Graphing Guide

Experimental Design

Overview

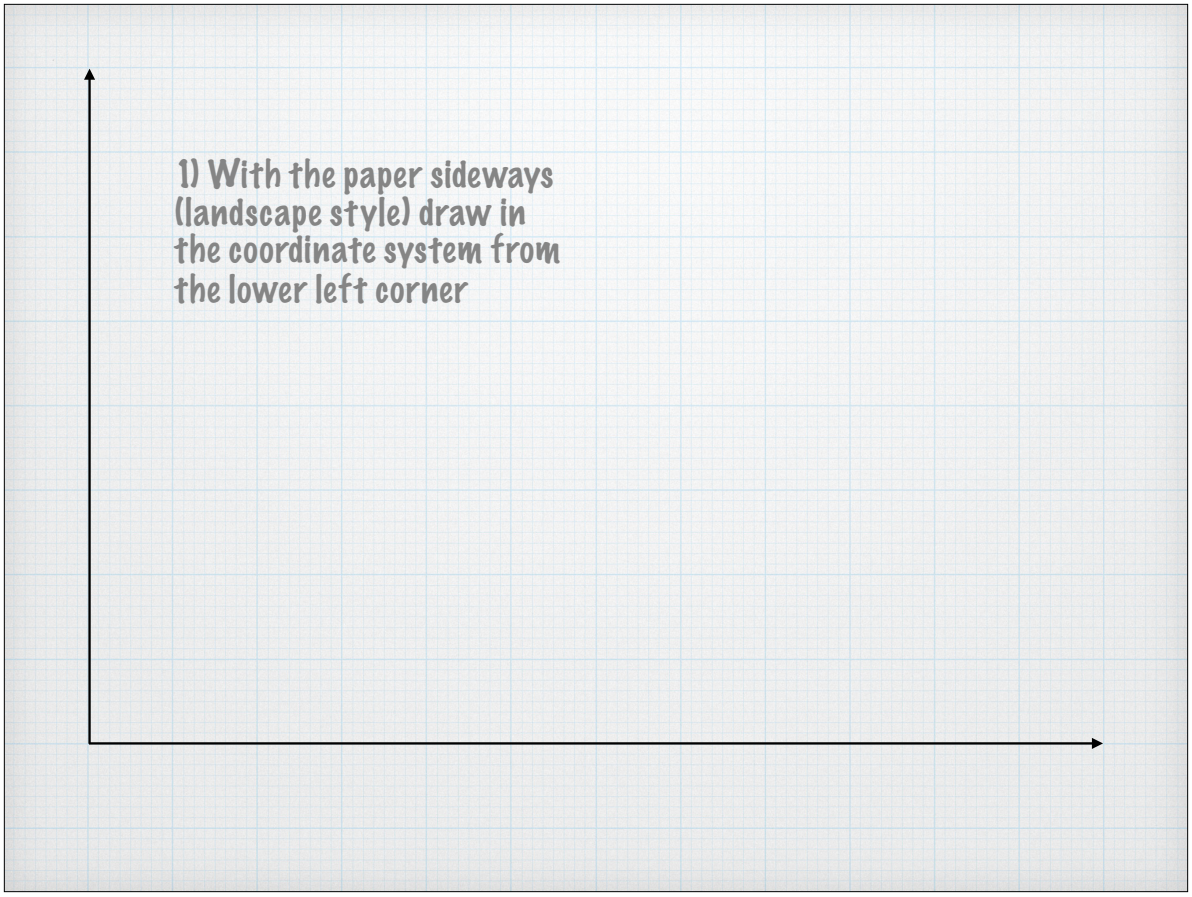
* This guide is meant to give an annotated description of how to hand plot simple graphs on a full sheet of graph paper. The method described is the fastest way I know to plot data, though it is not the prettiest. It's meant to get the job done with minimal mistakes or errors.

