Impulse and Momentum

LEARNING TARGET	DESCRIPTION
9.1	I can define, analyze, and solve problems involving impulse and linear momentum.

Review Momentum and Impulse

Momentum

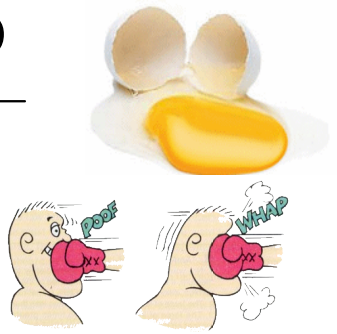
$$p = m v$$

Impulse-Momentum Theorem

$$F \Delta t = \Delta p = p_f - p_i$$

Impulse-Momentum Theorem

$$F = \frac{\Delta p}{\Delta t}$$



F t = change in momentum F t = change in momentum

Car Collisions

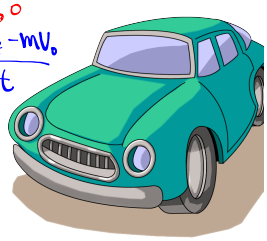
Seatbelts
Airbags
Crumple Zones

IN CLASS PROBLEMS

5. In an automobile collision, a 44 kg passenger moving at 15 m/s is brought to rest by an air bag during a 0.10 s time interval. What is the magnitude of the average force exerted on the passenger during this time?

$F = \frac{\Delta p}{t} = \frac{p_f - p_o}{t} = \frac{mv_f - mv_o}{t}$

$F = \frac{-(44\,kg)(15\,m/s)}{0.1\,s}$

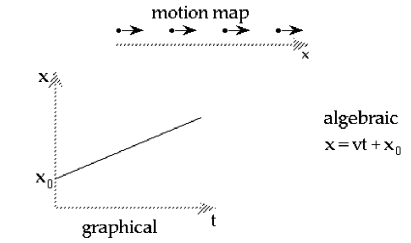


$F = \frac{-660\,kg\,m/s}{0.1\,s} = -6600\,N$

Modeling a Solution

1. Draw a diagram (labeled)
2. Create a graph
3. Mathematically solve
4. Write a solution statement(s)

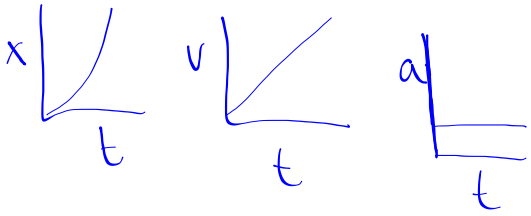
Multiple Representations
a particle moving at constant velocity

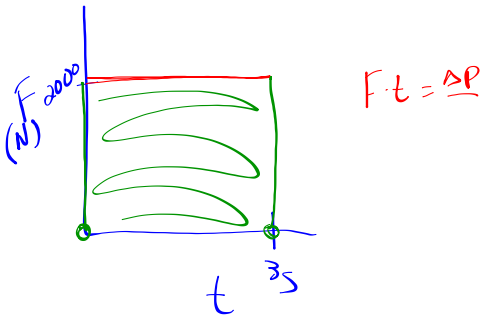


with explicit statements describing relationships

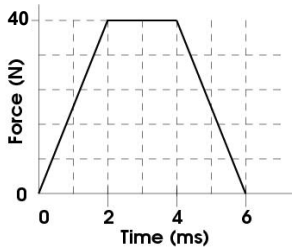
Model a Solution

A tow-truck applies a force of 2000 N on a 2000-kg car for a period of 3 seconds. If the car starts at rest, what will be its speed after 3 seconds?



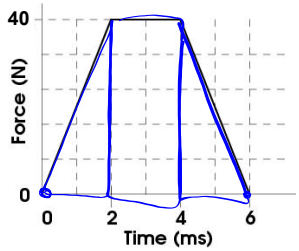


What's The Story?



Force vs. Time Graph

ΔP = Area
Tri = ½bh
Rect = bh



The **impulse** can also be found by finding the area under a force-time graph.