

Momentum Investigations Group 3

Investigations C and F



Investigation C: Does the impulse momentum theorem, $J = \Delta p$, hold true at an angle?

1) Control: flat surface

- a) Mass: 0.29879 kg
- b) Velocity_{initial}: 0.847 m/s
- c) Velocity_{final}: -0.771 m/s
- d) Impulse: -0.515 N*s

2) One book, firm bumper

- a) Mass: 0.29879 kg
- b) Velocity_{initial}: 0.637 m/s
- c) Velocity_{final}: -0.546 m/s
- d) Impulse: -0.457 N*s

3) One book, squishy bumper

- a) Mass: 0.29879 kg
- b) Velocity_{initial}: 0.693 m/s
- c) Velocity_{final}: -0.609 m/s
- d) Impulse: -0.471 N*s

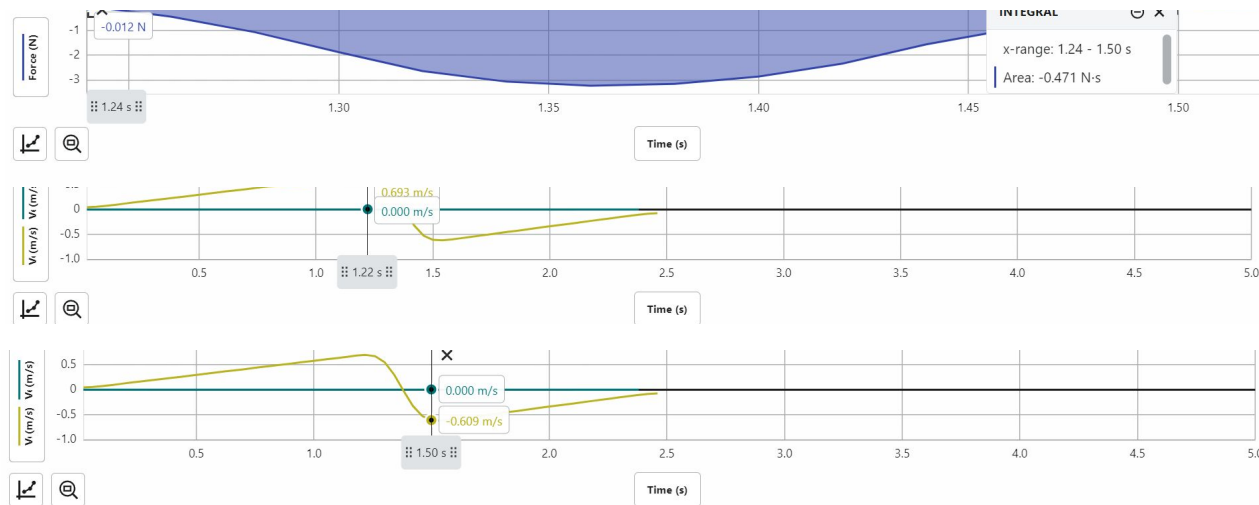


Figure 1: Squishy bumper example

Example Squishy Bumper Calculation:

