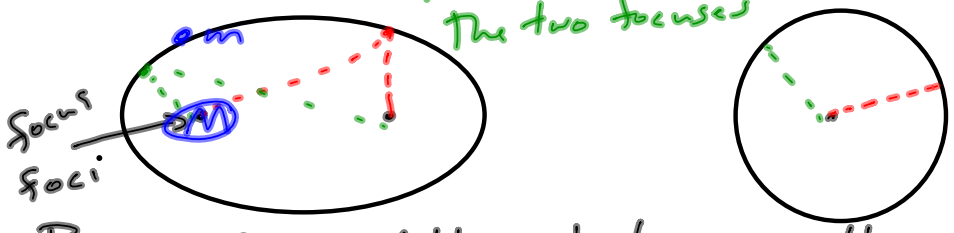
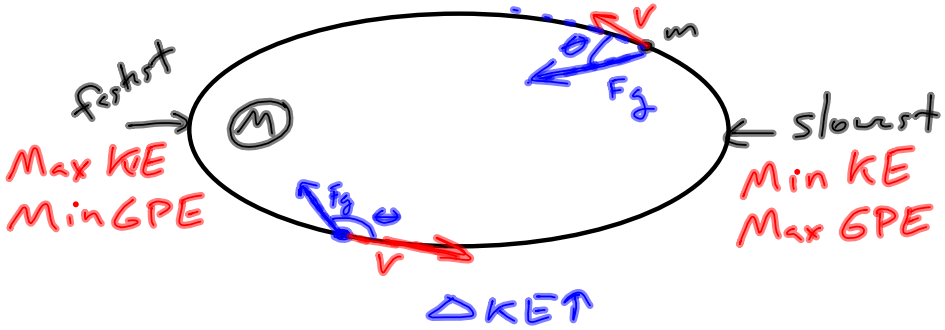
Ellipses: all points on an ellipse are the same total distance from the two foci



Reminder: All orbits are ellipses with the center of mass at a focus

- Forces between the objects are equal and opposite but the force increases when they are closer together

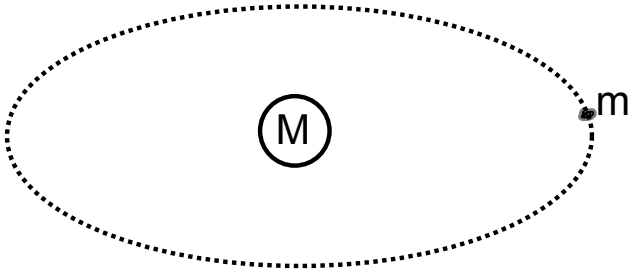
Energy



$\Delta E = W = F_g \cdot \Delta d \cos\theta$

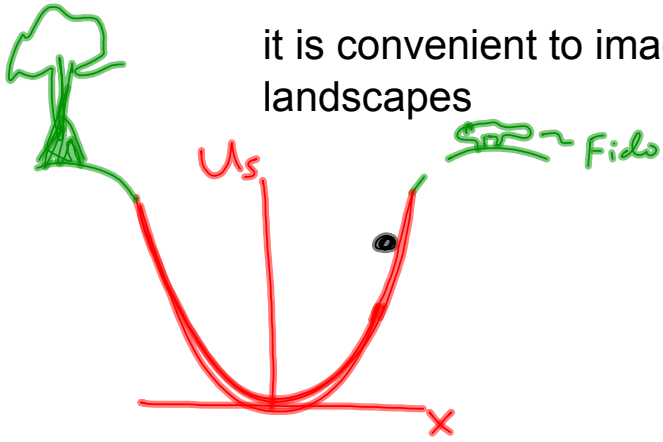
as an object moves toward the centre of mass, Positive work is done by gravity => K E increases.

