Introduction to Computer Tools and Uncertainties

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8/31/2012

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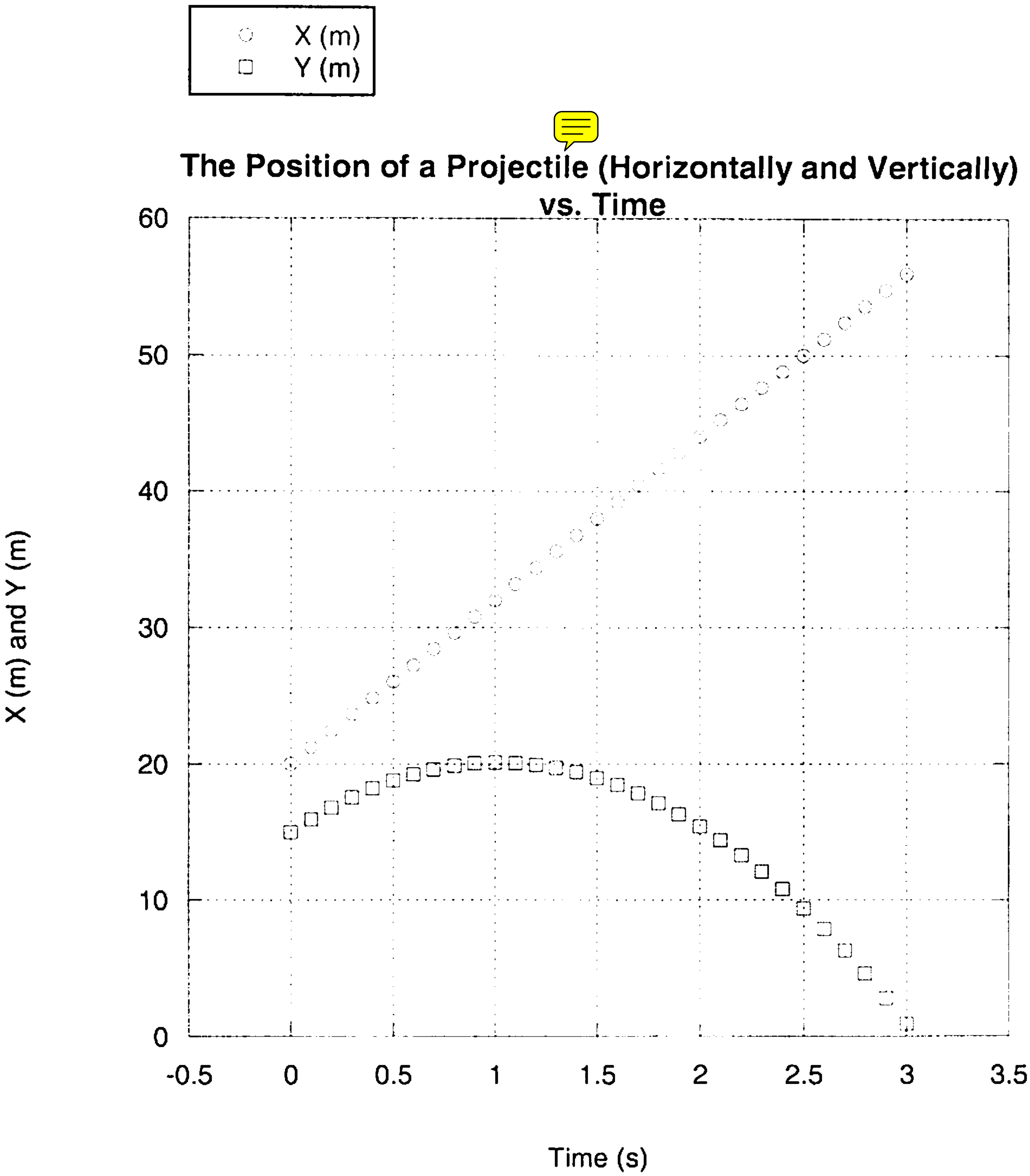
Sec # 04

