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# Orbits of the Kepler problem via polar reciprocals

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It is argued that, for motion in a central force field, polar reciprocals of trajectories are an elegant alternative to hodographs. The principal advantage of polar reciprocals is that the transformation from a trajectory to its polar reciprocal is its own inverse. The form of polar reciprocals of Kepler problem orbits is established, and then the orbits themselves are shown to be conic sections using the fact that the polar reciprocal of a conic section is a conic section. A geometrical construction is presented for the orbits of the Kepler problem starting from their polar reciprocals. No obscure knowledge of conics is required to demonstrate the validity of the method. Unlike a graphical procedure suggested by Feynman (and amended by Derbes), the algorithm based on polar reciprocals works without alteration for all three kinds of trajectories in the Kepler problem (elliptical, parabolic, and hyperbolic).

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