PHYS-008L 09/29/2021 LAB 3

PreLab 7:30 pm

Timestep - time that passes between two data points
Linearization - $y = mx + b$
5% rule - if intercept is < 5% of greatest y-value, then its negligible

LAB 03 Analyzing Data 09/30/2021 11:45 am

Using Data from LAB 02, refer to that data
bing.com/d56avtuk

Linearizing Data:
magnitudes of position, velocity, & acceleration (in data)

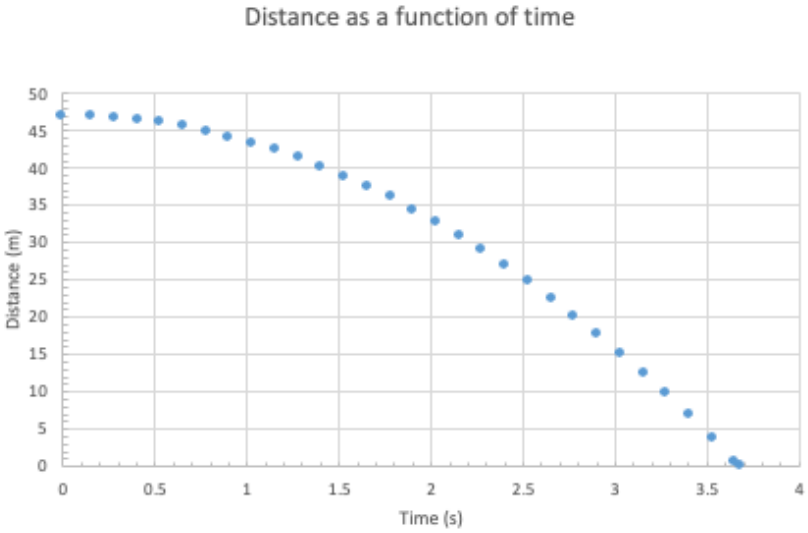
Distance: $\sqrt{x^2+y^2}$ at $t=0.156$ distance is $\sqrt{-33.17^2 + 33.1751^2} = 46.92$ m

Velocity: $\sqrt{v_x^2+v_y^2}$ at $t=0.156$ velocity is $\sqrt{0.7649^2 + -0.7649^2} = 1.082$ m/s

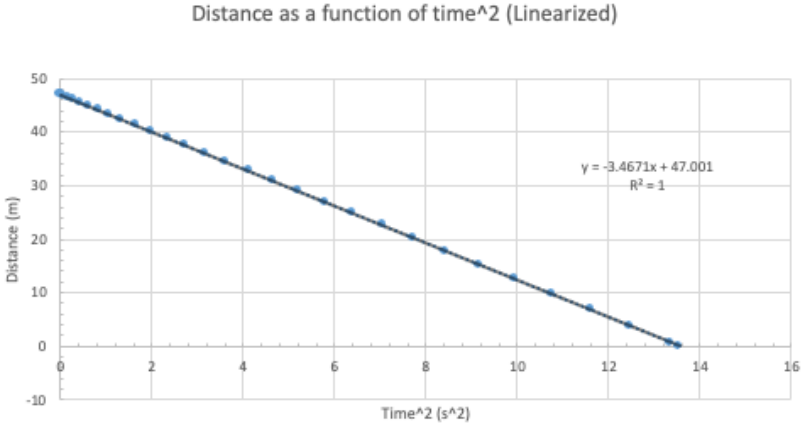
v_x is positive → v_y is negative ↓ negative direction

Acceleration: $\sqrt{a_x^2+a_y^2}$ at $t=0.156$ acceleration is $\sqrt{4.9^2+4.9^2} = -6.934$ m/s²

Distance (before linear):



Distance (after linear):