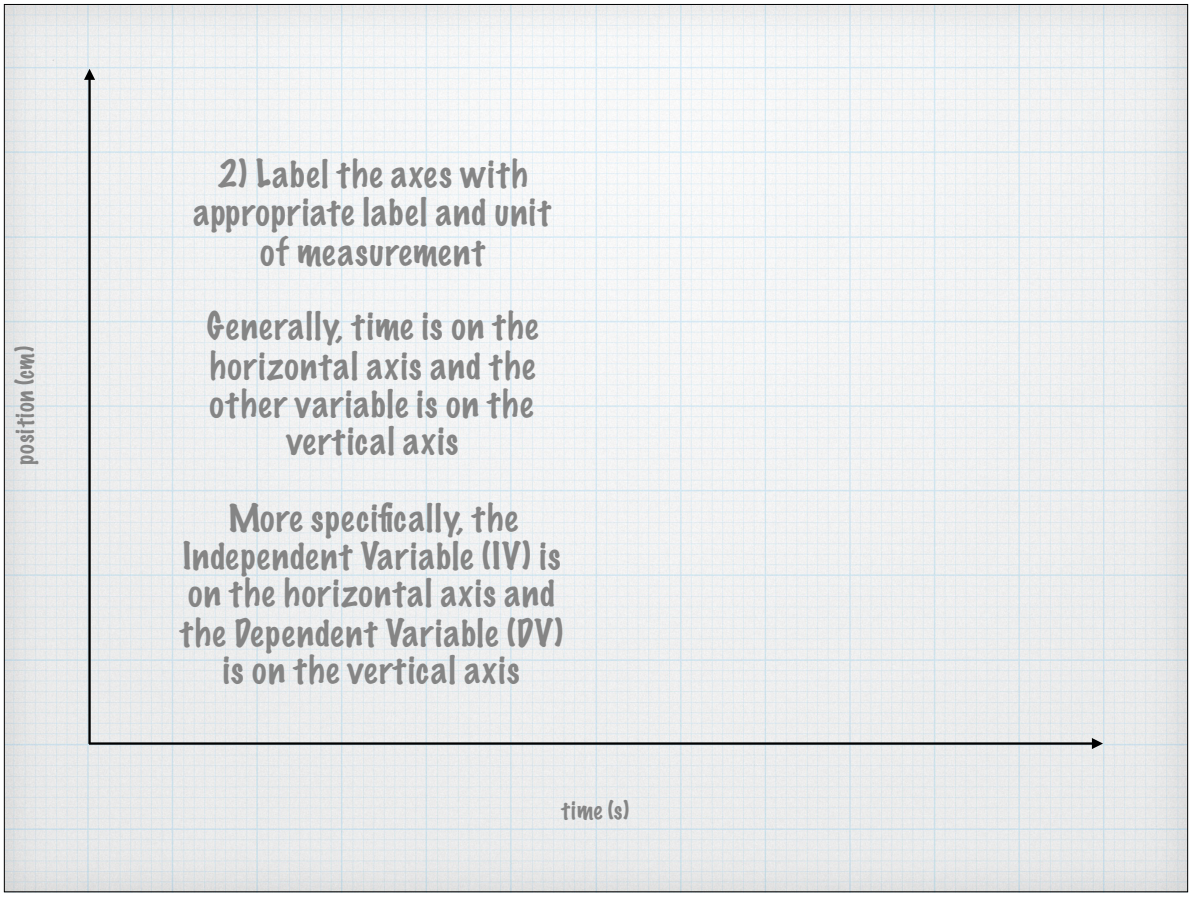
Fictional Data

* You measure the position and time data for a toy ball rolling across the floor.
* In this case we choose the time when we take the measurements (Independent Variable) and the position the ball is at, at that time, is the Dependent Variable.

Fictional Data

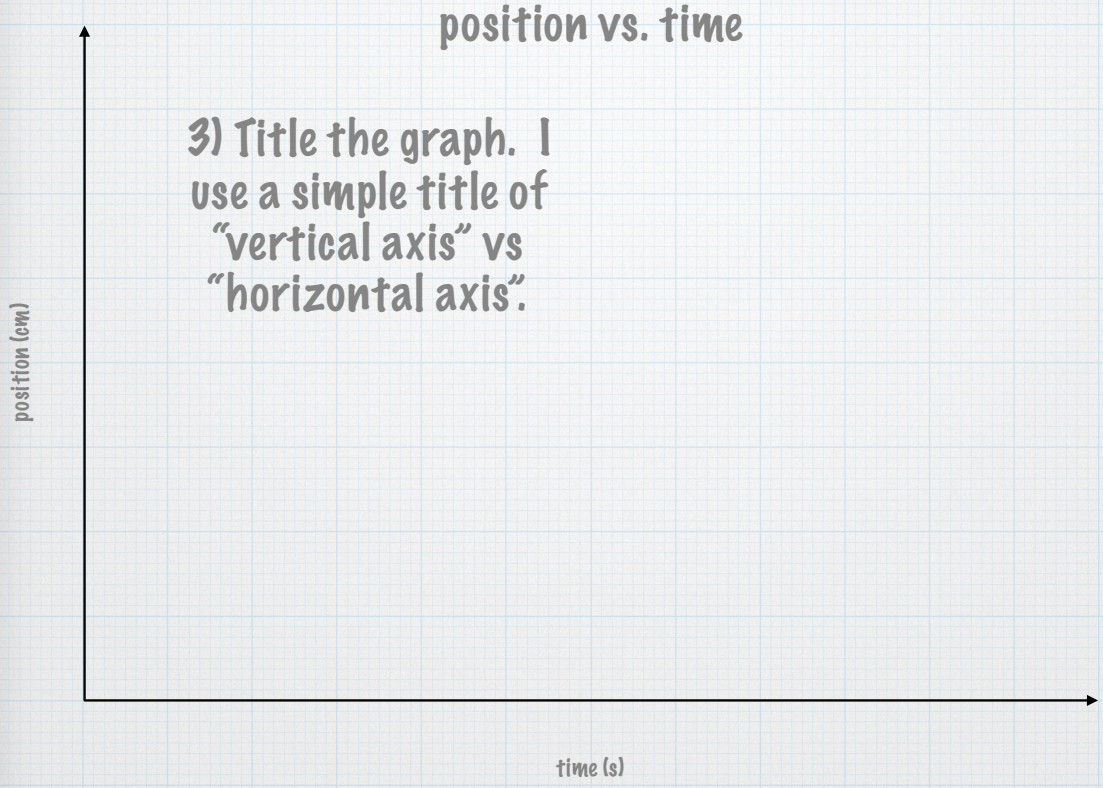
position (x)	time (s)
3	1
6	2
7	3
9	4
10	5
13	6
15	7