	A	B	C	D	E	F	G
1	Introduction to Computer Tools and Uncertainties						
2		g	x0	y0	vx0	vy0	
3		[m/s^2]	[m]	[m]	[m/s]	[m/s]	
4		9.8	20	15	12	10	
5							
6							
7							
8							
9		time	x	y			
10		[sec]	[m]	[m]			
11		0	20	15			
12		0.1	21.2	15.951			
13		0.2	22.4	16.804			
14		0.3	23.6	17.559			
15		0.4	24.8	18.216			
16		0.5	26	18.775			
17		0.6	27.2	19.236			
18		0.7	28.4	19.599			
19		0.8	29.6	19.864			
20		0.9	30.8	20.031			
21		1	32	20.1			
22		1.1	33.2	20.071			
23		1.2	34.4	19.944			
24		1.3	35.6	19.719			
25		1.4	36.8	19.396			
26		1.5	38	18.975			
27		1.6	39.2	18.456			
28		1.7	40.4	17.839			
29		1.8	41.6	17.124			
30		1.9	42.8	16.311			
31		2	44	15.4			
32		2.1	45.2	14.391			
33		2.2	46.4	13.284			
34		2.3	47.6	12.079			
35		2.4	48.8	10.776			
36		2.5	50	9.375			
37		2.6	51.2	7.876			
38		2.7	52.4	6.279			
39		2.8	53.6	4.584			
40		2.9	54.8	2.791			
41		3	56	0.9			

