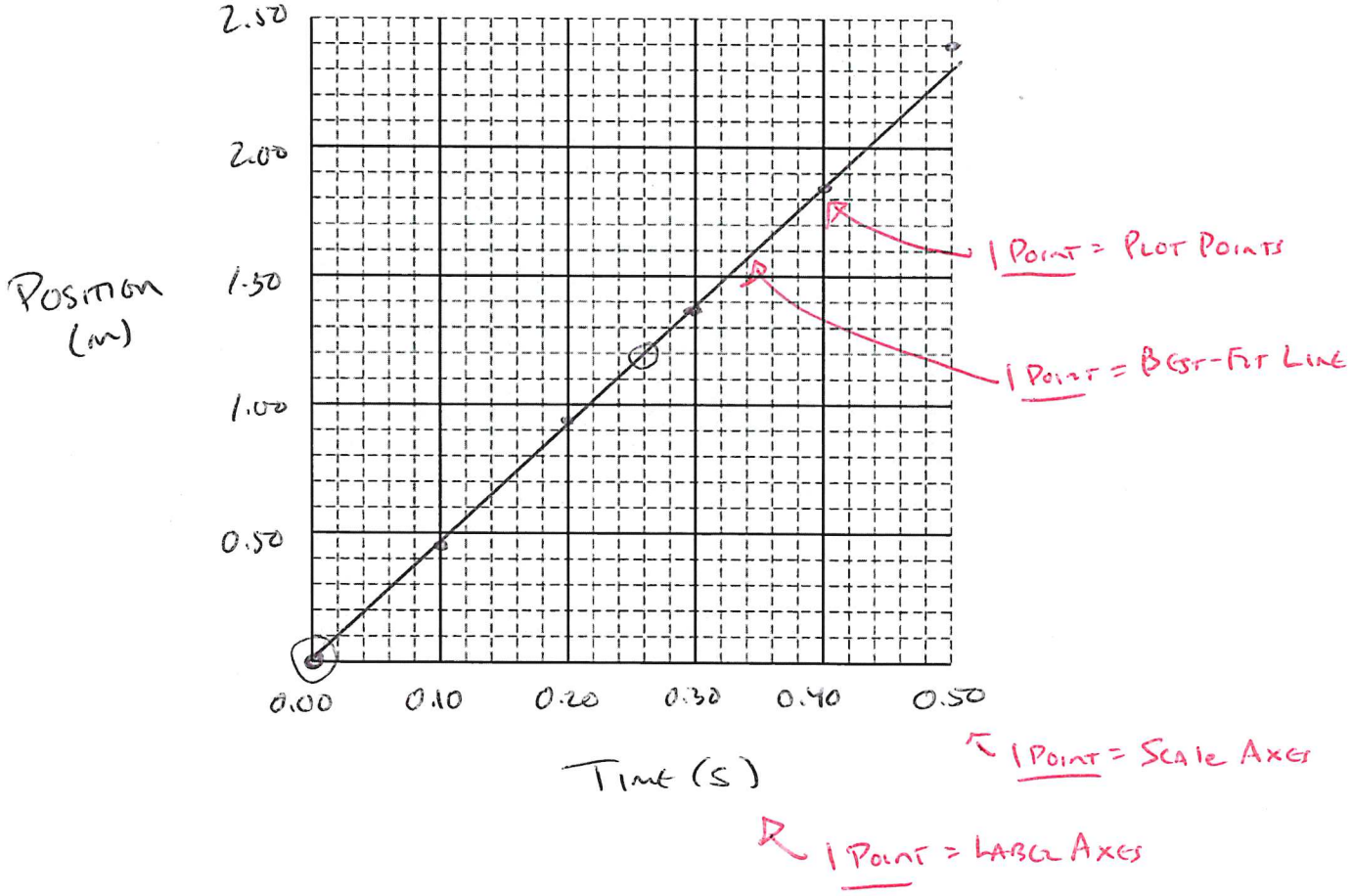
Week 0 HW - Sample Free Response

1. A physics student investigated the motion of a cart on a frictionless track. This student used a motion detector attached to a data collection device. The motion detector measured the position of the cart as a function of time. The collected data is shown in the table below.

Time (s)	Position (m)
0.00	0.00
0.10	0.45
0.20	0.94
0.30	1.38
0.40	1.84
0.50	2.40

(a) Plot the data points for the quantities indicated in the table on the graph below. Clearly scale and label all axes, including units. Draw a best-line fit of the data.



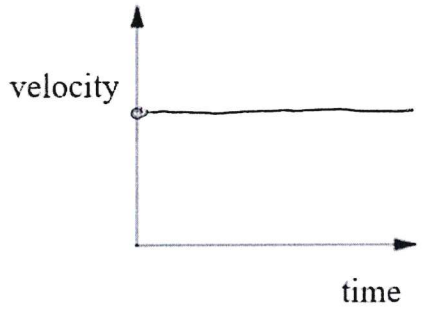
(b) Using the best-line fit from the graph, calculate the slope.

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{1.20 - 0.00}{0.26 - 0.00} = 4.62 \frac{m}{s}$$ 1 POINT

(c) Using your slope, determine the position of the cart at 0.75 sec.

$$4.62 \frac{m}{s} \times 0.75 \text{ sec} = 3.47 m$$ 1 POINT using (b)

(d) Sketch the velocity-time graph of the cart below.

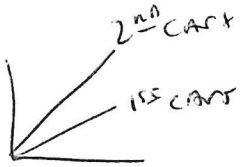


1 POINT

(e) The student repeated the experiment with a second cart that covered more distance in a shorter amount of time. How would that change the graph in part (a)?

THE NEW graph would have A steeper slope.

1 POINT



(f) The second cart has a motor that allows it to travel at a constant speed of 6.5 m/s. If this cart started at a position of 0 m at $t = 0$ sec, calculate the position of this cart at 0.32 sec. Write the equation, substitution, and solve with units.

$$v = \frac{d}{t} \Rightarrow d = v \cdot t$$

$$d = (6.5 \frac{m}{s})(0.325)$$

1 POINT = EQUATION + SUBSTITUTION

$$d = 2.1 m$$ ← 1 POINT = SOLVE WITH UNITS