The orbit of a particle of mass \( m \) moving in a central force field \( F(r) \) is a circle passing through the origin, namely

\[
r(\theta) = r_0 \cos(\theta) \quad \theta \in [-\pi/2, \pi/2],
\]

where \( r \) is the distance from the center of force, \( \theta \) is the angular displacement, and \( r_0 \) is the distance from the center of force at \( \theta = 0 \), i.e. the diameter of the circle.

(a) Using the equation of the orbit

\[
\frac{d^2}{d\theta^2} \left( \frac{1}{r} \right) + \frac{1}{r} = -\frac{mr^2}{l^2} F(r),
\]

where \( l \) is the magnitude of the conserved angular momentum, show that the central force \( F(r) \) varies like the inverse of the fifth power of \( r \) according to the law:

\[
F(r) = -\frac{2r_0^2l^2}{m} \frac{1}{r^5}.
\]

(b) Find the potential energy \( U(r) \) corresponding to \( F(r) \), write the total mechanical energy of the particle, and define the effective potential \( V_{\text{eff}}(r) \). Roughly sketch the shape of \( V_{\text{eff}}(r) \).

(c) Does this potential admit a circular orbit?