Blurbs for Cart Lab

1.) Velocity of cart at t = 0.5 sec.:

a.) using *velocity vs time* graph

b.) using *position vs time* graph

c.) determine $v_{.5}$ using $v_2 = v_1 + a(\Delta t)$ and graphs

d.) determine $v_{.5}$ using $v_2^2 = v_1^2 + 2a\Delta x$ and graphs

2.) Distance traveled between t = 0.25 and t = 0.60 seconds.:

a.) using *position vs time* graph

b.) using *velocity vs time* graph

c.) using $x_2 = x_1 + v_1 t + .5at^2$ and data from graphs

3.) determine % deviation for largest value discrepancy using information from:

a.) Question 1 (determining final velocity)

b.) Question 2 (distance traveled)

Questions:

1. What is the velocity of the cart @ $t = 0.5s$?

a)... using the velocity-time graph

$\boxed{V(0.5) \approx +1.13 \, m/s}$

[illegible]

we found this velocity by looking at the velocity time graph to see the the y-coordinate of the point at 0.5s. Then, we confirmed our estimate by using the equation for the best fit line ($y = 1.5424x + 0.3612$).

b)... using the distance-time graph

$\boxed{V(0.5) \approx +1.39 \, m/s}$ we found this value by approximating the slope of the graph at $t = 0.5s$. Then, we confirmed our estimate by using the derivative of the best fit line for the graph, which was $y = -0.009771x^2 + 1.396x - 0.2710$ @ $t = 0.5s$.

c)... using $V_2 = V_1 + a\Delta t$

$V_{0.5} = (0.45 \, m/s) + (1.542 \, m/s^2)(0.5s - 0.06s)$

$\boxed{V_{0.5} = +1.13 \, m/s}$

Values used: $t = 0.06$, $V = 0.45 \, m/s$, $a = 1.542 \, m/s^2$

d)... using $V_2^2 = V_1^2 + 2a\Delta x$

$V_{0.5}^2 = (0.45 \, m/s)^2 + 2(1.542 \, m/s^2)(0.425m - 0.015m)$

$\boxed{V_{0.5} = +1.20 \, m/s}$

Values used: @ $t = 0.06s$, $V = 0.45 \, m/s$, $a = 1.542 \, m/s^2$, $d = 0.015m$
@ $t = 0.5$, $d = 0.425m$

2. How far did the hanging mass travel between 0.25s and 0.6s?

a) find Δx using the distance-time graph

using the equation of the line of best fit, we plugged in $t = 0.25$ and $t = 0.6$ to find that $\boxed{\Delta x = 0.486m}$

$y = -0.09771x^2 + 1.396x - 0.2710$

$\left.\begin{array}{l} @\ t = 0.25,\ x = 0.077m \\ @\ t = 0.6,\ x = 0.563m \end{array}\right\} \rightarrow 0.563 - 0.077 = 0.486m$

c. $V_{0.5}$ using $V_f = V_i + a\Delta t$

$V = mt + b$

$V = [0.8771\ m/s/s][0.030324s] + [0.2770\ m/s]$

$V_{0.030324} = 0.304\ m/s$ finding Vi

$V = mt + b$

$\bar{a} = \frac{V_f - V_i}{T_f - T_i}$ acceleration is the slope of the velocity graph because it is the derivative

$\Delta t = 0.522283 - 0.030324 = 0.491959$

first and last data pts

$V_{0.5} = [0.304\ m/s] + [0.8771\ m/s/s][0.491959\ s]$

$\boxed{V_{0.5} = 0.735\ m/s}$

d. $V_{0.5}$ using $V_2^2 = V_1^2 + 2a\Delta X$

$\Delta X = 0.255$ → last point on distance-time graph

$V_{0.5}^2 = [0.304\ m/s]^2 + 2[0.8771\ m/s/s][0.255\ m]$

$V_{0.5}^2 = 0.539$ took the square root

$\boxed{V_{0.5} = 0.735\ m/s}$

2. How far did hanging mass travel between t = 0.25 s and t = 0.6 s?

a. Δx using distance - time graph

because an equation is given, it tells us the velocity and distance

$D = At^2 + Bt + C$

$D = [0.3116][0.25]^2 + [0.4001][0.25] + [-0.03012]$

$D_{0.25} = 0.089\ m$ plugging into equation

$D = [0.3116][\cancel{6.6}\ 0.6]^2 + [0.4001][0.6] + [-0.03012]$

$D_6 = \cancel{13.54\ m}\ 0.322$

$D_6 - D_{0.25} = \cancel{13.59}\ 0.322 - 0.089 = \boxed{\cancel{13.50\ m}}$

$D_{0.6} - D_{0.25} = \rightarrow \boxed{0.233\ m}$

Calculations

1. velocity at $t = .5s$?

a. Det $v_{.5}$ using vel-time graph

$v = .1271t + .04269$ → equation of line of best fit for velocity

$.1271(.5) + .04269$ — plug in time

$.10624$ m/s

b. Det $v_{.5}$ using dist-time graph

$d = .06302t^2 + .04407t - .004371$ take derivative of distance line of best fit

$.12604t + .04407$

$.12604(.5) + .04407$ plug in time

$.10709$ m/s

c. using [illegible] $v_2 = v_i + a\Delta t$

$v = .1271t + .04269$ take $\frac{dy}{dx}$ to get acceleration

$a = .1271$

At $t = .30919$,

$v = .0872$

$v_2 = .0872 + .1271(.19081)$

$v_i = .0872$

$a = .1271$

$\Delta t = .5 - .30919 = .19081$

$v_{.5} = .11145$ m/s

For the initial velocity, I took the first available data point with a velocity at $t = .30919$. I found the acceleration by taking the derivative of the line of best fit of the velocity. And the change in time I also found from the initial data points. By plugging in I found the velocity at $t = .5$.