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Poncelet's Closure Theorem: *Let C and D be two plane conics. If it is possible to find, for a given $n > 2$, one n-sided polygon that is simultaneously inscribed in C and outscribed about D (all of its edges are tangent to D), then it is possible to find infinitely many of them. Each point of C is a vertex, and each point of D is a tangency of one such polygon.*

1. Consider a circle A of radius $2\sqrt{2}$ centered at $(0, 0)$, and cricle B of radius 1 centered at $(1, 1)$. Prove that there does not exist *any* triangles which are inscribed in A and outscribed about B. {Hint: use line $y = x$ to consider creating an isosceles triangle.}

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Assume a **billiard table** is a convex domain with a smooth boundary cruve F. A **caustic** is a curve f inside a billiard table with the following property: if a segment of a billiard trajectory is tangent to f, then so is each reflected segment. We discussed recovering boundary curve F from caustic f using a *string construction*: wrap a closed nonelastic string around f, pull it tight at a point, and move this point around f to obtain a curve F'.

Nice references: https://www.math.psu.edu/tabachni/prints/grid.pdf
http://www.math.hardvard.edu/~knill/oldinterests/stringconf/triangle.pdf

2. Instead of a smooth convex caustic f, consider we had any convex polygon. We consider a string construction with string length k. As we let k approach infinity, what shape of curve F' do we approach?

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Here are some (very!) interesting dynamical systems videos. **Duhem's Bull** is the 5^{th} video.

3. http://www.youtube.com/playlist?list=PLelIK3uylPMHTEZ0hEx3PshdSx6awKmxa