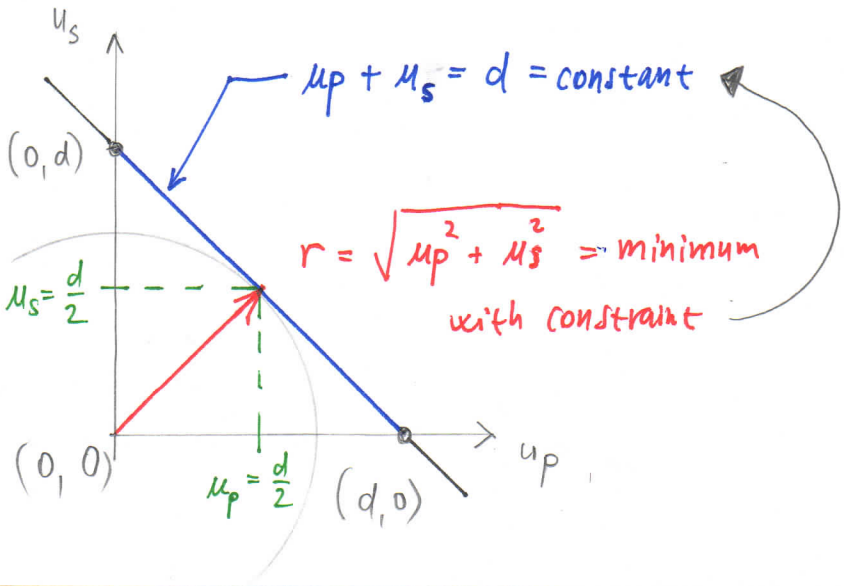


$u_p + u_s = d \Rightarrow u_s = d - u_p$

Minimize: $r^2 = u_p^2 + u_s^2$, with

$$r^2 = u_p^2 + (d - u_p)^2$$

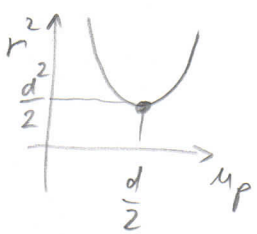
$$r^2 = u_p^2 + d^2 - 2d u_p + u_p^2$$

$$r^2 = 2u_p^2 - 2u_p d + d^2$$

$$r^2 = 2\left[u_p^2 - 2u_p \frac{d}{2} + \frac{d^2}{2}\right]$$

$$r^2 = 2\left[u_p^2 - 2u_p \frac{d}{2} + \left(\frac{d}{2}\right)^2 + \frac{d^2}{4}\right]$$

$$r^2 = 2\left[\left(u_p - \frac{d}{2}\right)^2 + \frac{d^2}{4}\right]$$



r^2 = minimum at $u_p = \frac{d}{2} = u_s$

$$r_{min}^2 = \frac{d^2}{2} \Rightarrow r_{min} = \frac{d}{\sqrt{2}} = \left(\frac{d}{2}\right)\sqrt{2}$$

as in the above drawing