1) With the paper sideways (landscape style) draw in the coordinate system from the lower left corner


2) Label the axes with appropriate label and unit of measurement
Generally, time is on the horizontal axis and the other variable is on the vertical axis
More specifically, the Independent Variable (IV) is on the horizontal axis and the Dependent Variable (DV) is on the vertical axis
position (cm)
time (s)

position vs. time

3) Title the graph. I use a simple title of "vertical axis" vs "horizontal axis".



position vs. time

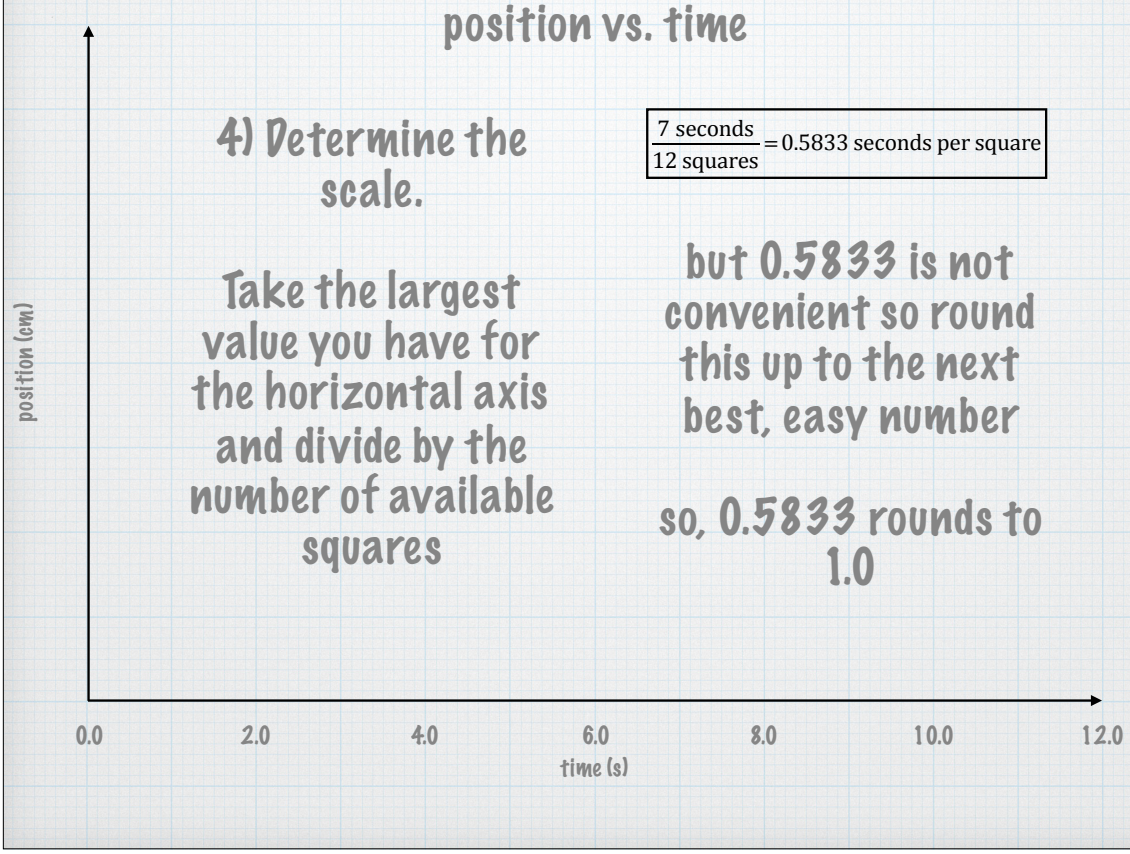
4) Determine the scale.

