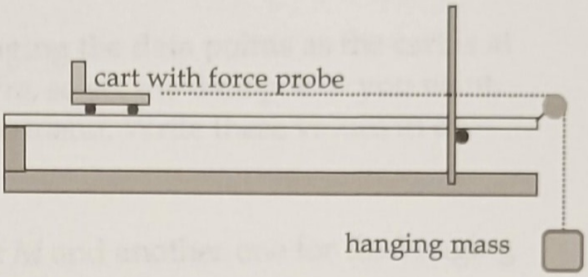
Experiment IV - Dynamic Forces

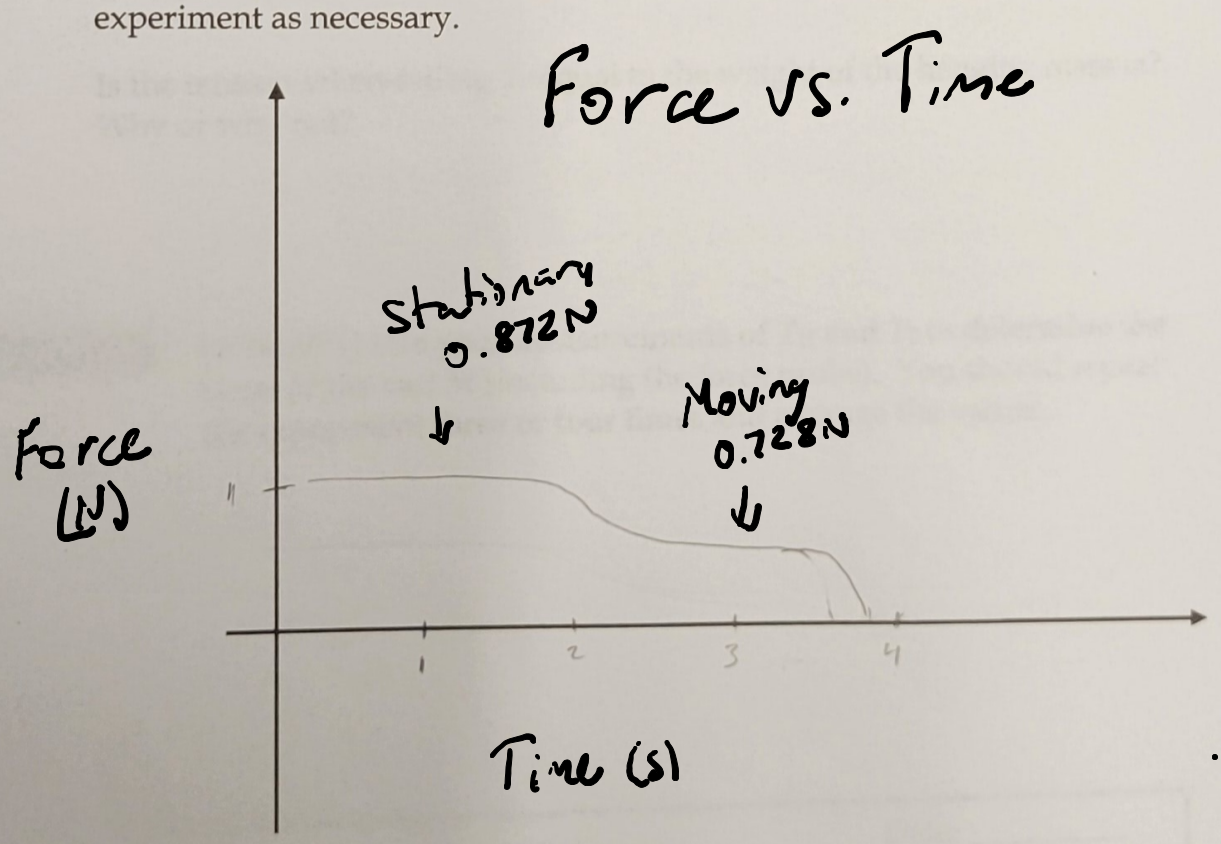
The apparatus consists of a cart and track as in Experiment I, but now with a pulley at the end of the track. A horizontal string connects the cart to a mass that hangs over the pulley. The cart has a force probe attached, which measures the tension in the string.



Activity 1 "Zero" the force probe with the cart sitting on the track and without the string attached ("0" icon near right of button bar).

Start with the cart as far from the pulley as the string allows. Start Logger*Pro* and hold the cart stationary for about two seconds after Logger*Pro* begins collecting data, then release the cart.

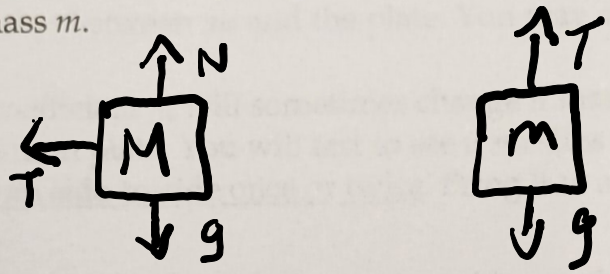
Sketch your data on the axes below. You may, of course, repeat the experiment as necessary.



Activity 2 Assume that the force measured by the force probe is equal to the tension in the string. Mark on your sketch the tension in the string while the cart is stationary. Mark on your sketch the tension in the string while the cart accelerates.

You can get numerical values by averaging the data points as the cart is at rest or as it accelerates. Using Logger*Pro*, select the data points you want, then choose Statistics from the Analyze menu. Write these values in on your sketch.

Draw a free-body-diagram for the cart M and another one for the hanging mass m.



Is the tension-when-hanging T_H equal to the weight of the hanging mass m? Why or why not?

Yes because hanging mass is stationary so net force is 0

Is the tension-when-falling T_F equal to the weight of the hanging mass m? Why or why not?

No because hanging mass is accelerating downwards

Graded Activity: [25%; 50%] **Use your measurements of T_H and T_F to determine the mass of the cart M** (including the force probe). You should repeat the experiment three or four times and average the values.

$T_H = .872$
$T_F = .728$

$.872 = 9.8\,m \rightarrow m = \frac{.966}{9.8} = .089$ kg

$ma = mg - T_F \rightarrow a = g - \frac{T_F}{m} = 9.8 - \frac{.728}{.089} = 1.62\ m/s^2$

$Ma = T_F \rightarrow M = \frac{T_F}{a} = \frac{.728}{1.62} = .449$ kg

Instructor Initials: _____ Date: _____