Exploring mathematics: maths in nature and art

The last universalist

Dr Michael Barnsley
I'm a mathematician. About seven years ago I left the Georgia Institute of Technology to found a company. The work that all of the employees are engaged in derives from a mathematical theorem. The work that they do will potentially influence the way you look at pictures on television in the future.

V/O Francesca Hunt
This is the story of one hundred years of maths research, leading to a very profitable application, but starting with an intriguing mistake by one of the world's greatest mathematicians.

Dr June Barrow-Green
This is the Mittag Leffler Institute in Stockholm and this is really where our story starts. In 1884 the King of Sweden and Norway, Oscar II, asked the Swedish professor of mathematics, Josta Mittag Leffler, whose beautiful house this is, to organise a mathematical competition for him to celebrate the king's sixtieth birthday in 1889. One of the questions they wanted to resolve was whether it was possible to prove mathematically the stability of the solar system. We know from observations that the planets will continue to move in the way that they always have done for a long time into the future, but it's another thing to know that they will always move in that way, and this was the question that they really wanted an answer to. And one of the entrants to this competition was the brilliant young French mathematician, Henri Poincaré.

Prof. Ian Stewart
Well Poincaré is without doubt one of the leading mathematicians of all time. He's known as the last Universalist. That means he was the last mathematician who really understood pretty much the whole subject, it's just got too big since then, and so he's not going to try for a prize unless it's really important.

V/O Francesca Hunt
It might seem obvious that the heavenly bodies behave in a stable and predictable way, but King Oscar's prize offered mathematicians a chance to prove it.

Prof. Ian Stewart
Now before Poincaré people knew about the motion of two bodies. They go round and round each other in ellipses, rather like this. Poincaré wanted to know what would happen if there were lots more bodies, and he focused in on three bodies. Now that's a bit like we have here, only here we have three magnets, two of which are actually fixed. So the question is not just, if I let go what will it do, the question is, what can we prove about it mathematically in general?

V/O Francesca Hunt
Poincaré showed that in one situation there are indeed periodic solutions which give repeating patterns of movement that remain stable over time. However, although Poincaré brought new skills and vision to this problem, it turns out that he didn't get it all right the first time.