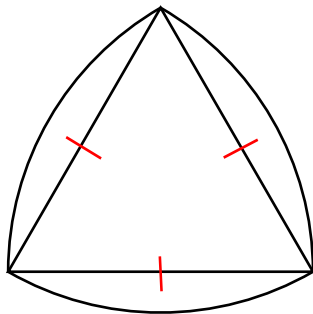


Constructing Shapes of Constant Width

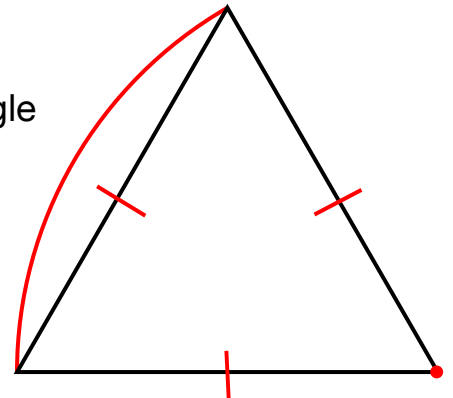
The Reuleaux Triangle is based around an equilateral triangle. An arc is drawn from each vertex of the triangle with a radius that is equal to the length of the side of the triangle.

1) We've started making a Reuleaux Triangle below; an arc has been drawn centred at the bottom right corner of the triangle. **Construct the other two arcs** on this Reuleaux triangle with a pair of compasses.

A complete Reuleaux Triangle



A Reuleaux Triangle for you to finish

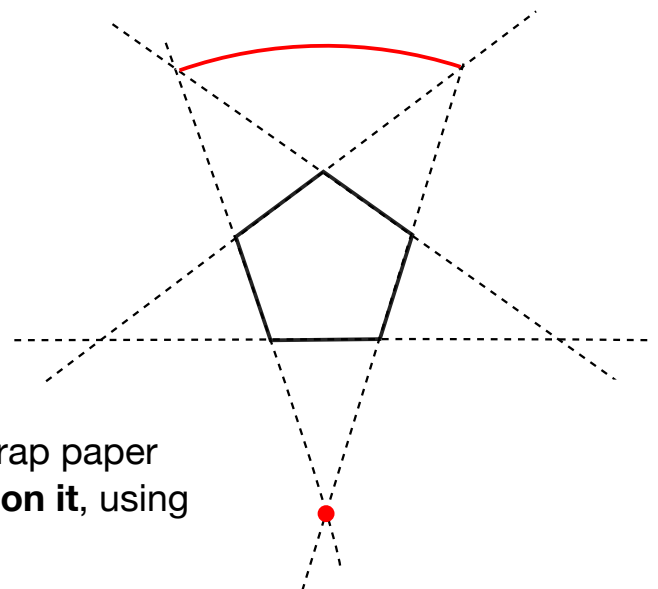
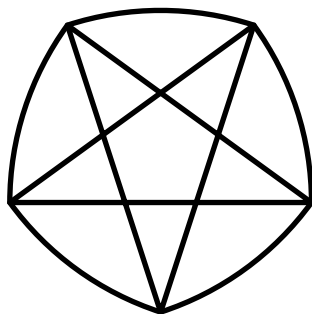


A shape of constant width can be constructed based on any regular other convex polygon with an odd number of sides by the **following method**:

- All the sides of the polygon are extended (the dashed lines in the diagram below), until they each cross over with another extended side. There will be the same number of crossing points as sides on the original shape.
- Choose a 'crossing point'. Draw an arc from that point, so that it connects the two points opposite it.
- Do the same for all the other crossing points.

2) **Finish constructing the shape of constant width below.** It is based on the regular pentagon in the centre. One arc has been drawn for you, centred at the bottom point.

A complete shape of constant width based on a regular pentagon

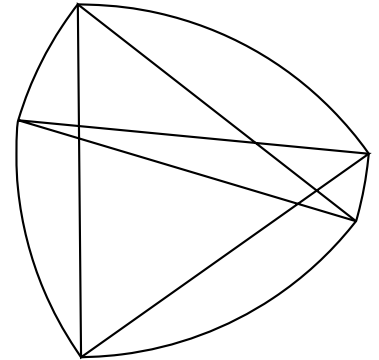


3) **Draw your own regular convex polygon** on scrap paper and **construct a shape of constant width based on it**, using the method above!

Constructing shapes of constant width

The convex polygon that a shape of constant width can be formed around need not be regular. However there is a slightly different method for constructing shapes of constant width from an irregular polygon. The shape on the right is based around an irregular pentagon at the centre.

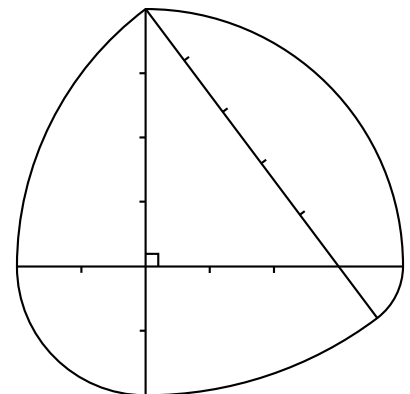
4) How does this shape of constant width differ from the shapes on the other page that were based around regular convex polygons?



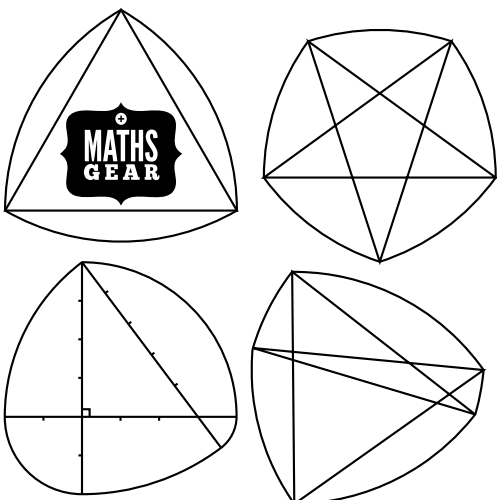
Coins are shapes of constant width. Vending machines measure a coin's width to identify which coin it is. The machine needs to be able to do this and get the same width regardless of the orientation of the coin.

5) On plain paper **construct either the 20p or 50p coin by using the construction method** outlined on the other page. You'll need to decide which polygon to start with and how to construct it!

In the shape on the right the space between little notches on a line show a unit of length.



6) By using the unit lengths to help you, explain why this is a shape of constant width.



Images of these four shapes of constant width are courtesy of Maths Gear.

Visit www.mathsgear.co.uk to buy this set of four shapes of constant width.

