Mathematical Table Balancing

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My investigation focused on a topic that, mathematically speaking, is somewhat out of the ordinary, but in practical terms is a problem that has confronted society for thousands of years. Essentially, the problem is this: Can a wobbly table always be made to balance?

Thinking of a square table just as the endpoints of its four legs, a simple application of the intermediate value theorem can show that simply rotating such a table about its centre on any continuous ground will give a position where the ends of all four legs are on the ground. Restricting the slope of the ground can ensure that the balancing position found does not result in the ground intersecting the legs or top of the table.

Table balancing can be extended by defining stricter balancing conditions, with the top of the table having to be horizontal as well as all 4 legs touching the ground. It is clear that such balancing cannot be achieved on all types of ground, but if we have a ground which is zero everywhere except for a convex “hill”, we can always balance a square table horizontally on top of the hill.

The majority of my project was spent familiarising myself with the mathematics behind the proofs of the claims made above and related ideas. As well as this, I spent some time pondering problems still open in the field, such as the horizontal balancing of any table with legs forming a concircular quadrilateral.

Overall, my project gave me a good feel for the differences between learning mathematics in a research-based environment in comparison to a structured course, and I found it rewarding to be able to explore a given topic more thoroughly that I have been able to previously.

Scott was an AMSI/MASCOS vacation scholar for 2007-8.