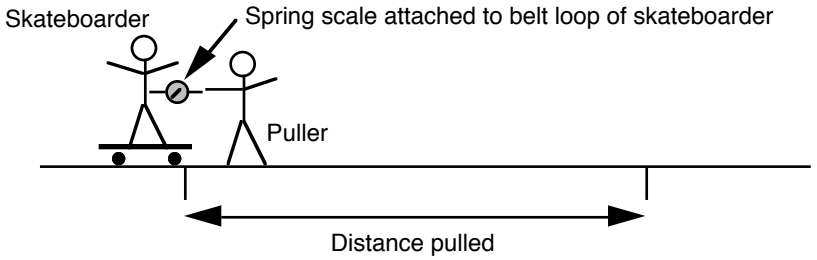
Lab 5-1: Accelerating on a Skateboard

Purpose: You will determine the affect of mass, force, and distance on the acceleration of an object. Note: there are no equations to be derived in this lab, you must simply give *qualitative* relationships between force, mass, distance, and acceleration for an object that is accelerating.

Procedure:

1. There are four different jobs that must be done. Divide yourselves accordingly:
   1 skateboarder 1 puller 3 timers 1 recorder
2. Mark off 5, 10 and 15 meter sections on the floor with some tape. Make sure to fold over an edge of the tape so that you can easily remove it when you are done.
3. One person with a stopwatch should stand at each 5 metere interval.
4. Attach the spring scale to a belt loop on the skateboarder. (This is the best way to keep the pulling force constant.) The timer should have one foot under the front wheels so the board can't move.
5. The puller should pull the skateboarder with a force of 20 Newtons. At this point the timer starts the watch and simultaneously removes his/her foot. It may take a *brief* impulse with a large force to initially get the skateboarder rolling, but the puller must then *immediately* pull with a constant force of 20 Newtons. The puller will move the skateboard through a distance of 15m.
6. Each timer should time how many seconds this takes for the skateboarder to cross their mark.
7. The skateboarder should do his/her best to keep in a *straight line*.
8. Repeat steps 4 to 7 two more times, making the following changes:
   Part 2: pull for 5 meters only, but with a force of 40 N.
   Part 3: pull for 5 meters only and 20 N, but with a different skateboarder. Try to get someone who has a very different mass compared to the first skateboarder.



Data:

	Part 1			Part 2	Part 3
Mass of Skateboarder + skateboard					
Pulling Force	20 N	20 N	20 N	40 N	20 N
Distance pulled	5 m	10 m	15 m	5 m	5 m
Time pulled					
Initial Velocity	0 m/s	0 m/s	0 m/s	0 m/s	0 m/s

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Calculations: Fill in the table below. Because the calculations for each trial are identical, you only have to show your calculations for the first trial. Write down the equation(s) you are using, **show the equation with your data substituted in**, and then the answer.

1. For each set of data, what was the *average* velocity of the skateboarder?

   Equation:_____

   ans. _____ (units?)

2. For each set of data, what was the *final* velocity of the skateboarder?

   Equation:_____

   ans. _____ (units?)

3. For each set of data, what was the acceleration of the skateboarder?

   Equation:_____

   ans. _____ (units?)

Results:

	Part 1			Part 2	Part 3
Initial Velocity	0 m/s	0 m/s	0 m/s	0 m/s	0 m/s
Average Velocity					
Final Velocity					
Time Pulled					
Acceleration					

Questions:

1. If there is a **constant force and mass**, what effect did *increased distance* have on the *final velocity* of the skateboarder?

   as distance increased, the velocity _____

2. If there is a **constant force and mass**, what effect did an *increased distance* have on the *acceleration*?

   as distance increases, the acceleration _____

3. If there is a **constant mass**, how does a pulling *force* affect the *acceleration* of an object?

   as the force increases, the acceleration _____

4. If there is a **constant force**, what effect did an *increased mass* of an object have on its *acceleration*?

   as mass increases, the acceleration _____

5. It is relatively simple to pull someone with a constant velocity, but can be very difficult to pull someone with a constant force. Why?