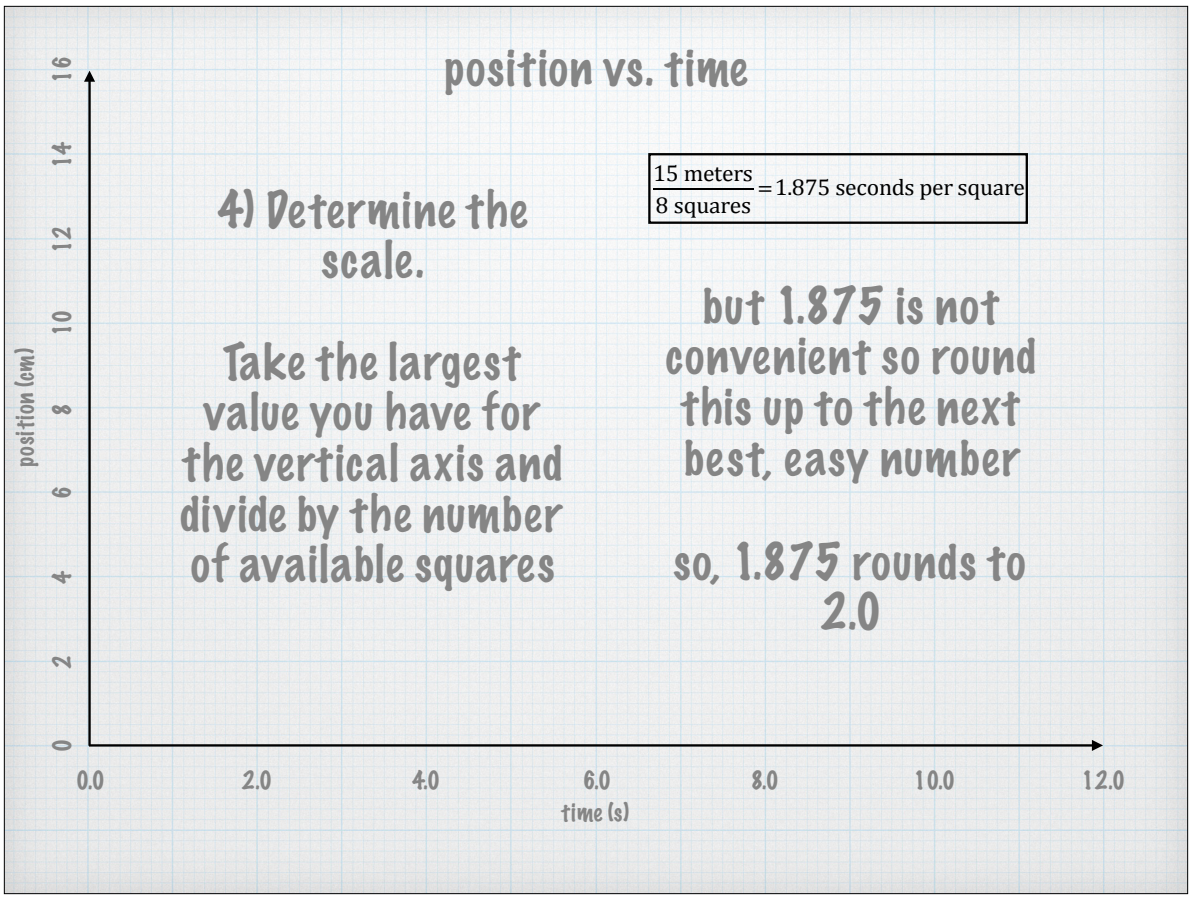
Take the largest value you have for the horizontal axis and divide by the number of available squares

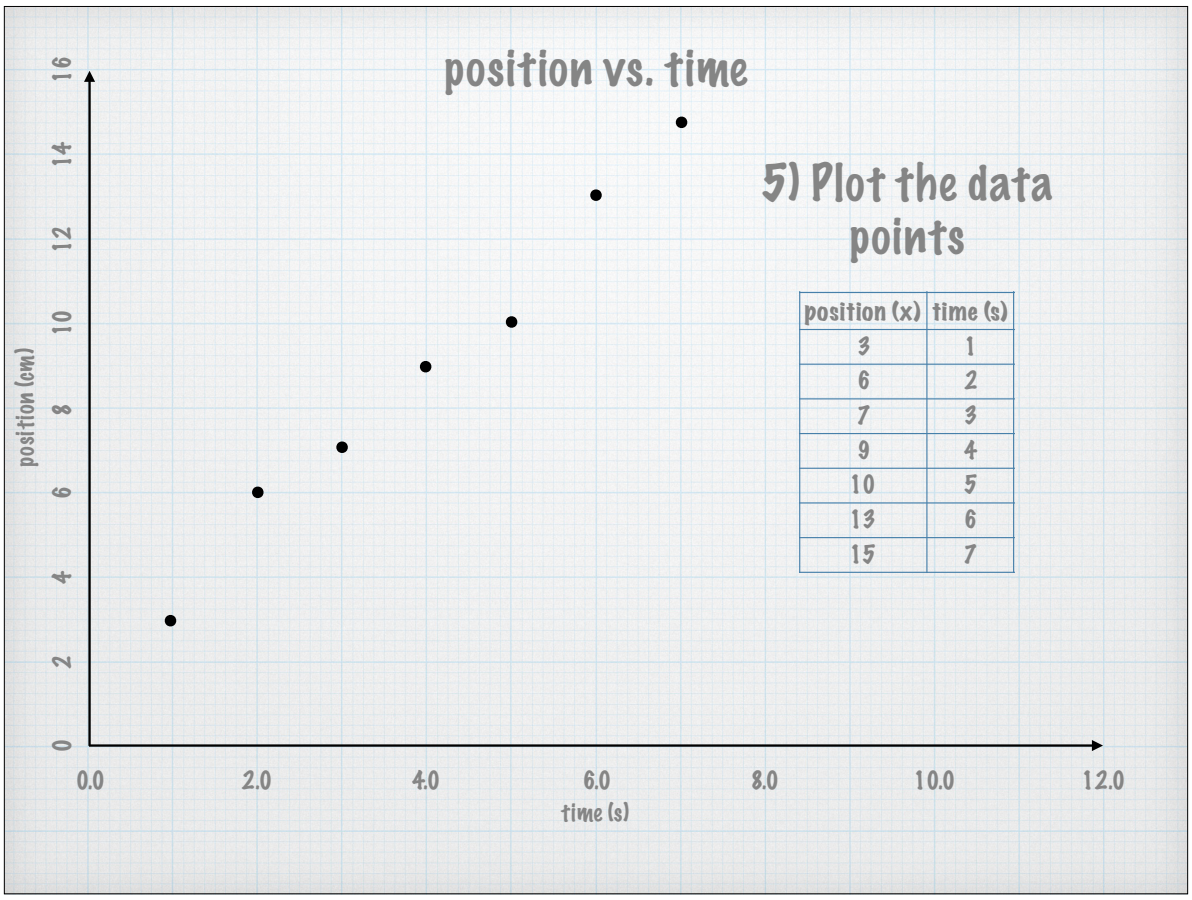
$$\frac{7 \text{ seconds}}{12 \text{ squares}} = 0.5833 \text{ seconds per square}$$

