

## When our Intuition Lets us Down

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If I am going to a party, and expect about 40 people to be there, I don't anticipate that any of them will have the same birthdate (11<sup>th</sup> May) as me. In fact, it seems to me not very likely that any two of the people there will have the same birthdate – after all, there are 365 possible birthdates, and 40 people are likely to be spread out amongst those different possibilities.

This same sort of thinking makes me surprised every time there are two consecutive numbers in the Lotto draw, like 3 – 23 – **35** – **36** – 43 – 49

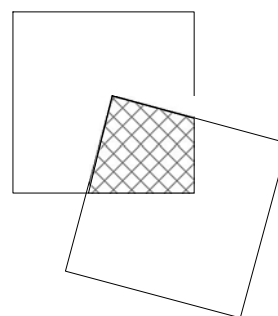
These are a couple of examples of occasions when my intuition is plain wrong (and I suspect that you would also have been wrong). In the case of the party, there is a probability of just under 0,9 that there will be two people with the same birthdate; in fact it is a good bet that there will be such a pair even if the party has dwindled to 23 people. As for the Lotto example, even though we are selecting 6 from 50, those 6 will contain two consecutive numbers about half the time.

Of course probability and chance are areas which are notoriously treacherous, and the maths behind them is seldom simple. But here are a few other examples.

1. If I put a belt around my waist, and it fits, and then I take the belt off and make it a metre longer (which means that I more than double its length), then when I try to put it around my waist again I get a gap. Assuming that I can find a way to make that gap the same all the way round my body, what is the size of the gap? About 16 cm, easily wide enough for me to pass my hand through. Now suppose that we do the same with the Earth: this time the belt around the equator is initially 40 million metres long, and again we add 1 extra metre, and again we adjust the gap to be the same all the way round. Intuition tells you that you will not be able to pass your hand through the gap, nor a mouse .... In fact, it would probably surprise you to find that a sheet of paper could pass through that gap. But actually the gap would be 16 cm – exactly the same as when we had the belt around my body.

2. 'Lattice points' are the points in a coordinate system whose coordinates are both whole numbers. One would certainly expect that choosing three of those to define a triangle could lead to all sorts of different areas for the triangle, and that many of those areas would be irrational – but in fact it is not only impossible to create such a triangle with irrational area, the area of such a triangle will always be  $N/2$  where  $N$  is a natural number. In other words the area will either be a whole number or will differ from a whole number by  $\frac{1}{2}$  !

3. If two identical squares are arranged so that a corner of one lies at the centre of the other, then clearly there is an overlap. As the orientation of the squares changes, so the shape of that overlap changes, and presumably the area of it too – but, no, that area actually remains constant.



The maths that proves that our intuition is misleading is remarkably simple and accessible to any Gr 9 learner – and therein lies the beauty: a little maths can go a long way. As educators we need to be constantly demonstrating to our learners that maths is not just a collection of tricks or rules, but that it has real power. We need to be looking for opportunities such as the ones illustrated by these examples to demonstrate that power, because then we help our students to appreciate why maths is regarded as so important.