$$J = \Delta p$$

$$J = m \cdot \Delta v$$

$$J = m \cdot (v_{\text{initial}} - v_{\text{final}})$$

$$-0.471 = 0.29879 \cdot (-0.609 - 0.693)$$

$$-0.471 = -0.389^*$$

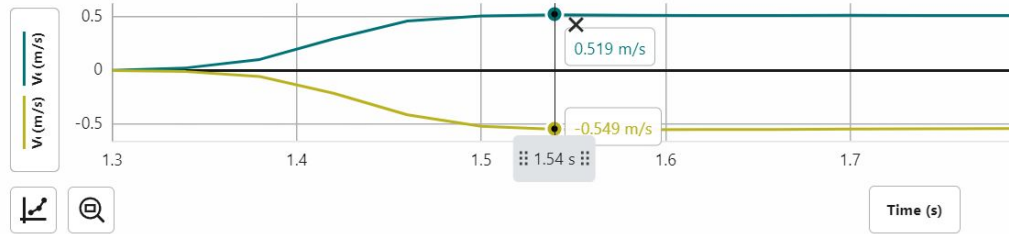
*not perfectly elastic due to gravity

Investigation F: Explosion

$$KE = 1/2MV^2$$

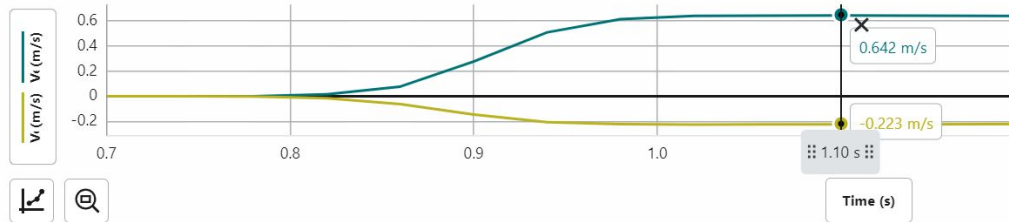
1) Control: Similar Masses

- a) Yellow Mass: 0.29879 kg
- b) Green Mass: 0.29900 kg
- c) Velocity_{initial}: 0 m/s
- d) Velocity_{final}: +/- 0.519 m/s
- e) $KE_{\text{final}} > KE_{\text{initial}}$



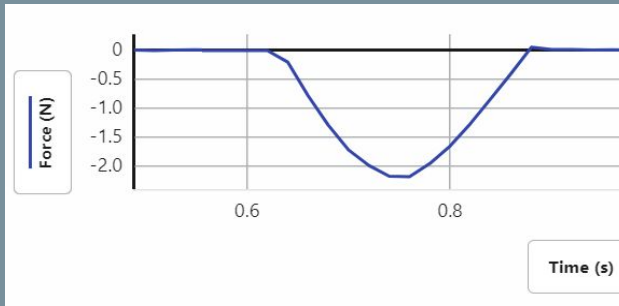
2) Increase mass of yellow cart

- a) Yellow Mass: 0.80276 kg
- b) Green Mass: 0.29900 kg
- c) Both Velocity_{initial}: 0
- d) Yellow Velocity_{final}: 0.233 m/s
- e) Green Velocity_{final}: -0.642 m/s
- f) $KE_{\text{final}} > KE_{\text{initial}}$



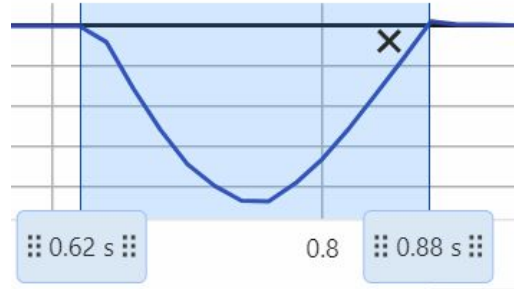
User Manual Feature: Apply Curve Fit

used to obtain equation for a section of data



Graph of force vs. time for cart hitting the bumper

If you need the equation of a section of data, the apply curve fit tool can give it to you:



Graph options

↓
Apply curve fit

Graph Legend

Interpolate

Tangent

[View Statistics](#)

[View Integral](#)

[Apply Curve Fit](#)

[Apply FFT](#)

[Apply Histogram](#)

[Add Annotation](#)

[Add Prediction](#)

[Add Graph Match](#)

Curve Fit

Linear

Proportional

Linear

Quadratic

Power

Inverse

Inverse Squared

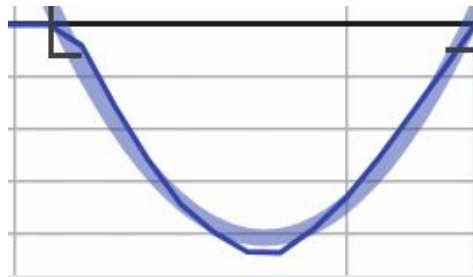
Natural Exponent

Natural Log

Sine

Cosine

Cosine Squared



QUADRATIC

x-range: 0.62 - 0.88 s

$y = ax^2 + bx + c$

QUADRATIC

a: 133.2

b: -199.9

c: 72.99

$$y = 133.2x^2 + -199.9x + 72.99$$