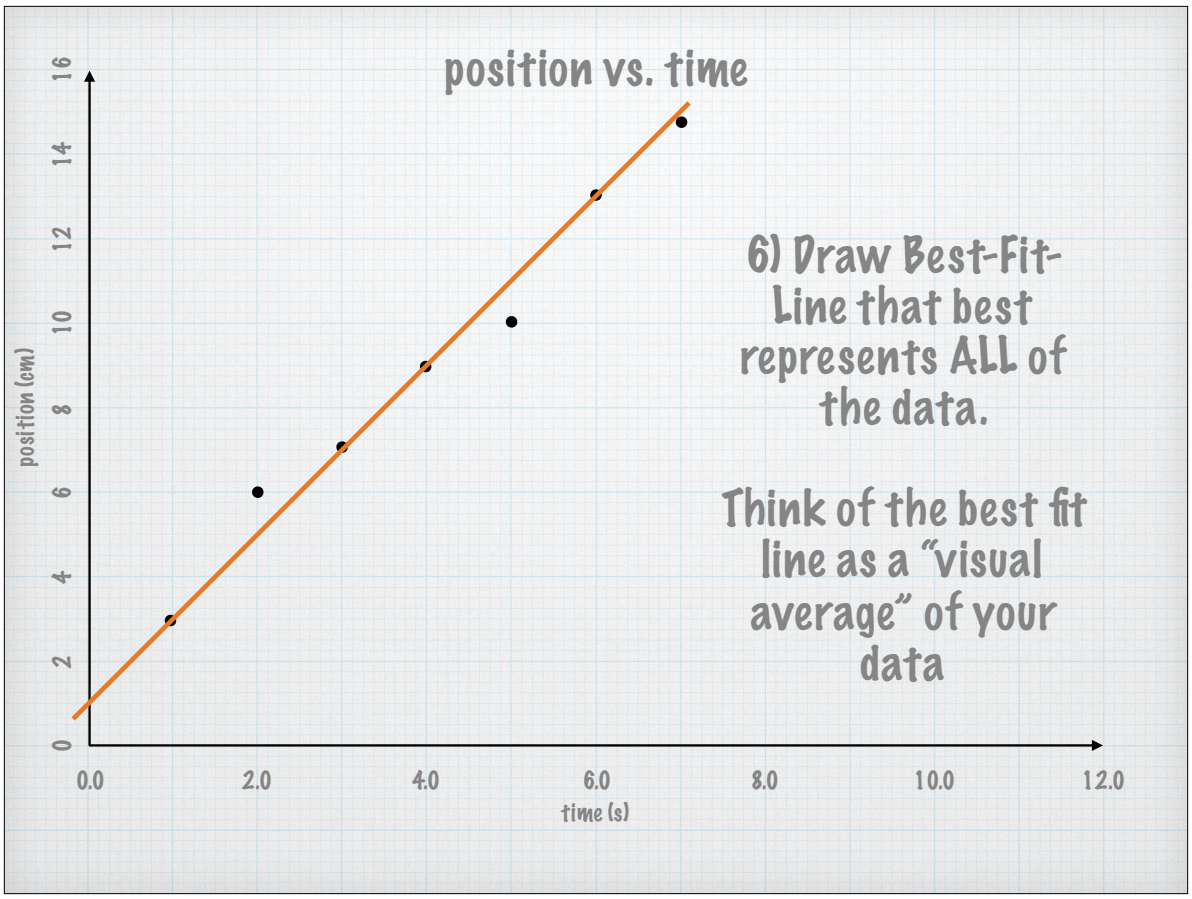
but 0.5833 is not convenient so round this up to the next best, easy number

