

## 57.11: Bertrand's Theorem

There is a theorem in classical mechanics called Bertrand's theorem, which proves that there are only two types of force law that can possibly lead to closed orbits (orbits for which the particle eventually retraces its own footsteps):

1. An inverse-square law force  $F \propto 1/r^2$  (e.g. gravity or electrostatics); and
2. A Hooke's law force  $F \propto r$  (e.g. a spring).

For a proof of Bertrand's theorem, see Appendix A of Ref. [8].

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