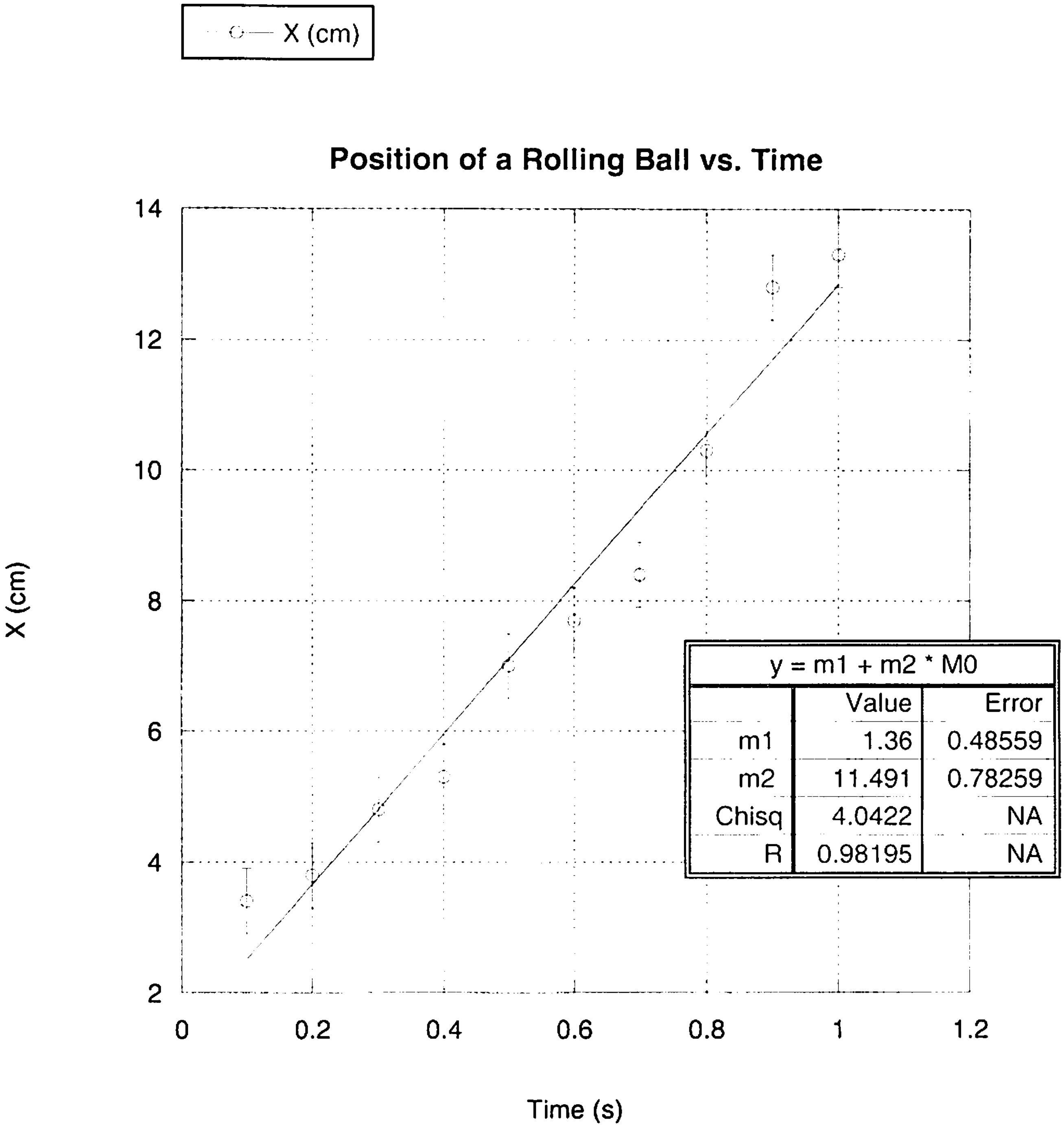
	A	B	C	D	E	F
1	**Introd**					
2		**g**	**x0**	**y0**	**vx0**	**vy0**
3		[m/s^2]	[m]	[m]	[m/s]	[m/s]
4		9.8	20	15	12	10
5						
6						
7						
8						
9		**time**	**x**	**y**		
10		[sec]	[m]	[m]		
11		0	=x0+vx0*B11	=y0+vy0*B11-0.5*g*B11^2		
12		=B11+0.1	=x0+vx0*B12	=y0+vy0*B12-0.5*g*B12^2		
13		=B12+0.1	=x0+vx0*B13	=y0+vy0*B13-0.5*g*B13^2		
14		=B13+0.1	=x0+vx0*B14	=y0+vy0*B14-0.5*g*B14^2		
15		=B14+0.1	=x0+vx0*B15	=y0+vy0*B15-0.5*g*B15^2		
16		=B15+0.1	=x0+vx0*B16	=y0+vy0*B16-0.5*g*B16^2		
17		=B16+0.1	=x0+vx0*B17	=y0+vy0*B17-0.5*g*B17^2		
18		=B17+0.1	=x0+vx0*B18	=y0+vy0*B18-0.5*g*B18^2		
19		=B18+0.1	=x0+vx0*B19	=y0+vy0*B19-0.5*g*B19^2		
20		=B19+0.1	=x0+vx0*B20	=y0+vy0*B20-0.5*g*B20^2		
21		=B20+0.1	=x0+vx0*B21	=y0+vy0*B21-0.5*g*B21^2		
22		=B21+0.1	=x0+vx0*B22	=y0+vy0*B22-0.5*g*B22^2		
23		=B22+0.1	=x0+vx0*B23	=y0+vy0*B23-0.5*g*B23^2		
24		=B23+0.1	=x0+vx0*B24	=y0+vy0*B24-0.5*g*B24^2		
25		=B24+0.1	=x0+vx0*B25	=y0+vy0*B25-0.5*g*B25^2		
26		=B25+0.1	=x0+vx0*B26	=y0+vy0*B26-0.5*g*B26^2		
27		=B26+0.1	=x0+vx0*B27	=y0+vy0*B27-0.5*g*B27^2		
28		=B27+0.1	=x0+vx0*B28	=y0+vy0*B28-0.5*g*B28^2		
29		=B28+0.1	=x0+vx0*B29	=y0+vy0*B29-0.5*g*B29^2		
30		=B29+0.1	=x0+vx0*B30	=y0+vy0*B30-0.5*g*B30^2		
31		=B30+0.1	=x0+vx0*B31	=y0+vy0*B31-0.5*g*B31^2		
32		=B31+0.1	=x0+vx0*B32	=y0+vy0*B32-0.5*g*B32^2		
33		=B32+0.1	=x0+vx0*B33	=y0+vy0*B33-0.5*g*B33^2		
34		=B33+0.1	=x0+vx0*B34	=y0+vy0*B34-0.5*g*B34^2		
35		=B34+0.1	=x0+vx0*B35	=y0+vy0*B35-0.5*g*B35^2		
36		=B35+0.1	=x0+vx0*B36	=y0+vy0*B36-0.5*g*B36^2		
37		=B36+0.1	=x0+vx0*B37	=y0+vy0*B37-0.5*g*B37^2		
38		=B37+0.1	=x0+vx0*B38	=y0+vy0*B38-0.5*g*B38^2		
39		=B38+0.1	=x0+vx0*B39	=y0+vy0*B39-0.5*g*B39^2		
40		=B39+0.1	=x0+vx0*B40	=y0+vy0*B40-0.5*g*B40^2		
41		=B40+0.1	=x0+vx0*B41	=y0+vy0*B41-0.5*g*B41^2		