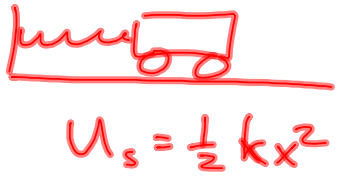
as an object moves away from the centre of mass, negative work is done by gravity => K E decreases

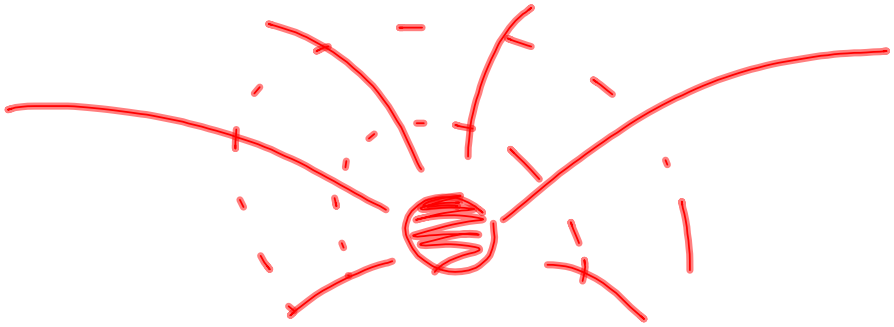


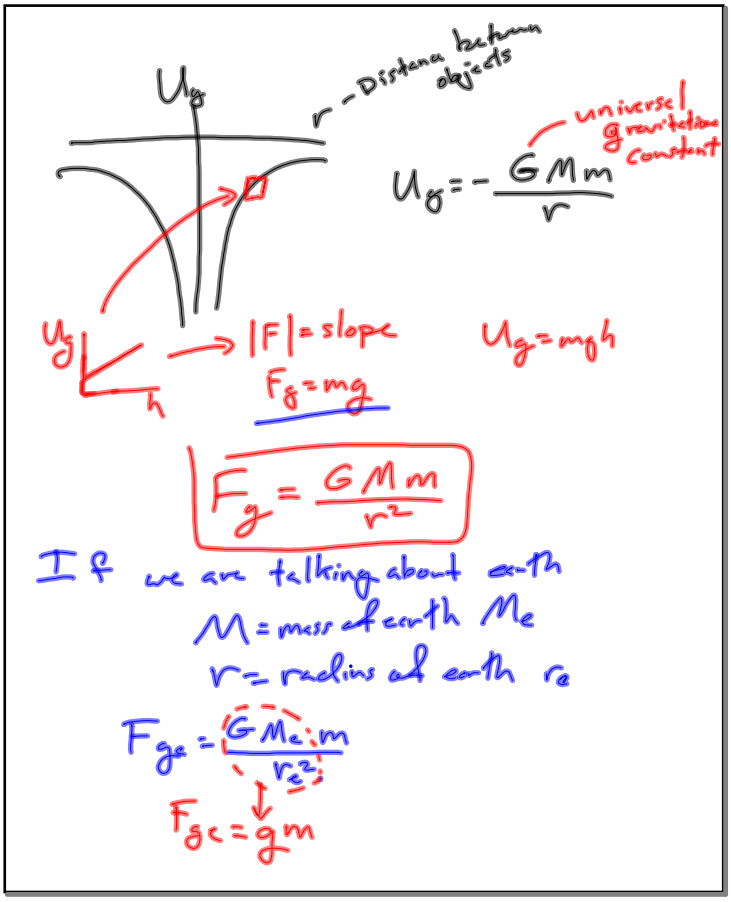
Potential Surfaces and forces

it is convenient to imagine potential Energy as landscapes








U_g
r - Distance between objects
$U_g = -\frac{GMm}{r}$
universal gravitation constant
U_g
h
$|F|$ = slope
$U_g = mgh$
$F_g = mg$
$F_g = \frac{GMm}{r^2}$
If we are talking about earth
M = mass of earth M_e
r = radius of earth r_e
$F_{ge} = \frac{GM_e m}{r_e^2}$
$F_{ge} = gm$