THE ELASTIC COASTLINE

In the last issue, we posed the innocent question: "How long is the coast of Australia?" Some sceptical readers have queried our conclusion, which was, as you will recall, that the question is not as innocent as it seems. The following table of published estimates of the length of our coast makes this quite dramatic.

C. R. Stone, "Australian Landforms" (1974)	8000 km
D. L. Inman and C. E. Nordstrom (1971)	14,900 km
E. D. Gill, "Coasts of Australia" (1975)	15,800 km
"Australian Handbook" (1974)	19,320 km
"Australian Encyclopaedia" (1958)	19,658 km
"Year Book of Australia" (1974)	36,735 km
R.W. Galloway and M.E. Bahr (1979)	47,070 km
Parabola (1981)	∞

(Observe how the length has tended to increase over the years, demonstrating yet again that Parabola is way ahead of its time.)

The problems confronting the would-be coast-line measurer are many and the report by Galloway and Bahr in the Australian Geographer, Volume 14 (1979), pages 244-247, makes interesting reading. Their measurements were based on the 1:250000 series of maps of Australia, modified by some artificial, but necessary, conventions. For example, estuaries and inlets were cut off as soon as their width fell below 1 km, thereby joining Kirribilli Point to Garden Island. (It is predicted that the burgeoning yacht fleet on Sydney Harbour will actually achieve this by 1984.) Islands with area less than 12 hectares were ignored, but Tasmania was included. With all this agreed, the coastline was measured with fine wire laid on the 162 maps covering the coast! This procedure was roughly equivalent to walking a measuring rod of length 0.7 km around the coast. (Compare method 1 in the article in Parabola, Volume 17, number 2.) Further measurements corresponding to measuring rods of different lengths confirmed the empirical law that the measured length of the coast obtained with a measuring rod of length L km is proportional to $L^{-0.13}$. Apparently, it is not possible to assign a length to the coast until the length scale L has been specified. For example, by extrapolating the data, we can obtain a length for the coast corresponding to a measuring rod of length 1 mm. It is 185,000 km, which is more than four times the circumference of the earth.

How long is the coast of Australia? The answer is that it all depends on the purpose of the measurement. For an oyster, the appropriate length scale might be 1 cm, for a real estate developer, it might be 25 m (or perhaps less), for the coast-guard, it might be 1 km. I must go down to the sea again to see if the shore's still there.

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H.S.C. CORNER BY TREVOR

Some of you are facing one of the most important examination of your life in the immediate future. I hope that Parabola in general and Trevor's Corner in particular helped you in your preparations.

We all wish you good luck and a cool head!

A Problem on Conic Sections

Let S be a focus and P a variable point on the ellipse. Show that the locus of the mid-point of SP is an ellipse and find its centre.

The equation of the ellipse is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ or in parrametric form } P(a\cos\theta, b\sin\theta)$$

the focus S has co-ordinates (ae,0). The mid-point of SP is then

$$(x',y') = \left(\frac{ae + a\cos\theta}{2}, \frac{b\sin\theta}{2}\right)$$

and $2x' - ae = x$ $2y' = y$. These clearly satisfy the ellipse equation, so

$$\left(\frac{2x' - ae}{a}\right)^2 + \left(\frac{2y'}{b}\right)^2 = 1 \text{ and after}$$

rearranging we get

$$\frac{\left(x' - \frac{ae}{2}\right)^2}{\left(\frac{a}{2}\right)^2} + \frac{y'^2}{\left(\frac{b}{2}\right)^2} = 1 \text{ clearly}$$

an ellipse with centre at $\left(\frac{ae}{2}, 0\right)$, with semi-major and semi-minor axes $\frac{a}{2}$ and $\frac{b}{2}$.

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