§ 1.1 Intro

Monday, August 24, 2020 12:28 PM

Falling Ball

air resistance force acts in direction opposite of motion

γv

v = velocity

gravitional force

mg

$v > 0$

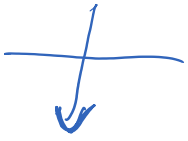
Ball is falling = moving in positive direction

$$F = ma = m\frac{dv}{dt}$$

$$F = +mg - \gamma v$$

$$m\frac{dv}{dt} = mg - \gamma v$$

coordinate system



positive direction pts down

Suppose $m = 10$ kg $\quad \gamma = 2$ kg/sec

$$m\frac{dv}{dt} = mg - \gamma v$$

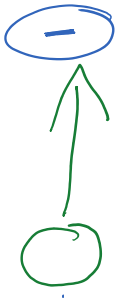
$$\frac{10}{10}v' = \frac{(10)(9.8)}{10} - \frac{2}{10}v$$

$$\frac{dv}{dt} = 9.8 - \frac{1}{5}v$$

v' $\quad \dot{v}$

$\frac{dv}{dt}$

What if I throw the ball up



$$F = mg - \gamma v$$

$$F = mg + (-\gamma v)$$

$F = mg + (-\gamma v)$

note $\gamma v < 0$

$-\gamma v > 0$

$mv' = mg - \gamma v$ for ball

falling & moving up

moving down

thrown up

Ex: $m = 10$ $\gamma = 2$

$$v' = 9.8 - \frac{1}{5}v$$

Solve: see Wednesdays class

or draw slope field = direction field

(visual graph)

$\frac{dv}{dt} = 9.8 - \frac{v}{5}$

t	v	
	0	slope = 9.8
	49	0
	less than 49	+
	greater than 49	−

"than 49

no dependence on t

graph small portions of tangent lines

Slope 0: $\frac{dv}{dt} = 9.8 - \frac{v}{5}$

$0 = 9.8 - \frac{v}{5} \Rightarrow \frac{v}{5} = 9.8$

$v = (9.8)(5) = 49$