6.1 Geometrical properties

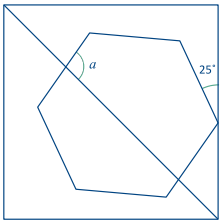
6.1.1 Understand and use angle properties (2)

This week's tasks require knowledge of the interior angles of various regular polygons.

The tasks can be classed as angle chasing tasks, but where the method of solution may not be immediately obvious and where it might help to add auxiliary lines or to transform part of the given figure, for example by a translation or rotation. As such the tasks encourage students to use and develop their visualisation skills.

The diagram shows a regular hexagon inside a square.

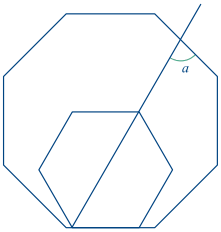
Find the size of angle a.



GeometricSparks — GEOM 02A — mathsmed.co.uk

The diagram shows a regular hexagon inside a regular octagon.

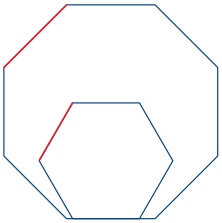
Find the size of angle a.



GeometricSparks — GEOM 02B — mathsmed.co.uk

The diagram shows a regular hexagon inside a regular octagon.

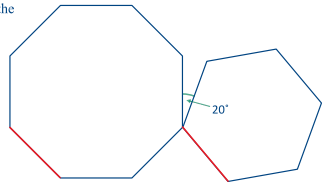
Find the size of the angle between the two red edges.



GeometricSparks — GEOM 02C — mathsmed.co.uk

The diagram shows a regular octagon and a regular hexagon.

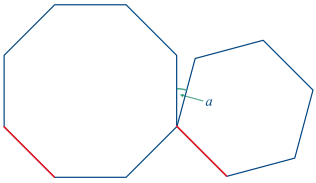
Find the size of the angle between the two red edges.



GeometricSparks — GEOM 02D — mathsmed.co.uk

The diagram shows a regular octagon and a regular hexagon.

Find the size of angle a if the two red edges are parallel.

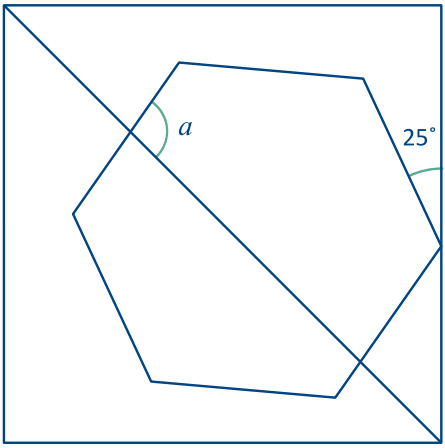


GeometricSparks — GEOM 02E — mathsmed.co.uk

Here we can use the fact that the given diagonal makes an angle of 45˚ with the sides of the square, and that the interior angle of a regular hexagon is 120˚.

The diagram shows a regular hexagon inside a square.

Find the size of angle a.



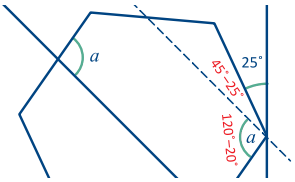
GeometricSparks©
Generating links with shapes in space

GEOM 02A

mathsmed.co.uk
© Maths Medicine - Dexter Graphics

A standard, 'static' way to solve this task, and perhaps the one that students are most likely to use, is to find the size of the angles in the triangle that one can see in the bottom-right of the given diagram. One of these is equal to angle a, one is 45˚, and the other is 180˚ – 25˚ – 120˚ = 35˚.
So a = 180˚ – 45˚ – 35˚ = 100˚.

Another approach is to translate the given diagonal, or draw an auxiliary line, to go through the point where the hexagon touches the square. In essence, this reduces the earlier triangle to a single point. This gives us a = 120˚ – (45˚ – 25˚).



Or we could rotate the hexagon clockwise through 25˚, which would reduce the size of angle a by 25˚. This gives us the relationship a – 25˚ = 45˚ + 30˚.