Two cycles (oriented circles) touch if they are tangent as circles and if they have the same tangent direction at their point of tangency.

**Theorem (Pythagoras - Laguerre)** Let $A$, $B$, $C$, $D$ be four cycles such that each touches the next (cyclically) and the four points of tangency are collinear. If $C$ is any cycle touching $R$ and $S$, then the square of the tangential distance from $A$ to $B$ is the sum of the squares of the tangential distances from $B$ to $C$ and from $C$ to $A$.

There is a Euclidean proof of this particular theorem, but it is not completely trivial. We obtained it by applying a Laguerre transformation to the classical Pythagorean theorem.

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Points of tangency collinear

\[ a + b = c \]

R and S of same radius & opposite orientations

\[ a^2 + b^2 = c^2 \]
Figure 8. Octahedron in $M^3$. All edges but those in plane $ABCD$ are light-like.

Figure 9. Octahedron from $\Pi^2_E$. Cycles $A,M,B$ have a common center of similitude as do cycles $C,M,D$ and $R,M,S$. 
Figure 10. Perspective view of the proof
Figure 14. Steiner power in the Minkowski plane

Figure 15. Laguerre transformation of Steiner power in the Minkowski plane