$y = mx + b$

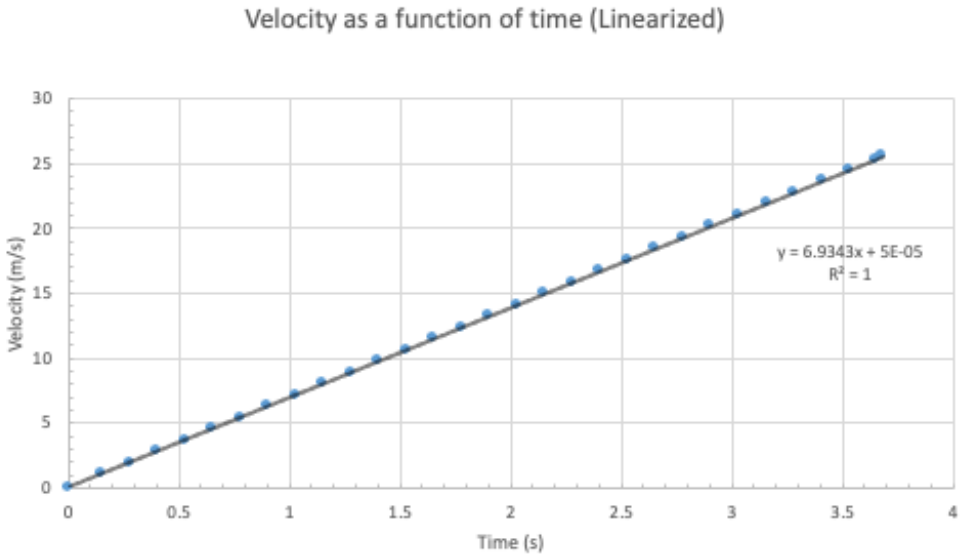
distance $= \frac{1}{2}a t^2 + b$ (m = $\frac{1}{2}a$, x = t^2)

* as t^2 increases, distance decreases by $\frac{1}{2}a$. *

PHYS-008L 09/30/2021 LAB 3

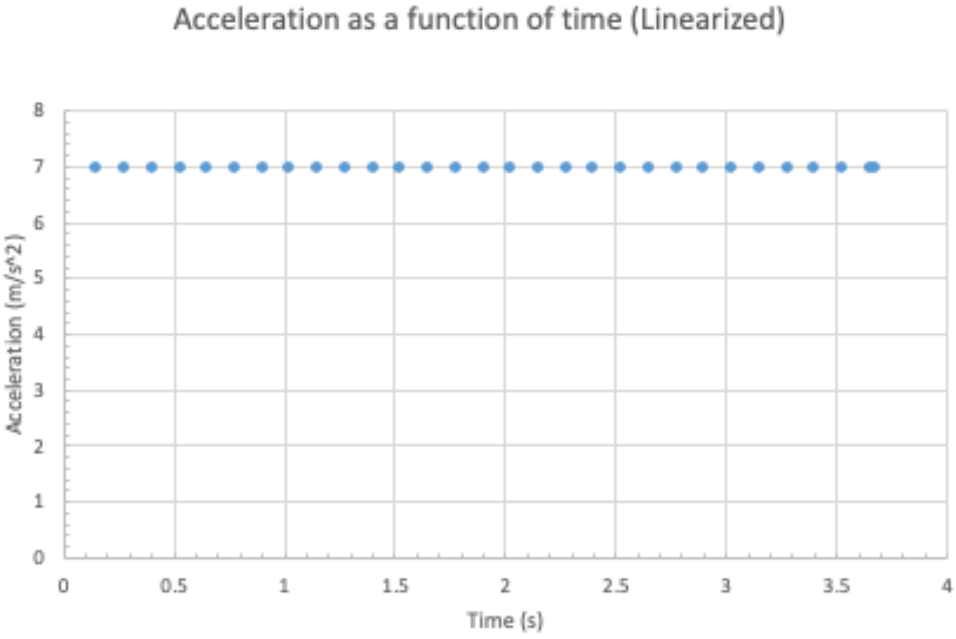
Velocity is already linearized.... $v_f = at$ *as t increases, velocity increases by a* (matches previously found in Lab 2 graph)

