulate)

That is:



$ABCD$ is a parallelogram. The diagonals AC and BD intersect at E.

Prove that $AE = EC$ and $BE = ED$