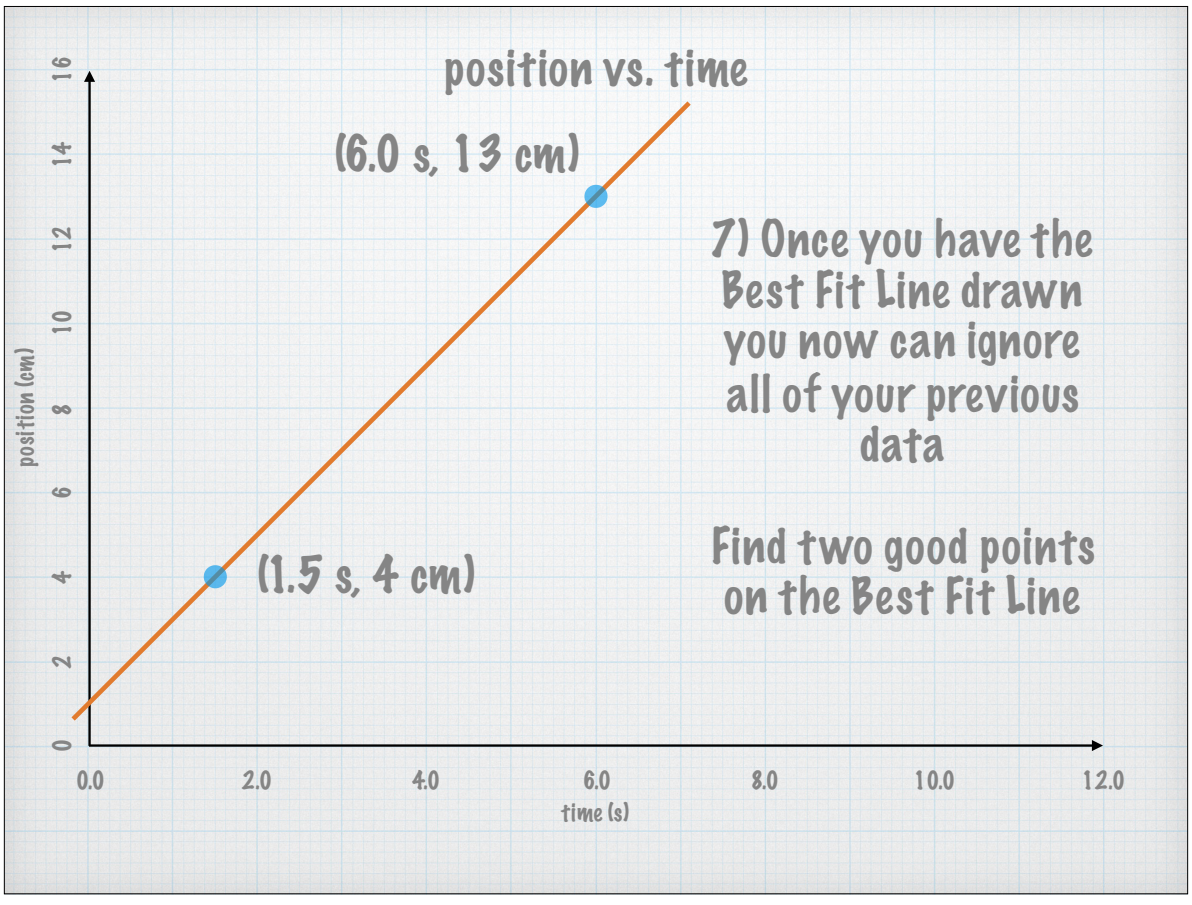
so, 0.5833 rounds to 1.0

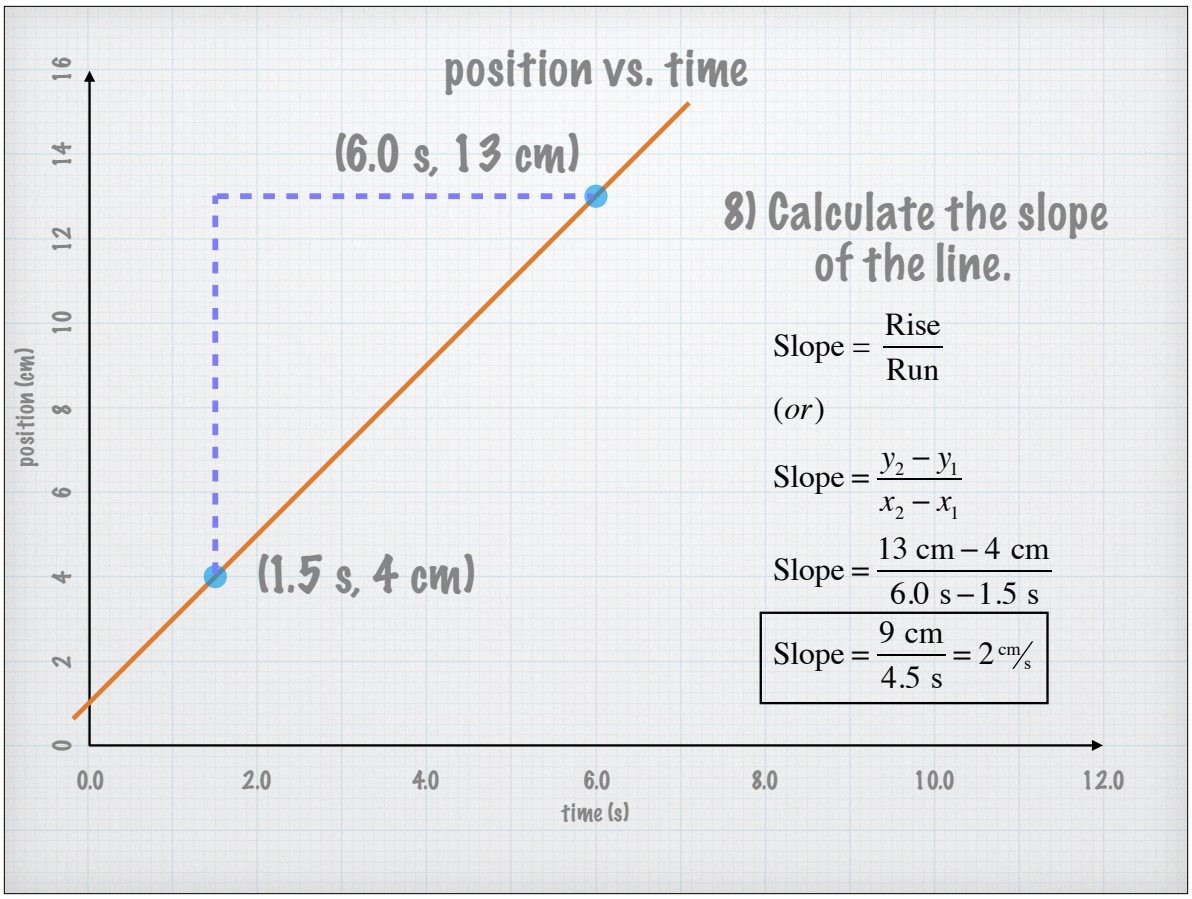



position vs. time
4) Determine the scale.
Take the largest value you have for the vertical axis and divide by the number of available squares
$\frac{15 \text{ meters}}{8 \text{ squares}} = 1.875 \text{ seconds per square}$
but 1.875 is not convenient so round this up to the next best, easy number
so, 1.875 rounds to 2.0
position (cm)
0
2
4
6
8
10
12
14
16
0.0
2.0
4.0
6.0
8.0
10.0
12.0
time (s)


position vs. time
5) Plot the data points
position (x) | time (s)
3 | 1
6 | 2
7 | 3
9 | 4
10 | 5
13 | 6
15 | 7
position (cm)
0
2
4
6
8
10
