8-9) Initially $E = -\frac{k}{2R}$, $\ell = \sqrt{k\mu R}$, $u(R) = -\frac{k}{R}$, $T = \frac{mv^2}{2} = \frac{k}{2R}$

After the rocket fires

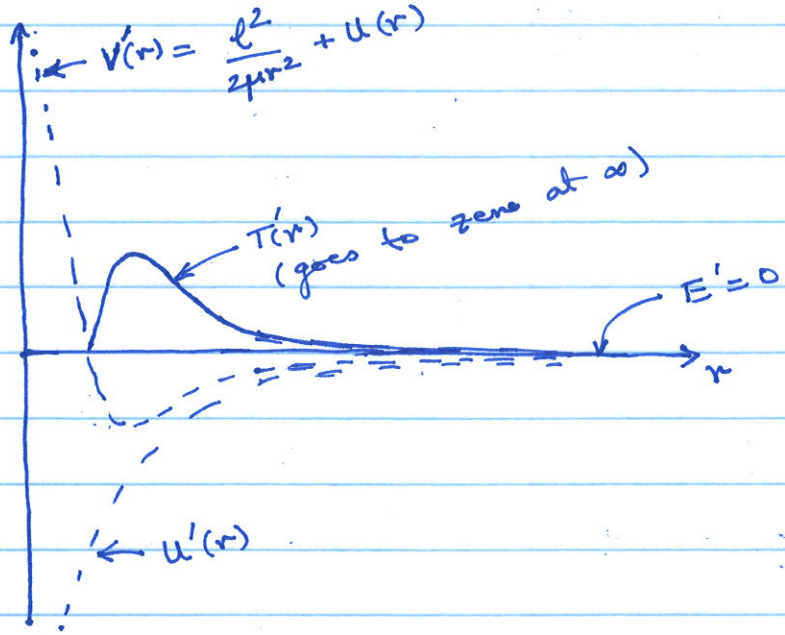
$T' = \frac{mv^2}{2} + \frac{mv^2}{2} = mv^2$. Thus, $E' = \frac{k}{R} - \frac{k}{R} = 0$.

$\ell' = \ell$ since the impulse is in the direction of $\vec{r}$.

Thus,

(a) $E'/E = 0$ and $\ell'/\ell = 1$.

(b) Since $E' = 0$ the rocket escapes to infinity in a barely elliptical i.e., in a parabolic orbit.



Note that only one turning point is at finite r.