Homework 1

Trial	T(s)
1	3.254
2	3.154
3	3.217
4	3.250
5	3.186
6	3.265
7	3.268
8	3.164
mean =	3.220
std dev=	0.046
StD mean=	0.016

1. The average time and the standard deviation of the average time is calculated at the right . The mean time is 3.220s and σ_{mean} = 0.016s. L=2.5990m and σ_L = 0.00050m. Then $g = 4\pi^2(L/T^2)$= 9.98963m/s^2.

   The standard deviation of g is given by $(\sigma_g)^2 = g^2[(2\sigma_T/T)^2 + (\sigma_L/L)^2]$. Here $\sigma_T = \sigma_{mean}$ = 0.016s, g =9.98963m/s^2, L=2.5990m, and σ_L = 0.00050m. Putting these in yields σ_g = 0.10m/s^2. As a result

   g = 9.90 m/s^2 ± 0.10m/s^2

   with the proper number of significant digits.

   Note: since $g = 4\pi^2(L/T^2)$, $(\sigma_g/g)^2 = (2\sigma_T/T)^2 + (\sigma_L/L)^2$

2. For this problem, the position at various times is given and you are to estimate the velocity of the particle. Here you use a linear regression. The important part is

	Coefficients	*Standard Error*
Intercept	0.4768	0.0608
X Variable 1	**0.6046**	**0.0113**

   The X variable is the slope = 0.6046m/s and the standard error or standard deviation is 0.0113m/s. Rounded to the proper number of significant figures,

   V = 0.6046m/s ± 0.011m/s

3. The table at the right shows the calculation of the velocities and their mean value, standard deviation and standard deviation of the mean velocity, all done in Excel. This calculation yields a

   V = 0.633m/s ± 0.041m/s

   For both of these the position data, i.e. x was generated from the following equation in Excel where B7 is the time in the column t(s).

   x =0.5 + 0.6*(B7+0.5*(0.5-RAND()))

   As a result, one would <u>expect</u> an average v close to 0.600m/s. Obviously the regression gives a result with a small standard deviation and a v closer to 0.600m/s.

t(s)	x(m)	v (m/s)
1	1.018	
1.5	1.384	0.731
2	1.690	0.612
3	2.326	0.636
3.5	2.667	0.682
5	3.635	0.646
6	3.978	0.342
7	4.555	0.577
8.5	5.625	0.714
9	6.004	0.758
	ave v =	0.633
	stdev =	0.124
	std mean=	0.041