Graph from LAB 2:



Acceleration is already linearized.. $a_f = a_0$ *acceleration is constant, so whatever the b is in $y = mx + b$, that what a_f will be* (matches LAB 2 graph)

Graph from LAB 2:



PHYS-008L 09/30/2021 LAB 3

Working with your data: 12:30 pm

Expectations:

Trial 1

Distance: $distance = \frac{1}{2}at^2 + x_0$; $a = -6.934$ ∴ $distance \approx -3.45t^2 + \overbrace{47}^{x_0}$ → $t: 0 \to 0.02433\,s^2$

Velocity: $v_f = at$; $a = 6.934$ ∴ $v_f = 6.934t + \overbrace{0}^{v_0}$ → $t: 0 \to 0.15\,s$

Acceleration: $a_f = a_0$; $a = 6.934$ ∴ $a_f = 6.934\,m/s^2$

Trial 2

Distance: $distance = \frac{1}{2}at^2 + x_0$; $a = -6.934$ ∴ $distance \approx -3.45t^2 + \overbrace{47}^{x_0}$ → $t: 0 \to 0.01963\,s^2$

Velocity: $v_f = at$; $a = 6.934$ ∴ $v_f = 6.934t + \overbrace{0}^{v_0}$ → $t: 0 \to 0.14\,s$

Acceleration: $a_f = a_0$; $a = 6.934$ ∴ $a_f = 6.934\,m/s^2$

Trial 3

Distance: $distance = \frac{1}{2}at^2 + x_0$; $a = -6.934$ ∴ $distance \approx -3.45t^2 + \overbrace{47}^{x_0}$ → $t: 0 \to 0.0196\,s^2$

Velocity: $v_f = at$; $a = 6.934$ ∴ $v_f = 6.934t + \overbrace{0}^{v_0}$ → $t: 0 \to 0.14\,s$

Acceleration: $a_f = a_0$; $a = 6.934$ ∴ $a_f = 6.934\,m/s^2$

Trial 4

Distance: $distance = \frac{1}{2}at^2 + x_0$; $a = -6.934$ ∴ $distance \approx -3.45t^2 + \overbrace{47}^{x_0}$ → $t: 0 \to 0.0121\,s^2$

Velocity: $v_f = at$; $a = 6.934$ ∴ $v_f = 6.934t + \overbrace{0}^{v_0}$ → $t: 0 \to 0.11\,s$

Acceleration: $a_f = a_0$; $a = 6.934$ ∴ $a_f = 6.934\,m/s^2$

Trial 5

Distance: $distance = \frac{1}{2}at^2 + x_0$; $a = -6.934$ ∴ $distance \approx -3.45t^2 + \overbrace{47}^{x_0}$ → $t: 0 \to 0.02465\,s^2$

Velocity: $v_f = at$; $a = 6.934$ ∴ $v_f = 6.934t + \overbrace{0}^{v_0}$ → $t: 0 \to 0.157\,s$