	A	B	C	D	E	F
1						
2		Uncertainty in X				
3		δX =	0.5	cm		
4						
5						
6			Time	X	X for greatest slope	X for least slope
7			(seconds)	(cm)	(cm)	(cm)
8			0.1	3.4	2.10	2.92
9			0.2	3.8	3.33	3.99
10			0.3	4.8	4.56	5.06
11			0.4	5.3	5.78	6.13
12			0.5	7	7.01	7.20
13			0.6	7.7	8.24	8.27
14			0.7	8.4	9.47	9.34
15			0.8	10.3	10.69	10.41
16			0.9	12.8	11.92	11.48
17			1	13.3	13.15	12.55

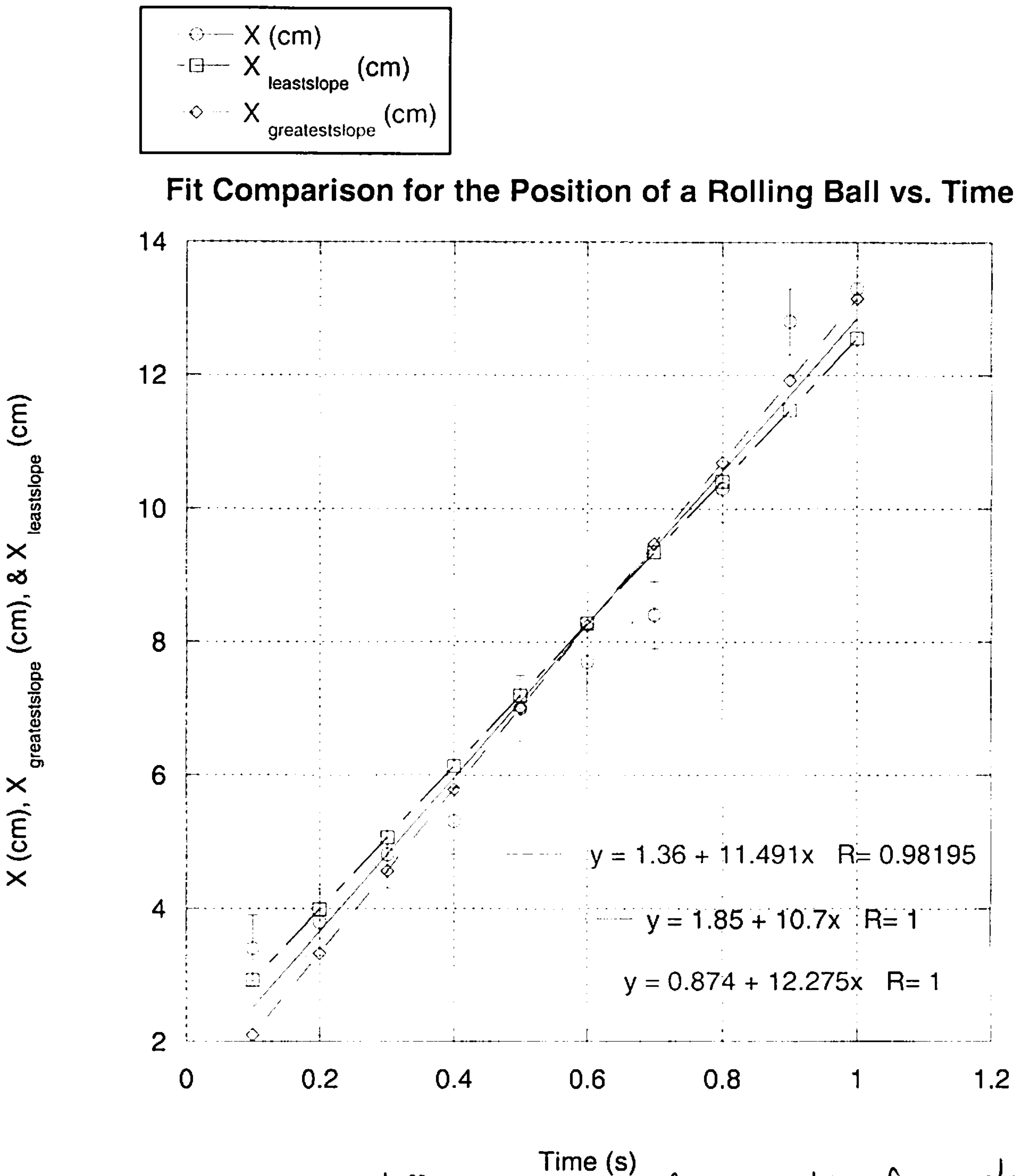
	A	B	C	D	E	F
1						
2		Uncertainty in				
3		δX =	0.5	cm		
4						
5						
6			Time	X	X for greatest slope	X for least slope
7			(seconds)	(cm)	(cm)	(cm)
8			0.1	3.4	=(11.491+0.783)*C8+(1.36-0.486)	=(11.491-0.783)*C8+(1.36+0.486)
9			0.2	3.8	=(11.491+0.783)*C9+(1.36-0.486)	=(11.491-0.783)*C9+(1.36+0.486)
10			0.3	4.8	=(11.491+0.783)*C10+(1.36-0.486)	=(11.491-0.783)*C10+(1.36+0.486)
11			0.4	5.3	=(11.491+0.783)*C11+(1.36-0.486)	=(11.491-0.783)*C11+(1.36+0.486)
12			0.5	7	=(11.491+0.783)*C12+(1.36-0.486)	=(11.491-0.783)*C12+(1.36+0.486)
13			0.6	7.7	=(11.491+0.783)*C13+(1.36-0.486)	=(11.491-0.783)*C13+(1.36+0.486)
14			0.7	8.4	=(11.491+0.783)*C14+(1.36-0.486)	=(11.491-0.783)*C14+(1.36+0.486)
15			0.8	10.3	=(11.491+0.783)*C15+(1.36-0.486)	=(11.491-0.783)*C15+(1.36+0.486)
16			0.9	12.8	=(11.491+0.783)*C16+(1.36-0.486)	=(11.491-0.783)*C16+(1.36+0.486)
17			1	13.3	=(11.491+0.783)*C17+(1.36-0.486)	=(11.491-0.783)*C17+(1.36+0.486)



