




Here are the full, or partial solutions.

## Year 8 and below

You have two, identical timer-sticks. Each stick takes exactly 60 minutes to burn along its whole length. The sticks burn non-uniformly: for example, one half of the length of a stick might burn in 15 minutes while the other half takes 45 minutes. You have a lighter to ignite the sticks.

Ignite at end 

How can you measure out 45 minutes?

## Solution

If we light one of the sticks at both ends, it will take half the original time, that is, 30 minutes, to burn completely. Notice that this is true even though the rate of burning along the stick is not uniform, this just means that the point where the two burning points meet may not be in the middle of the stick.

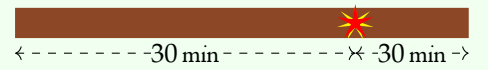

So, we light one of the sticks, Stick 1, at both ends, and we light the other stick, Stick 2, at one end.

Stick 1   
 Stick 2 

Thirty minutes later, Stick 1 finishes burning, and thirty minutes burning time is left on Stick 2.

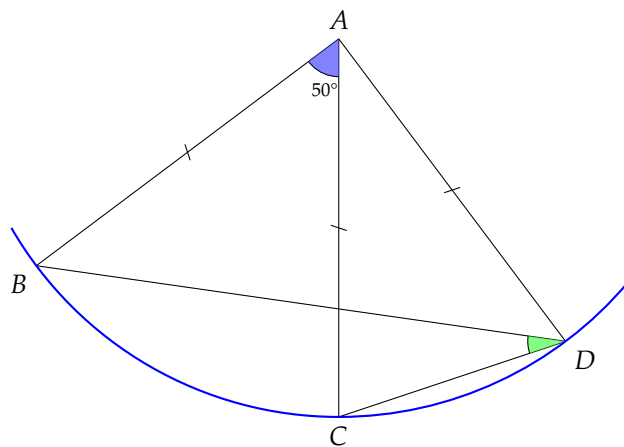
As soon as Stick 1 completes, we light the other end of Stick 2. With one end burning there were thirty minutes left, but with both ends burning, Stick 2 only has 15 min of burning time left.

So when Stick 2 is completely burned, 45 minutes will have elapsed.

Stick 1   
 Stick 2 

### Year 9 and above

Find the green angle.



### Solution

We are told that  $AB = AC = AD$ . If we take these three lengths as the radii of a circle centre  $A$ , then the arc  $BC$  subtends an angle of  $50^\circ$  at the centre.

We can see that the same arc  $BC$  subtends the green angle at  $D$  on the circumference of the circle.

By the circle theorem: angle at the centre is twice the angle at the circumference (see N<sup>o</sup> 16),  $\angle BDC = \frac{1}{2}\angle BAC$ , so the green angle is  $25^\circ$