Acceleration: $a_f = a_0$; $a = 6.934$ ∴ $a_f = 6.934\,m/s^2$

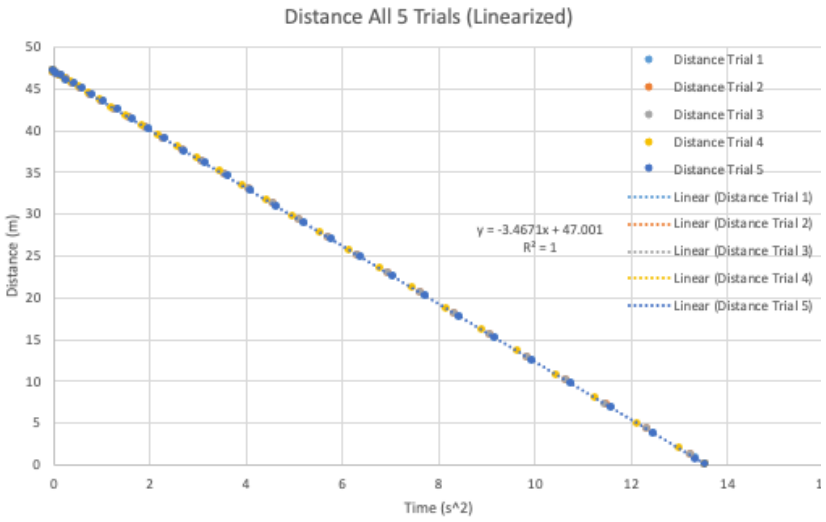
* only thing that varied between trials was time ∴ I think the linearizations of each trial's graphs will match*

Graph on next page →

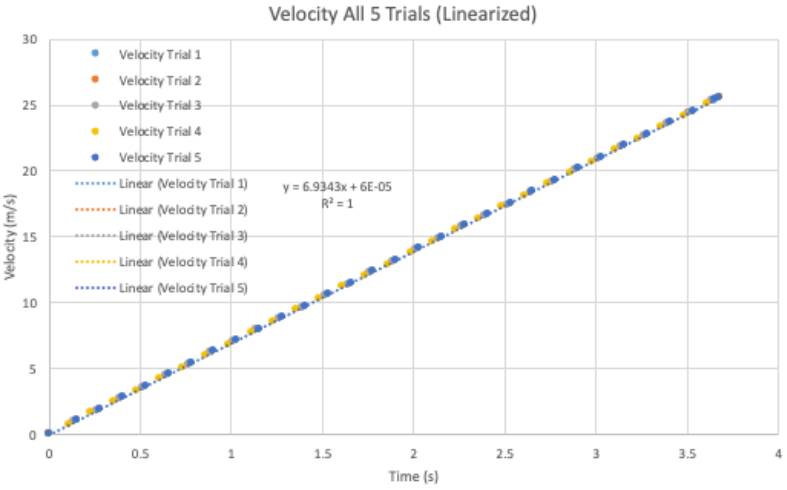
PHYS-008L 09/30/2021 LAB 3

Graph of all 5 trials 12:48pm

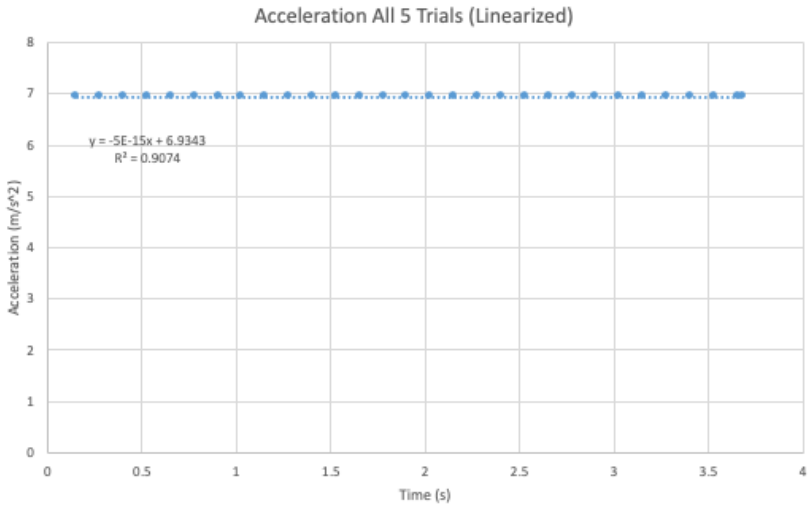
Distance



Velocity



Acceleration



Conclusion

* my expectations were correct. the only thing that varied was time. The slope for position was $\frac{1}{2}a$, velocity's slope was a, and acceleration was constant. Therefore, the slopes had to do with acceleration and change in time. All linearizations of 5 trials matched.