This plot represents the vertical and horizontal positions of a projectile under the gravity of earth. It was generated by a formula. The horizontal distance is a straight line and matches $X = v_{x0}t + X_0$; the vertical distance is a parabola and matches $Y = -\frac{1}{2}gt^2 + v_{y0}t + Y_0$.



This plot represents the position of a rolling ball. We took the data and made a linear fit. It matches the equation $X = V_{x_0} t + X_0$. We notice it is somewhat linear, and we can extract the velocity from the slope and the initial position from the intercept.



This plot compares three different fits to the same data from plot 2: the best fit, the greatest slope fit, and the least slope fit. We generates $X_{greatestslope}$ and $X_{leastslope}$ to explore the uncertainties in the fit parameters from plot 2. We notice that while different, all 3 lines fit the data reasonably well, which shows our uncertainties are reasonable. See questions 4 & 5.

Questions

In answering the questions in every laboratory this semester, a measured quantity must ALWAYS include: 1) the numerical value, 2) its units, and 3) its uncertainty. Unless otherwise stated, missing any of these quantities, the measurement will be considered incomplete and will receive reduced credit.

1. What is the slope of the best-fit line obtained using the Kaleidagraph fit?

The slope is 11.481 ± .783 cm/s

2. What is the "y-intercept" of the best-fit line obtained using the Kaleidagraph fit?

The Y-intercept is 1.36 ± .49 cm

3. What are the numerical value and units for the parameters in the parentheses of equations 3 and 4? Show these for one value of your calculation of $X_{greatestslope}$, and one value of your calculation of $X_{leastslope}$.

For $t = 0.1$ s We have:

$X_{greatest\ slope} = (11.491 + .783) * (0.1) + (1.36 - .486)$

$X_{least\ slope} = (11.491 - .783) * (0.1) + (1.36 + .486)$

Thus:

	Slope	Intercept
$X_{greatest\ slope}$	12.27 cm/s	.87 cm
$X_{least\ slope}$	10.71 cm/s	1.85 cm

4. The lines of "greatest reasonable slope" and "least reasonable slope" used the slope, intercept and their uncertainties from the Kaleidagraph best-fit. Do these lines pass through most of your error bars? Consider my graph. $X_{greatest\ slope}$ passes through 6/10; $X_{least\ slope}$ passes through 6/10; $X_{best\ fit}$ passes through 5/10. Taken together, the lines hit 7/10 points, so they do pass through most.

5. Does the Kaleidagraph fit return a reasonable estimate of the uncertainties in the slope and intercept of the best-fit line?

The uncertainties in the slope and intercept of the best fit line are reasonable. Notice: each of the lines goes through about the same number of error bars. We used those uncertainties to construct the two extreme fits. Since all the fits do as well, they are all nearly the same in quality, so my uncertainty is appropriate.