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Asymptotic Behaviour of the Maximum Curvature of Lamé Curves

The curve $|x/a|^p + |y/b|^p = 1$ for $a, b, p > 0$ in the xy-plane is called a Lamé curve. It is also known as a superellipse and is one of the symbols of Scandinavian design. For fixed a and b, the above curve expands as p increases and shrinks as p decreases. The curve converges to a rectangle as $p \to \infty$, while it converges to a cross shape as $p \to 0^+$. In general, if $p > 2$, Lamé curves have shapes which lie between ellipses and rectangles. From the viewpoint of application, one of the fundamental problems is to detect the "optimal" value of the exponent p which creates the "most refined" shape. With this in mind, we closely examine how the curvature of Lamé curves depends on p. In particular, we derive an explicit expression of the asymptote of the maximum curvature, which is the main result of this paper.

Keywords: Lame curve, superellipse, curvature, maximum curvature.

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