

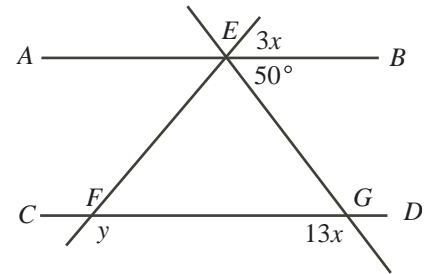


Intermediate Math Circles

Wednesday 05 October 2016

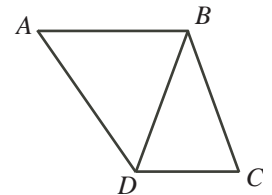
Problem Set 1

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

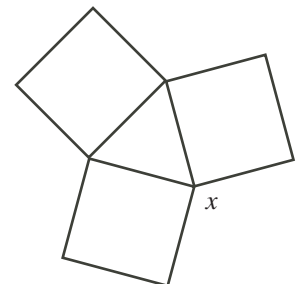


2. Triangle ABC has a right angle at B . AC is extended to D so that $CD = CB$. The bisector of angle A meets BD at E . Prove that $\angle AEB = 45^\circ$.

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

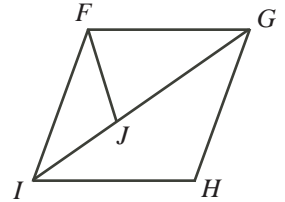


4. The diagram shows three squares of the same size. What is the value of x ?



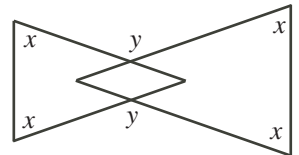


5. The diagram shows a rhombus $FGHI$ and an isosceles triangle FGJ in which $GF = GJ$. Angle FJI equals 111° . What is the measure of angle JFI ?

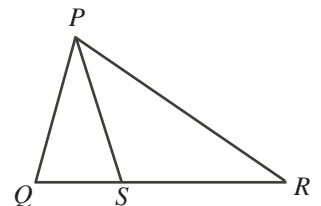


6. $ABCD$ is a square. The point E is outside the square so that CDE is an equilateral triangle. Determine the measure of angle BED .

7. 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 .

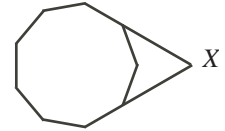


8. In the diagram, QSR is a straight line. $\angle QPS = 12^\circ$ and $PQ = PS = RS$. What is the measure of $\angle QPR$?

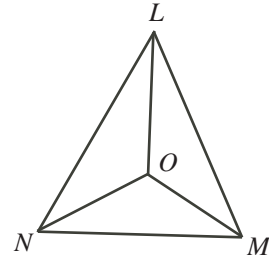




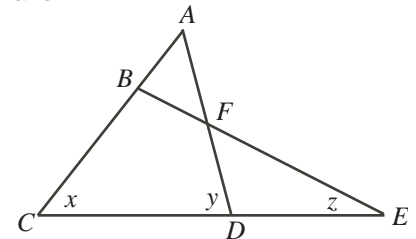
9. The diagram shows a regular nonagon with two sides extended to meet at point X . What is the size of the acute angle at X ?



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



11. In the figure shown, $AB = AF$ and ABC , AFD , BFE , and CDE are all straight lines. Determine an equation relating x , y and z .

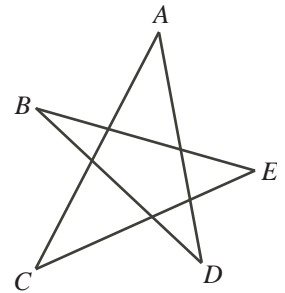


12. The angles of a nonagon are nine consecutive numbers. What are these numbers?



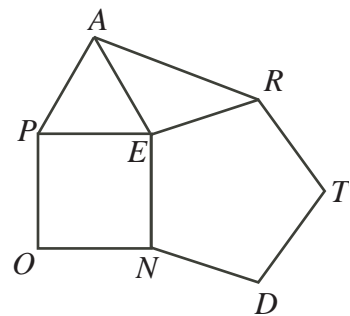
13. What is the measure of the angle formed by the hands of a clock at 9:10?

14. Determine the sum of the angles A , B , C , D , and E in the five-pointed star shown.



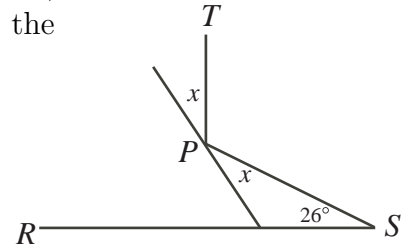
15. In $\triangle PQR$, $PQ = PR$. PQ is extended to S so that $QS = QR$.
Prove that $\angle PRS = 3(\angle QSR)$.

16. A regular pentagon is a five-sided figure which has all of its angles equal and all of its side lengths equal. In the diagram, $TREND$ is a regular pentagon, PEA is an equilateral triangle, and $OPEN$ is a square. Determine the size of $\angle EAR$.

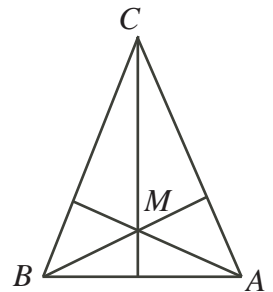




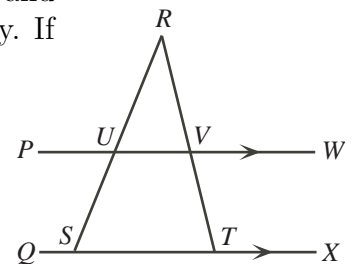
17. A beam of light shines from point S , reflects off a reflector at point P , and reaches point T so that PT is perpendicular to RS . What is the value of x ?



18. In the diagram, let M be the point of intersection of the three altitudes of triangle ABC . If $AB = CM$, then what is $\angle BCA$ in degrees?



19. In the diagram, PW is parallel to QX , S and T lie on QX , and U and V are the points of intersection of PW with SR and TR , respectively. If $\angle SUV = 120^\circ$ and $\angle VTX = 112^\circ$, what is the measure of $\angle URV$?





20. Three regular polygons meet at a point and do not overlap. One has 3 sides and one has 42 sides. How many sides does the third polygon have? Can you find other sets of three polygons that have this property?

Answers

- | | | |
|----------------------------------|--------------------------------|------------------------------|
| 1. $x = 10^\circ, y = 150^\circ$ | 3. $\angle DBC = 28^\circ$ | 4. $x = 120^\circ$ |
| 5. $\angle JFI = 27^\circ$ | 6. $\angle BED = 45^\circ$ | 7. $y = 2x$ |
| 8. $\angle QPR = 54^\circ$ | 9. 60° | 10. $\angle LOM = 124^\circ$ |
| 11. $x - y + 2z = 180^\circ$ | 12. 136° to 144° | 13. 145° |
| 14. 180° | 16. $\angle EAR = 39^\circ$ | 17. $x = 32^\circ$ |
| 18. $\angle BCA = 45^\circ$ | 19. $\angle URV = 52^\circ$ | 20. 7 sides |