

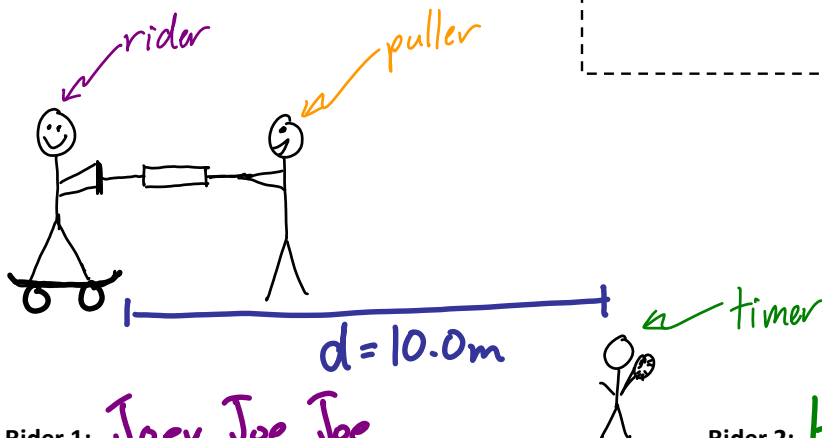
Newton's 2nd Law

Cart Race

Purpose: To determine the relationships between acceleration, force and mass.

Materials: cart, timer, measuring tape, graph paper

Procedure:



Data:

Rider 1: Joey Joe Joe
 Mass (cart + rider): 62 kg
 Distance: 10.0 m

Rider 2: Hans Moleman
 Mass (cart + rider): 48 kg
 Distance: 10.0 m

Force (N)	Time (s)	Acceleration ($a = 2d/t^2$) (m/s ²)
10.	23.92	
20.	10.31	
30.	7.78	
40.	6.14	
50.	5.55	

Force (N)	Time (s)	Acceleration ($a = 2d/t^2$) (m/s ²)
10.	15.34	
20.	8.30	
30.	6.26	
40.	5.27	
50.	4.41	

Discussion:

- 1) Plot a graph of **Force vs. Acceleration** for Rider 1. Draw a line of best fit and determine the slope and y-intercept (include units). Do all your work on the graph paper.
- 2) On the same axis plot a graph of F vs. a for Rider 2. Draw a line of best fit and determine the slope and y-intercept (include units).
- 3) Analyze your results and determine the relationship between force and acceleration.
- 4) Analyze your results and determine the relationship between acceleration and mass.
- 5) Should the lines you plotted go through (0,0)? Explain.
- 6) The relationship between force and acceleration is given by Newton's 2nd Law: **F_{net} = ma**. In this case this becomes:

$$F_{app} - F_f = ma.$$

- a. Rearrange this formula to fit the equation of a straight line:

$$y = mx + b$$

- b. What does the y-intercept represent?
 c. What does the slope represent?