Proof in Year 9 Geometry

1. Fold a tape whose width is constant, as in the figure.

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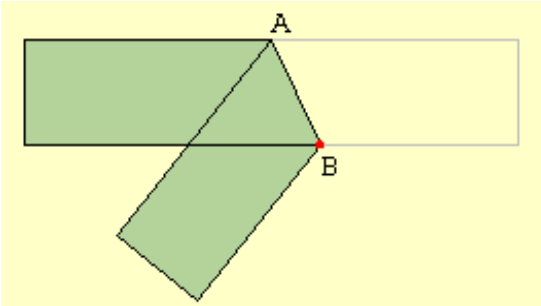
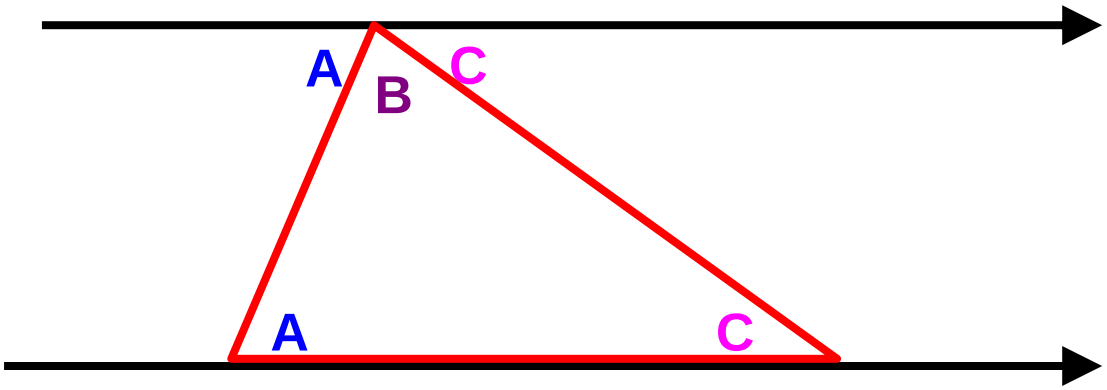


a. What type of triangle is formed by the part of the tape that overlaps itself? Measuring side lengths and/or angles may help you make an educated guess.

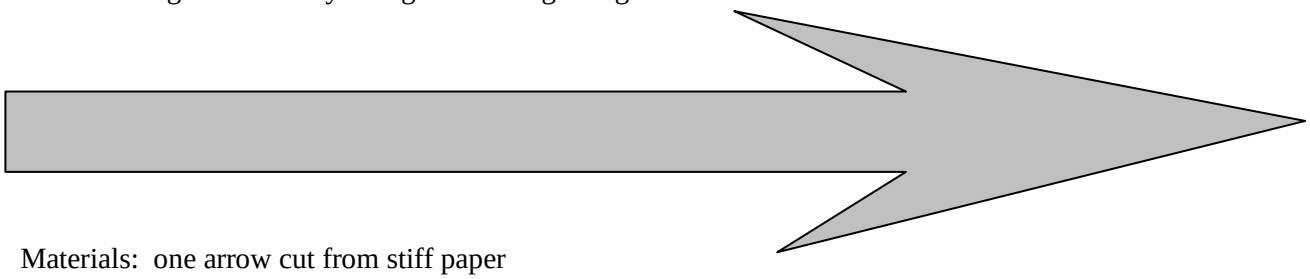
b. Use your knowledge of geometry to prove it.

Sum of the angles of a triangle

2a. Use the diagram below to prove that the sum of the angles of a triangle is a straight angle.



2b. Prove the angle sum of any triangle is a straight angle.

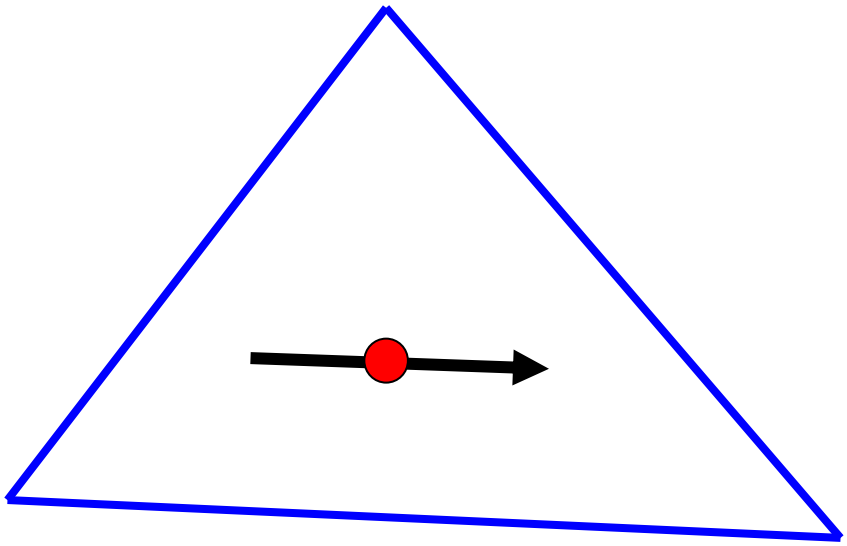


Materials: one arrow cut from stiff paper

Method:
Draw a large triangle on the whiteboard. Move the arrow around the triangle, rotating it through each vertex angle in turn. When it returns to its starting position, it is facing the other way, and has rotated through an angle of 180 degrees.

