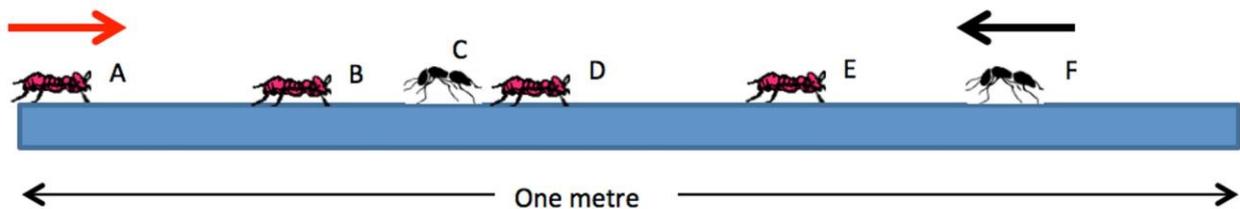


# The ant maths puzzle

By Rob Eastaway, UK

[Also found on the Guardian website here

[https://www.theguardian.com/science/2016/jan/18/can-you-solve-it-the-ants-on-a-stick-puzzle?CMP=share\\_btn\\_fb](https://www.theguardian.com/science/2016/jan/18/can-you-solve-it-the-ants-on-a-stick-puzzle?CMP=share_btn_fb)]



Four red ants and two black ants are walking along the edge of a one metre stick. The four red ants, called Alf, Bert, Derek and Ethel, are all walking from left to right as we look at the diagram, and the two black ants, Charlie and Freda, are walking from right to left.

The ants always walk at exactly one centimetre per second. Whenever they bump into another ant, they immediately turn around and walk in the other direction. And whenever they get to the end of a stick, they fall off.

Alf starts at the left hand end of the stick, while Bert starts 20.2 cm from the left, Derek is at 38.7cm, Ethel is at 64.9cm and Freda is at 81.8cm.

Charlie's position is not known - all we know is that he starts somewhere between Bert and Derek.

**So here is the puzzle: Which ant is the last to fall off the stick? And how long will it be before he or she does fall off?**

**The answer (also by Rob Eastaway):** Charlie falls off last after exactly 100 seconds.

**The workings:** Seasoned readers of this column will have immediately realised that the arbitrary-sounding distances - 20.2cm, 38.7cm, etc - were a decoy. These lengths were a sign that you needed to think laterally about the puzzle. No half-decent puzzle is going to require algebra or arithmetic with numbers like 20.2 and 38.7. Certainly not here!

Of course, it would be possible to work out the answer by calculating the positions but this will be messy. (Full marks for effort for all of you who tried to do it this way.)

The piece of insight that makes this an elegant puzzle is this: imagine two ants colliding and turning around. If you blur your eyes, this is equivalent to those two ants walking past each other. In other words, this puzzle can be treated as if it is six ants each on their own track walking to the end of the stick. Since Alf starts at the left end of the stick walking to the right, one of these 'blurred' ants will walk the maximum possible distance - the entire length of the stick - and then fall off. So, it will take 100 seconds - 1m at 1 cm per sec - until the last ant drops.

Or, as reader [William Guest](#) elegantly wrote in a comment, imagine that each ant has a leaf, and on each collision they exchange leaves. The leaves will be moving at 1cm per sec in a unique direction. The leaf that will take the longest to fall off the edge is the one that starts with Alf.

Now to the identity of the ant that falls last.

All we need to remember is that the order of the ants cannot change since they can't walk past each other. At the start, four ants are walking to the right. So four ants will drop off the right hand end. So the ant that is positioned fourth to the right will fall last. Stand up Charlie, that's you.

The fact that we don't know his position to start with is irrelevant.