12
14
16
0.0
2.0
4.0
6.0
8.0
10.0
12.0
time (s)


position vs. time
position (cm)
0
2
4
6
8
10
12
14
16
0.0
2.0
4.0
6.0
8.0
10.0
12.0
time (s)
6) Draw Best-Fit-Line that best represents ALL of the data.
Think of the best fit line as a "visual average" of your data


position vs. time
(6.0 s, 13 cm)
(1.5 s, 4 cm)
position (cm)
0
2
4
6
8
10
12
14
16
0.0
2.0
4.0
6.0
8.0
10.0
12.0
time (s)
7) Once you have the Best Fit Line drawn you now can ignore all of your previous data
Find two good points on the Best Fit Line



8) Calculate the slope of the line.

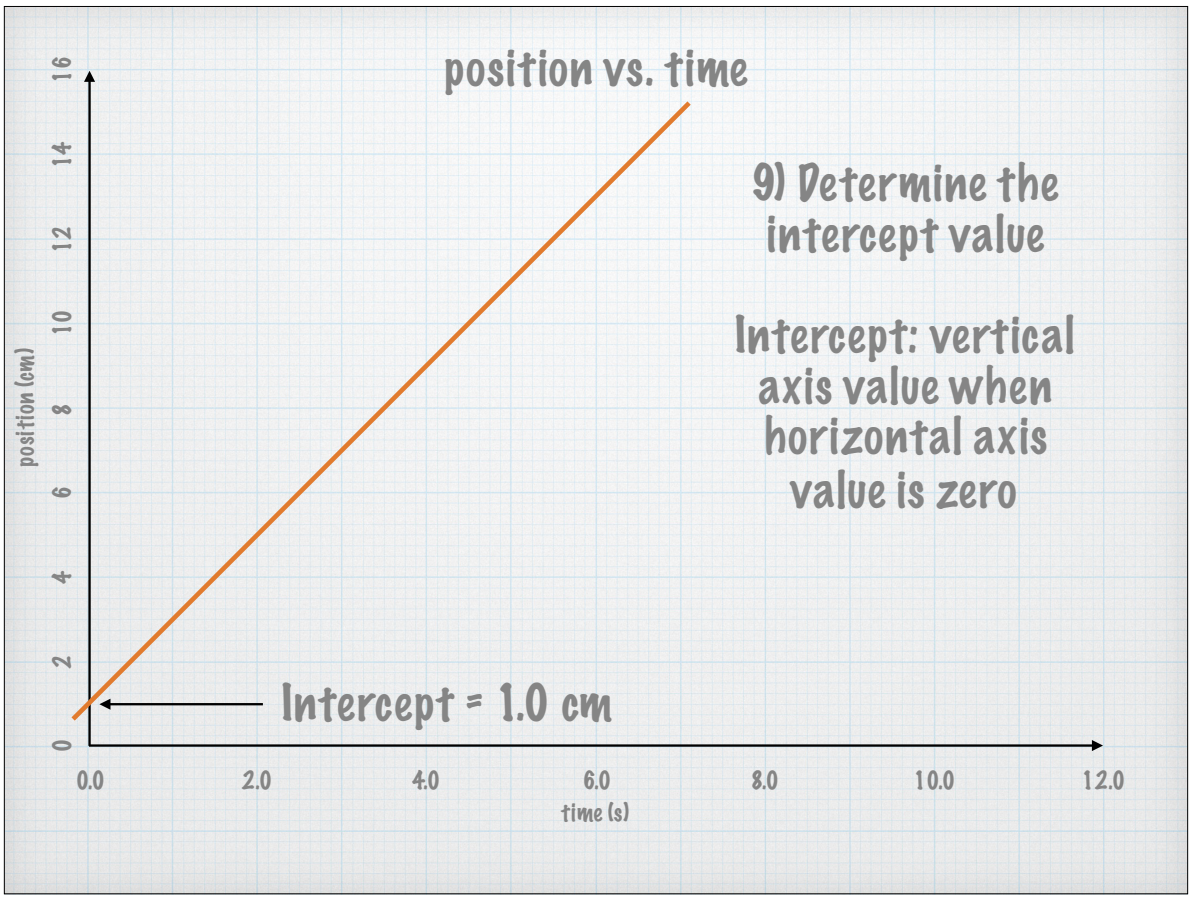
$$\text{Slope} = \frac{\text{Rise}}{\text{Run}}$$

