M-GP General Physics Week 29 5/1

Ch 9 Linear Momentum and Collisions

Newton's 1st
- Inertia

Newton's 2nd
$F = ma$

Newton's 3rd
Reactionary forces

momentum = mass * velocity

Momentum is the duration of a force

rho $\rho = mv$

$F = ma$

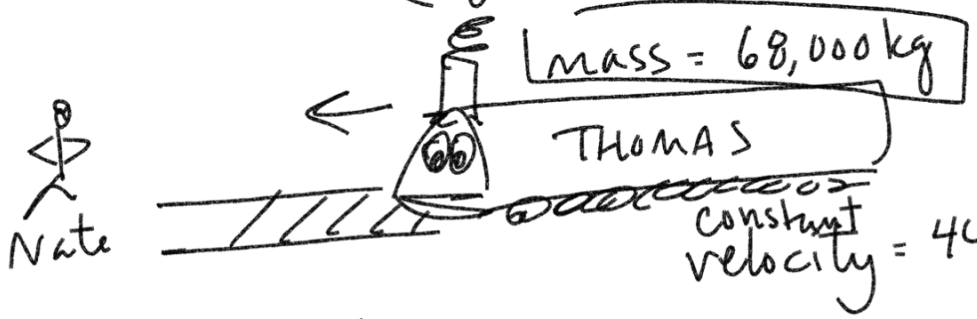
$F = kg \cdot m/s^2$

$\rho = Ft$

$\rho = kg \cdot m/s$

$\rho = Ft$

$(kg \cdot m/s^2)\,s = kg\,m/s$



momentum $\rho = mv$

Nate Thomas $(68{,}000\,kg)(44.7\,m/s)$

$m_1 v_1 = m_2 v_2$

$3{,}039{,}600\ kg\,m/s$

$v_1 = \frac{m_2 v_2}{m_1}$ Nate $m = 78\,kg$ $\frac{3{,}039{,}600\ kg\,m/s}{78\ kg} = 38{,}969\,m/s$

Force of impact: 0N

0.050 kg bullet travels at 1500 m/s

what is its momentum?

$$p = mv = (0.050\,kg)(1500\,m/s) = \boxed{75\,kg\,m/s}$$

Momentum must be conserved —
[energy, matter]

$$m_1 v_1 = m_2 v_2$$

Momentum of bullet = 75 kg m/s

DJ Pikeman 87.2kg

$$\frac{m_1 v_1}{m_1} = \frac{m_2 v_2}{m_1}$$

$$v_1 = \frac{m_2 v_2}{m_1} = \frac{75\,kg\,m/s}{87.2\,kg}$$

$$\boxed{= 0.86\,m/s}$$

Mike Tyson 4 kg fist and travels at 40 m/s. What is the resulting velocity of Nate if Tyson punches him in his stupid, stupid face? $m_1 = 78$ kg

Nate fist

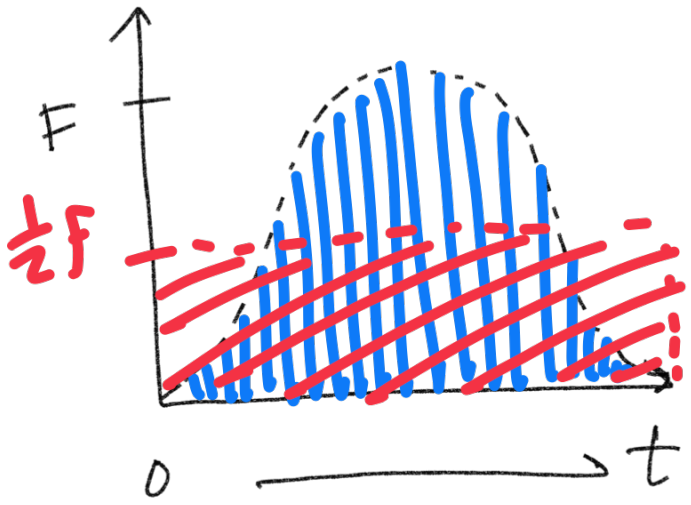
$$m_1 v_1 = m_2 v_2$$

$$v_1 = \frac{m_2 v_2}{m_1} = \frac{(4\text{ kg})(40\text{ m/s})}{78\text{ kg}} = 2.05\text{ m/s}$$

Impulse → change in momentum

$$I = \bar{F}\Delta t$$

($\bar{F}$: average force)



Impulse = area under the curve

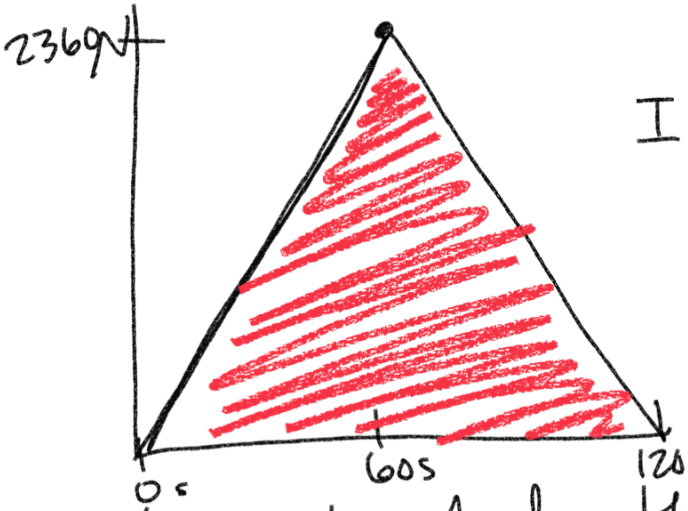
What is worse? (Impulse)

Andre the Giant

520 lb → 236 kg

$F = ma$

$F_w = mg$



$I = F\Delta t$

Area

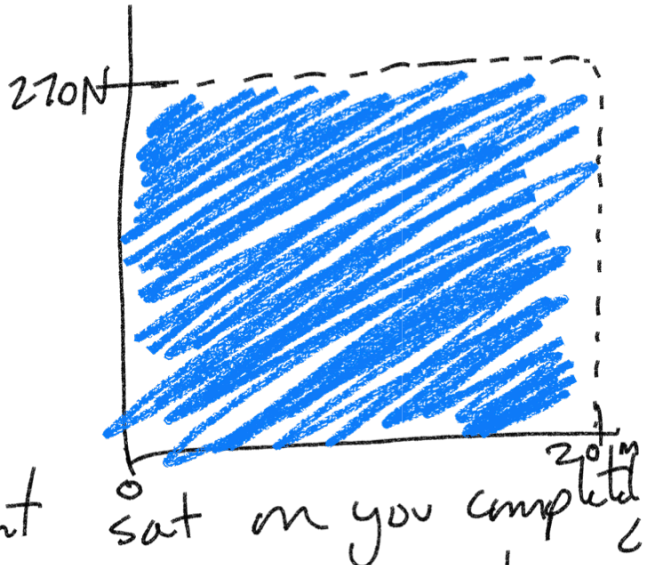
sat on by Andre the Giant slowly over 2 minutes

$\frac{1}{2}bh = \frac{1}{2}(120s)(2360\,N)$

$I = 141{,}600\ kg\,m/s$

Carnival Little Person

60 lbs → 27 kg



sat on you completed for 20 minutes

bh

$(1200s)(270N)$

$I = 324{,}000\ kg\,m/s$