What You Need to Know

- Use equations of kinematics to solve problem in 1D and 2D

$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$\Delta x = \frac{1}{2}(v_0 + v_f)t$$

$$2a\Delta x = {v_f}^2 - {v_0}^2$$

$g = 9.81\ m/s^2 \Downarrow$

- Tell the direction of acceleration from change in velocity

speeding up $\Leftrightarrow$ $\vec{v}$ and $\vec{a}$ point in same direction

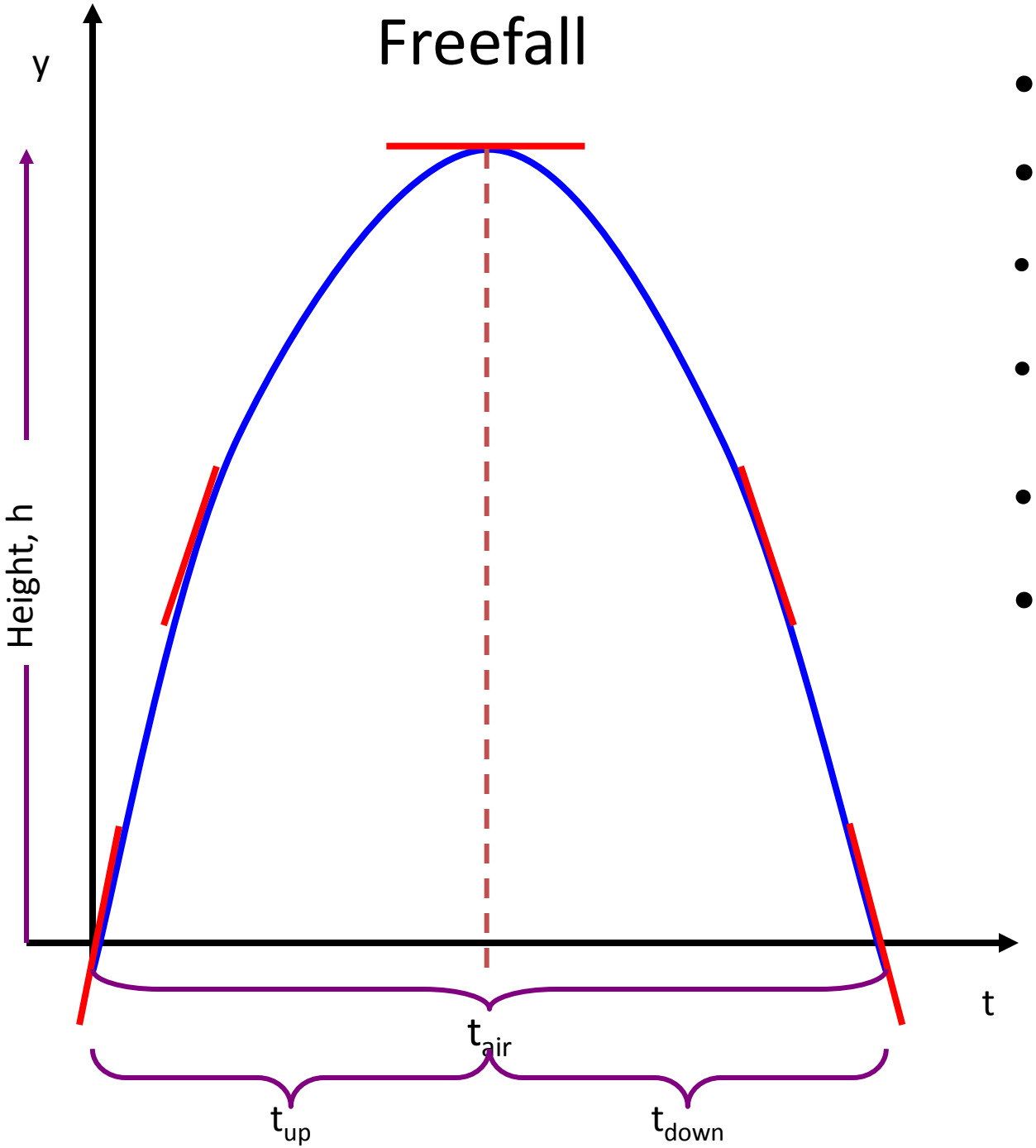
slowing down $\Leftrightarrow$ $\vec{v}$ and $\vec{a}$ point in opposite directions

