SPH4U0

Graphical Analysis Example — SOLUTION

1. Plot a graph of Distance versus Time for a cart rolling down a ramp. (Traditionally, we describe a graph as "y versus x" so Distance goes on the y axis and Time goes on the x-axis.)

Time (s)	Distance (m)	Square of Time (t^2) (s^2)
0.00	0.00	0.00
0.20	0.13	0.04
0.40	0.52	0.16
0.60	1.17	0.36
0.80	2.09	0.64
1.00	3.26	1.00
1.20	4.69	1.44
1.40	6.39	1.96
1.60	8.35	2.56
1.80	10.56	3.24
2.00	13.04	4.00

* Graph 2 is a linear relationship

We know now that the relationship is $d \propto t^2$.

We solve for the constant of proportionality by finding the slope of the line. Pick two points far apart when finding slope

∴ slope is 3.2 m/s² and the full relationship is

$d = (3.2 \frac{m}{s^2}) t^2$

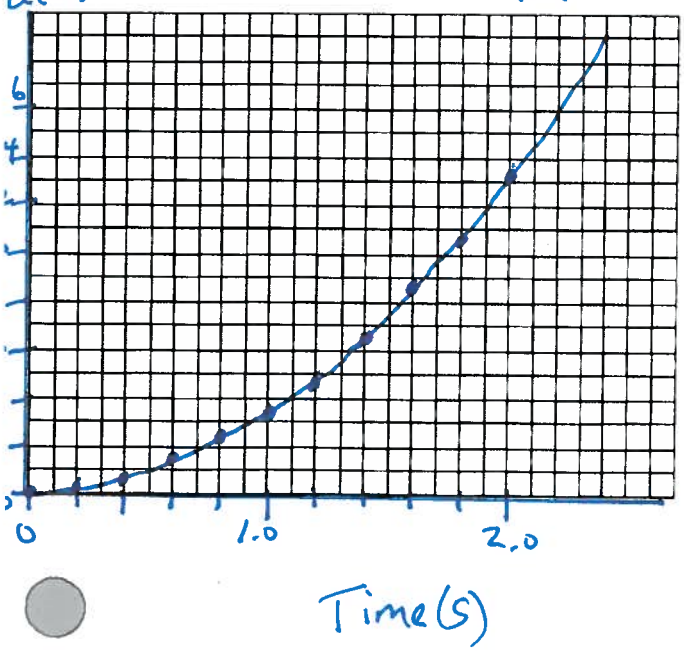
2. Identify the general type of relationship that is demonstrated between distance and time. Power → $d \propto t^2$ (eg. Linear, power, root, etc.)

3. Modify the independent values (the "x" variable data or time values in this case) to reflect the relationship identified and re-plot the data on a new graph. For example, you think it is a root relationship, you would plot the dependent values (distance values) versus the square root of the time values (d vs $\sqrt{t}$).

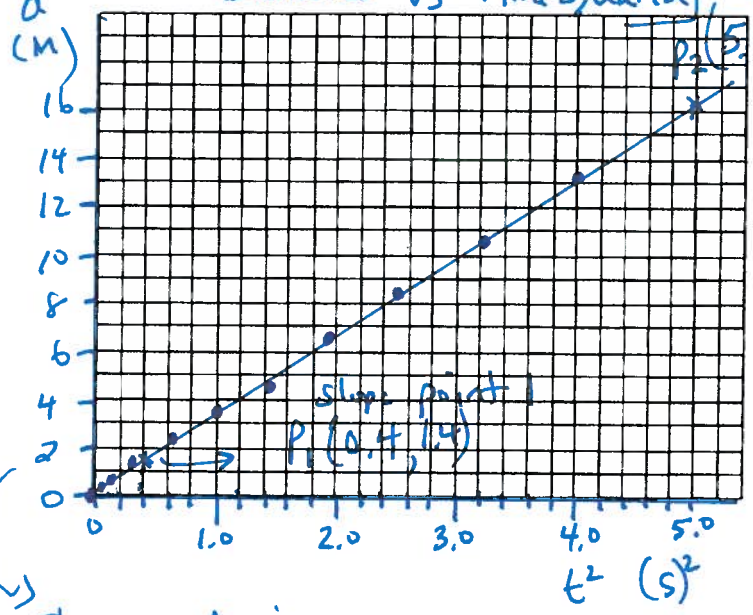
4. If the graph has been linearized and the y-intercept is close to the graph origin, find the slope of the graph. You can now express the full, mathematical relationship for the graph including a constant of proportionality.

Graphs:

#1 Distance vs Time



#2 Distance vs Time Squared



Slope analysis:

$\text{Slope} = \frac{(16.3 - 1.4)(m)}{(5.0 - 0.4)(s)^2} = \frac{14.9 m}{4.6 s^2} = 3.2 \frac{m}{s^2}$