

5. The gravitational force between the two parts is

$$F = \frac{Gm(M-m)}{r^2} = \frac{G}{r^2} (mM - m^2)$$

which we differentiate with respect to  $m$  and set equal to zero:

$$\frac{dF}{dm} = 0 = \frac{G}{r^2} (M - 2m) \implies M = 2m$$

which leads to the result  $m/M = 1/2$ .