- If $\vec{a}$ is at an angle to $\vec{v}$, the object turns

$$\vec{v} = \vec{v}_0 + \vec{a}t,$$

if t is large, $\vec{v}$ & $\vec{a}$ point same direction

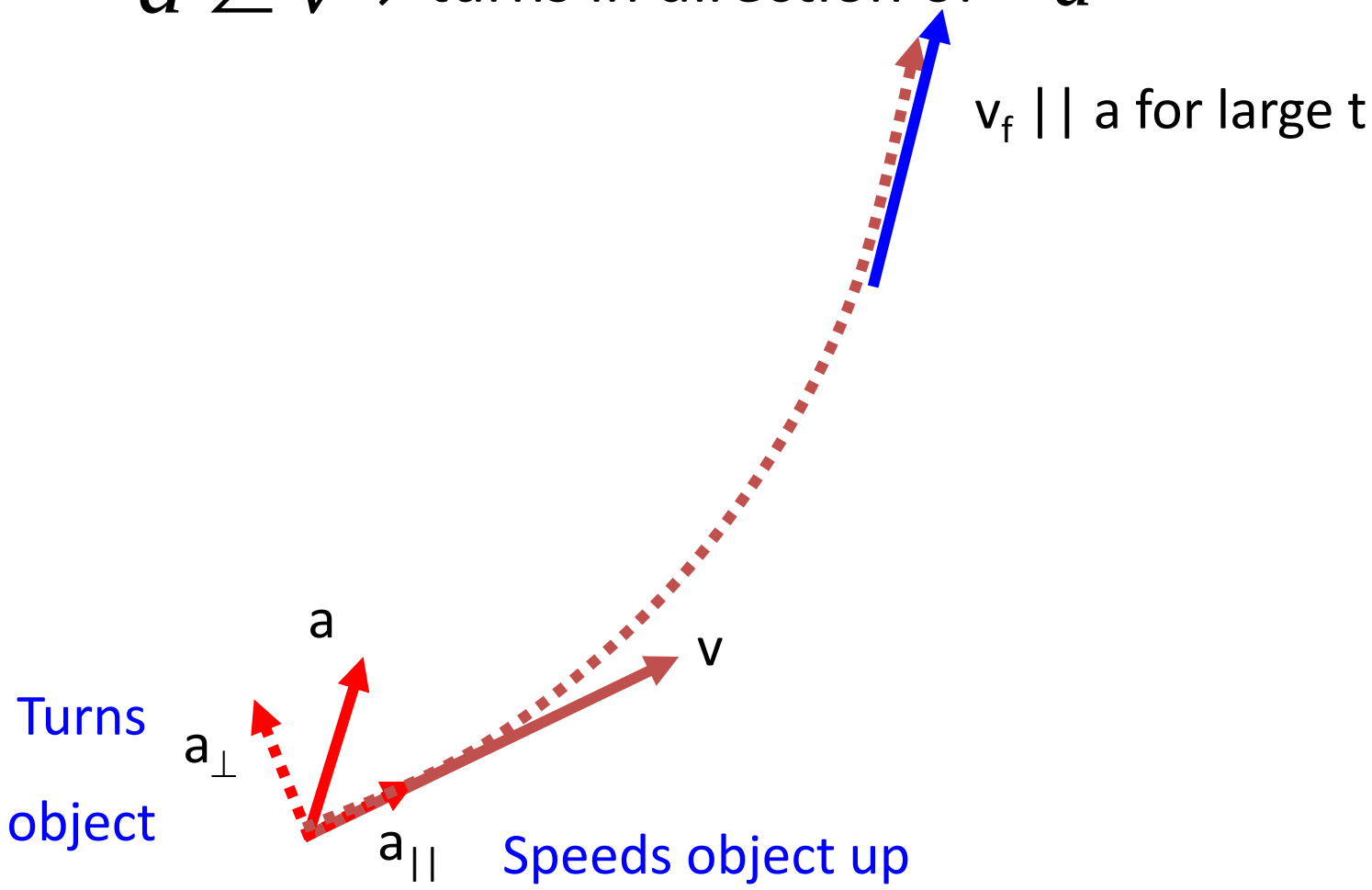
Freefall



- Symmetric
- $t_{up} = t_{down} = \frac{1}{2} t_{air}$
- $\vec{v}_{up}(h) = -\vec{v}_{down}(h)$
- $\vec{v}_{top}(h_{\max}) = 0$
- $2gh = v_0^2$
- $t_{air} = 2v_0/g$