(*or*)

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

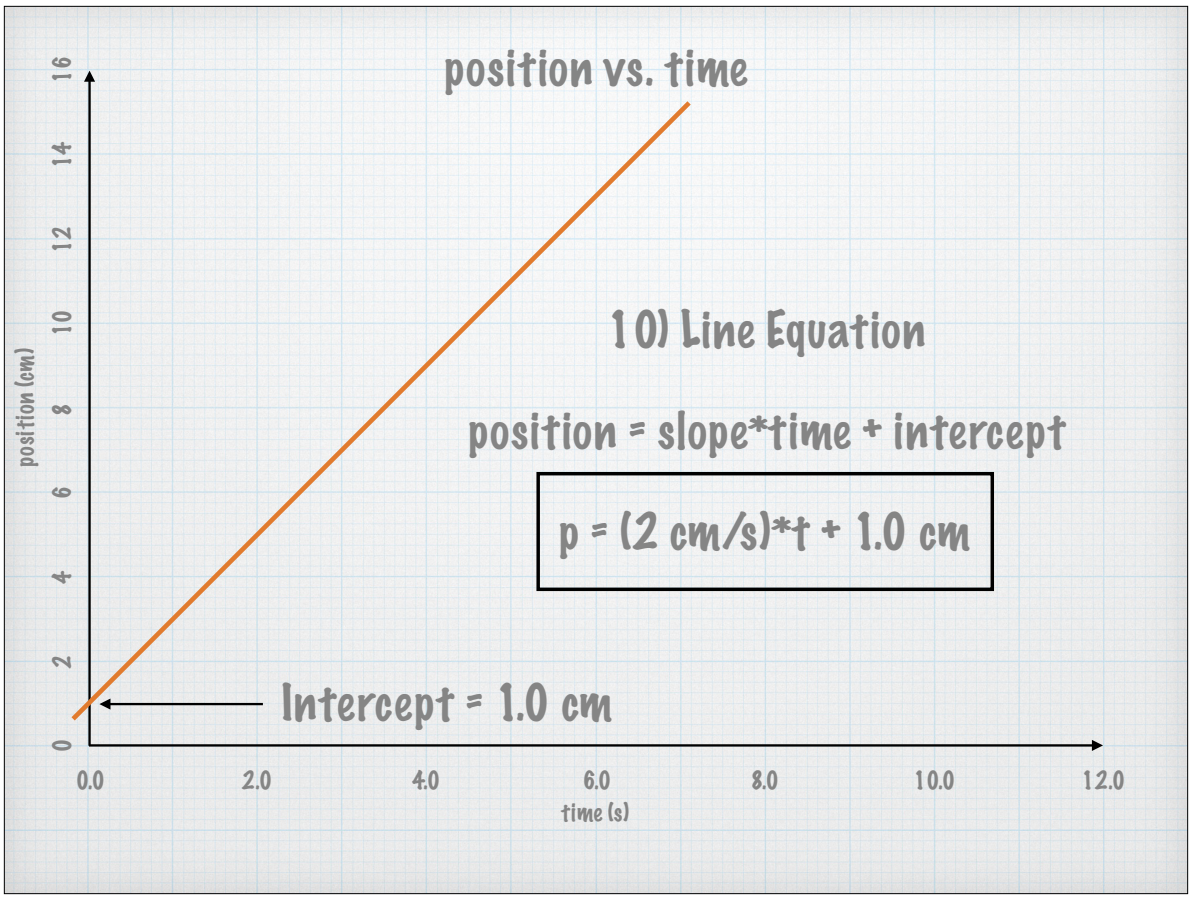
$$\text{Slope} = \frac{13\text{ cm} - 4\text{ cm}}{6.0\text{ s} - 1.5\text{ s}}$$

$$\boxed{\text{Slope} = \frac{9\text{ cm}}{4.5\text{ s}} = 2\ {}^{\text{cm}}\!/_{\text{s}}}$$



9) Determine the intercept value

Intercept: vertical axis value when horizontal axis value is zero


position vs. time
10) Line Equation
position = slope*time + intercept
p = (2 cm/s)*t + 1.0 cm
Intercept = 1.0 cm
position (cm)
0
2
4
6
8
10
12
14
16
0.0
2.0
4.0
6.0
8.0
10.0
12.0
time (s)