2c. Prove: The angle sum of a triangle is a straight angle.

Method: Move the arrow around the triangle, rotating it through each vertex angle in turn. When it returns to its starting position, it is facing the other way, and has rotated through an angle of 180 degrees.

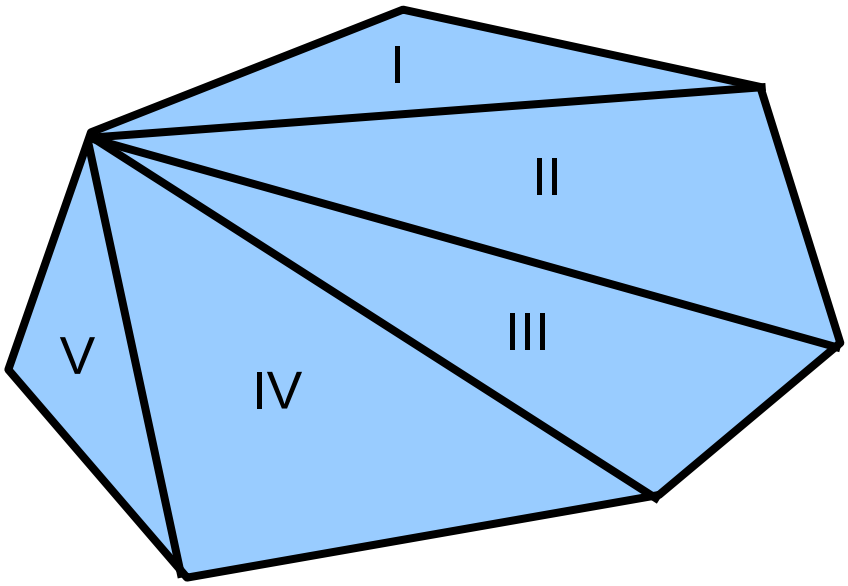


3a. Prove: the angle sum of a polygon with n sides is 180(n-2) degrees.

A similar method can be used to find the angle sum of any convex polygon. Just count the number of straight angles through which the arrow turns.

3b. Prove: the angle sum of a polygon with n sides is 180(n-2) degrees.

Method: Just divide the polygon into n-2 triangles, each with one vertex at a common point.