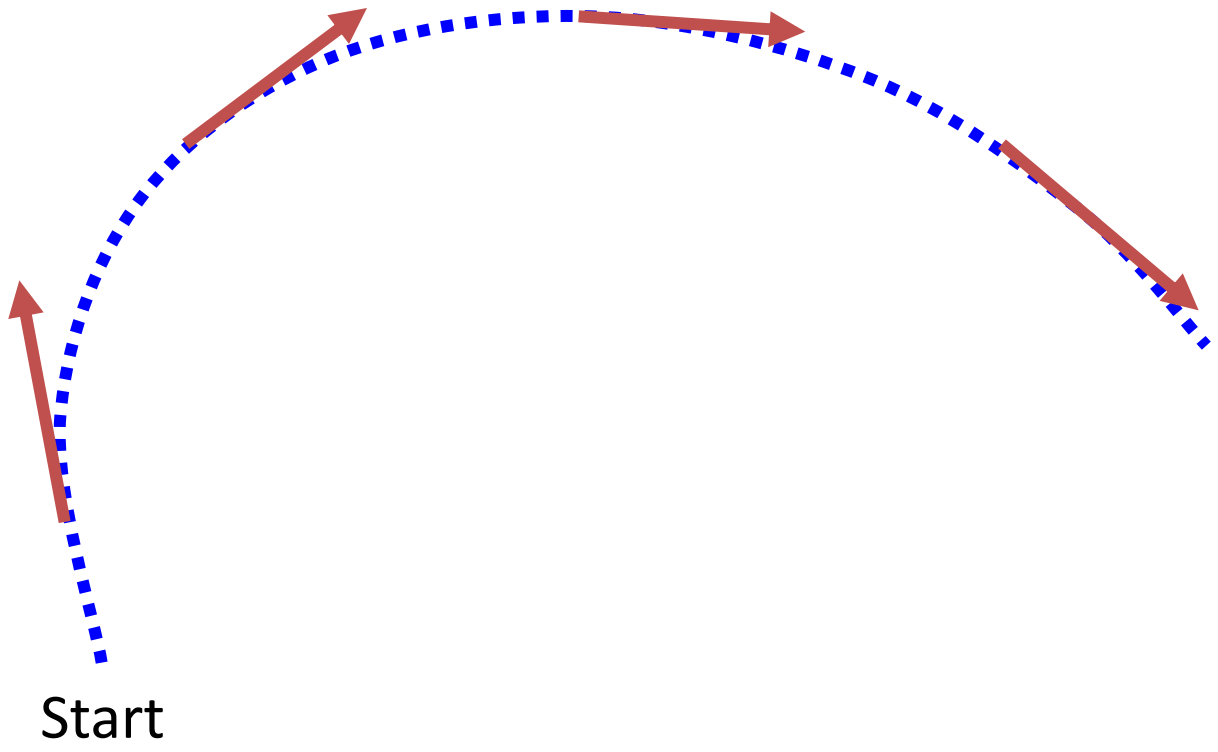
OHQ

$\vec{a} \angle \vec{v} \rightarrow$ turns in direction of $\vec{a}$

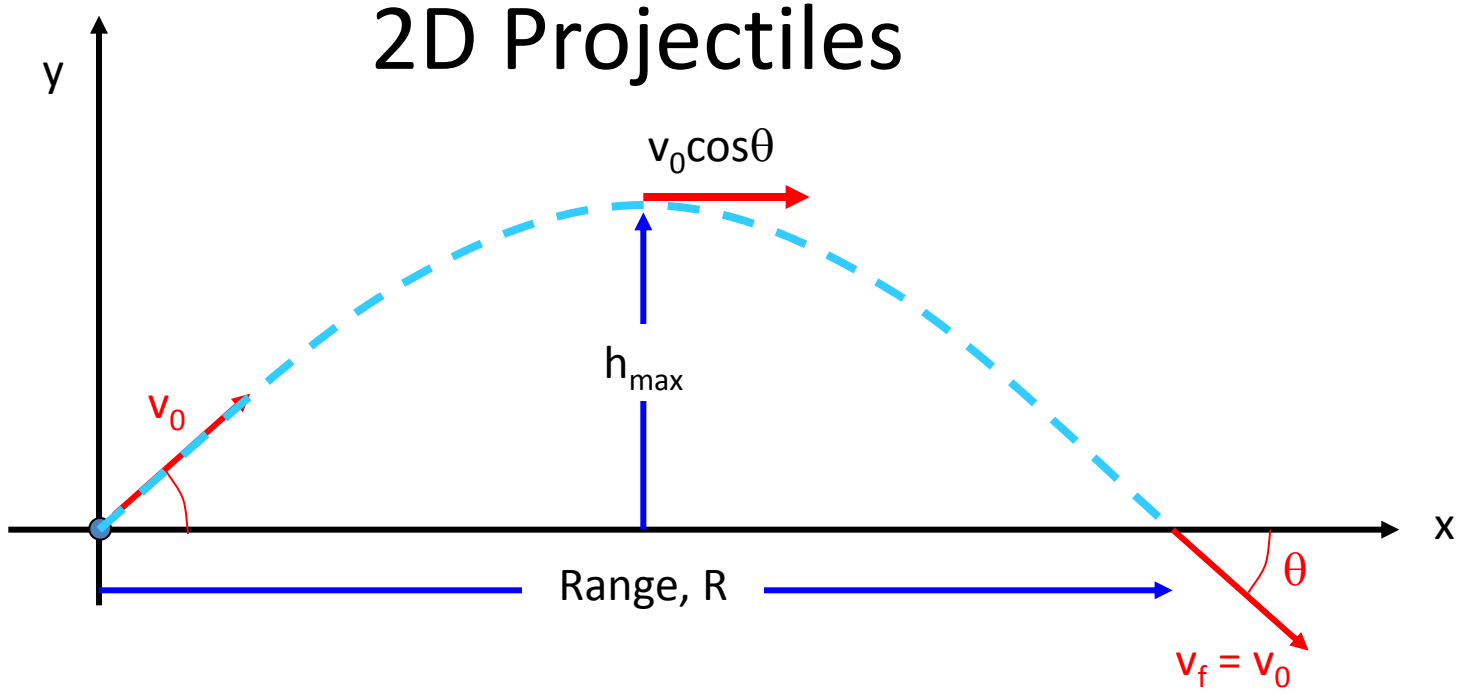


Motion in 2D

