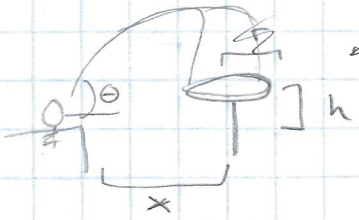
20-P-KM-AF-011

Curvilinear Motion:

Q: An important part of game development is the physics of it. ~~Mario~~ Mario typically jumps with angle $\theta = A°$. What is the max and minimum speed must Mario jump to make it on to the mushroom if the gravity in this game is ~~-8 m/s~~ -B m/s.



use surface area ↑ give area

A:

$$x = x_0 + v_{0x} t$$

$$x - r = 0 + \cos(\theta) \cdot v \cdot t \quad \Rightarrow \quad v = \frac{x-r}{(\cos(\theta) t)}$$

$$h = s_0 + v \cdot \sin(\theta) \cdot t + \tfrac{1}{2}(-g) t^2$$

$$h = \tan\theta\,(x-r) - 4t^2$$

$$4t^2 = \tan(\theta)(x-r) - h \quad \Rightarrow \quad t^2 = \frac{\tan(\theta)(x-r) - h}{4} \quad \Rightarrow \quad t = \sqrt{\frac{\tan(\theta)(x-r) - h}{4}}$$

$$r = \sqrt{\frac{\text{area}}{\pi}}$$

$$v = \frac{x-r}{\cos(\theta) t}$$

(use $x+r$ for max.)

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