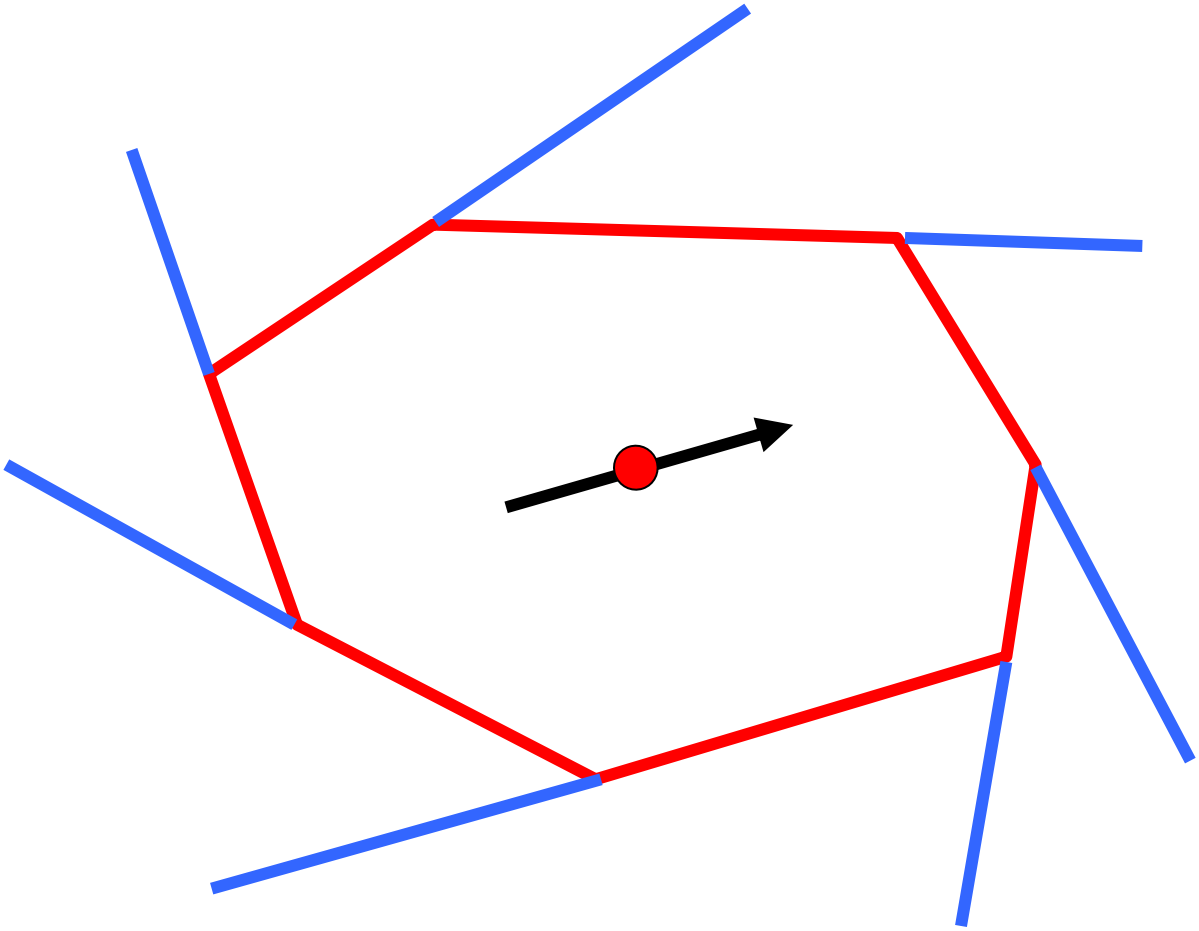


4a. Prove: the sum of the external angles of a convex polygon equals two straight angles.

Materials: one arrow cut from stiff paper

Method:
Draw any large convex polygon on the blackboard. Draw in the external angle on each side. Move the triangle around the polygon. After it has returned to its starting point, it has rotated through two straight angles.

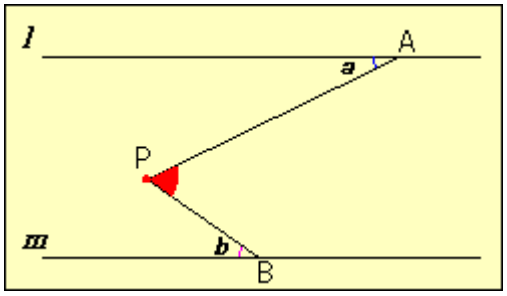
4b. Prove: The sum of the exterior angles of a convex polygon is two straight angles.



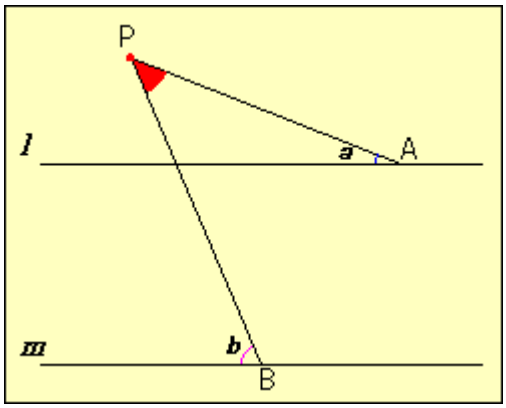
Parallel Lines – some surprising results

5. Lines *l* and *m* are parallel. A is a point on *l* and B is a point on *m*. Draw lines AP and BP to intersect at P, between the parallel lines. Mark angles *a* and *b* as in the diagram.

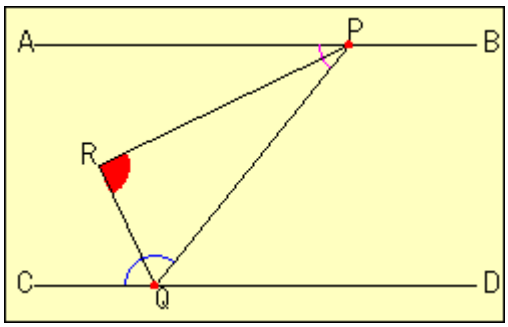
   Make a conjecture about ∠APB. You may wish to measure some angles to help you. Now prove it.



6. In the diagram below, lines *l* and *m* are parallel. BP interesects AP above line *l*. Angles *a* and *b* are as marked in the diagram. Prove that ∠APB = b - a



7. In the diagram bekow, PR bisects ∠APQ, and QR bisects ∠CQP. Prove that ∠PRQ is a right angle.



8. In the diagram, triangle ABC is isosceles. Find the size of the angle marked y. Clearly mark any other angles you need to find first. Give the reason for each angle that you mark in.