PEDAL CURVES PROJECT

DIFFERENTIAL GEOMETRY, SPRING 2015

Central Theme

This project is about a classical construction for planar curves called the *pedal curve*. This should provide opportunity to explore interesting curves and their parametrizations.

Minimum Requirements

Write a paper exploring the basics of pedal curves.

- 7-10 pages, in LaTeX, with attention paid to standard English grammar, spelling and usage.
- Give a clear definition of the pedal curve associated to a given curve and a given point.
- Compute several examples, including at least these: a line, a circle, the conchoid of Nicomedes, the folium of Descartes, and the figure eight curve.
- Include images where appropriate.
- For each example, give a parametrization of the curve and its pedal curve with respect to the origin.
- Prove the theorem below.

Theorem (Struik 1.13.15)**.** *Suppose that α is a given curve, and β is the pedal curve of α with respect to a given point A. If P is a point on α and Q is the corresponding point on β, then AQ makes the same angles with the pedal curve β as AP makes with α.*

Extensions to Explore

Compute the pedal curves of the examples with respect to other points. How does the shape of the pedal curve change if the point changes?

Resources

Struik makes explicit mention of pedal curves in the exercises in §1.13.

There is a list of classical planar curves you might find helpful here: `http://www-history.mcs.st-and.ac.uk/Curves/Curves.html`