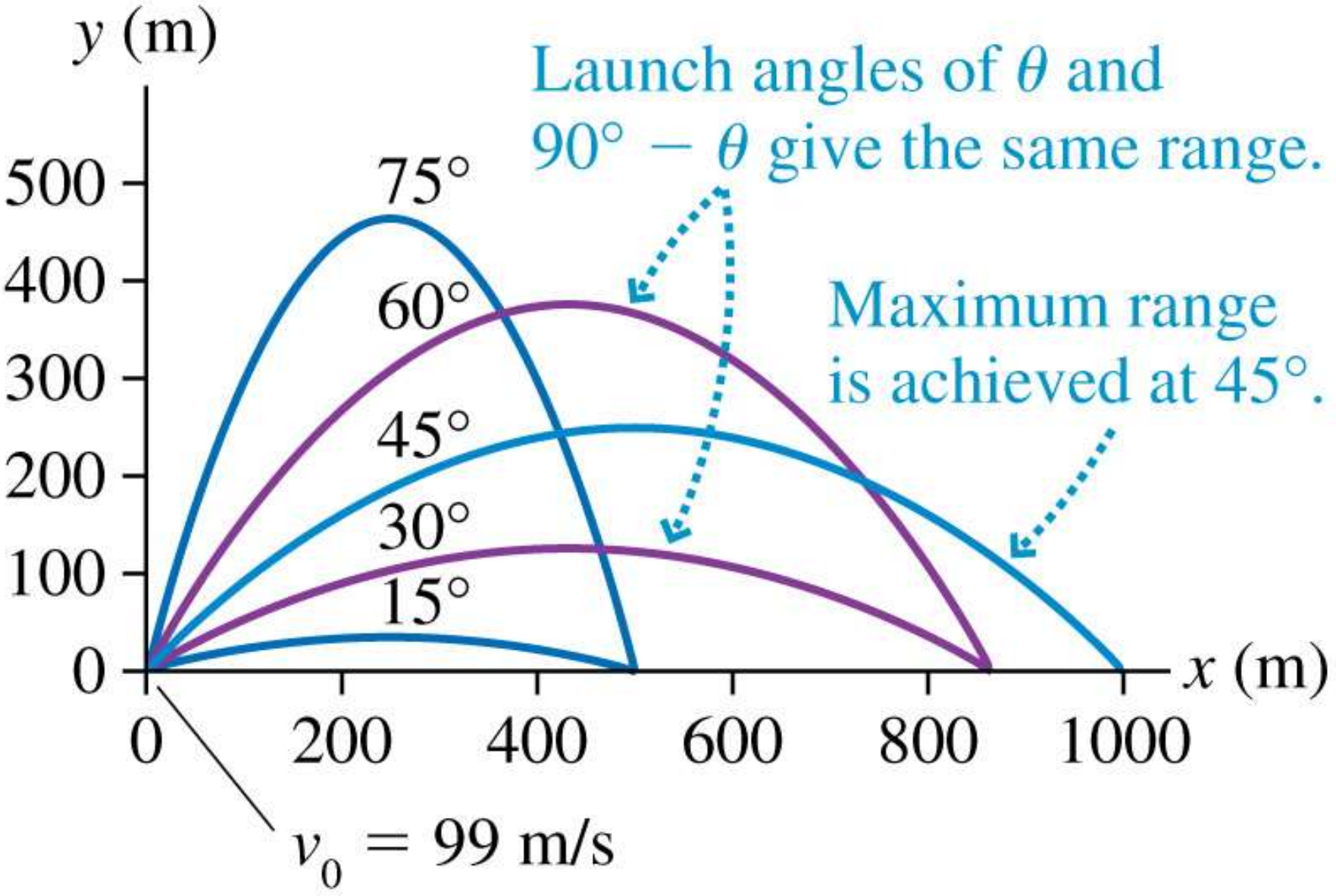
v tangent to x-y trajectory



2D Projectiles



- Symmetric
- $t_{up} = t_{down} = \frac{1}{2} t_{air}$
- $\vec{v}_{up,y}(h) = -\vec{v}_{down,y}(h)$, *and* $\vec{v}_x$ *is* constant since $\vec{a}_x = 0$
- $\vec{v}_{top}(h_{max}) = \hat{i} v_0 \cos\theta$
- $t_{air} = 2v_{0y}/g$
- $2gh = v_{0y}^2$



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