F. S. T. **Name: __KEY_____**

Homework 2-8 **Block: _____**

1. A rock was thrown downward from a cliff 250 m off the ground. The height of the rock was measured at one-second intervals and is given in the table at the right.

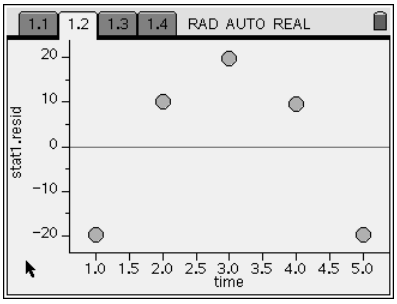
Time (Sec)	Height(m)
1	243
2	217
3	171
4	105
5	20

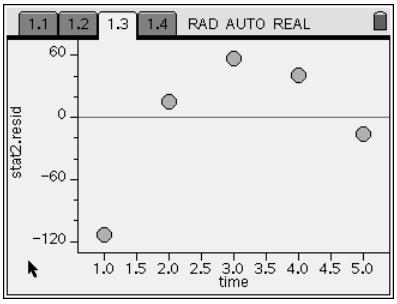
a. Find each Model:

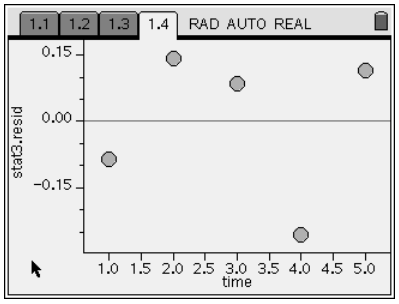
Linear: $h = -55.8t + 318.6$ Exponential: $h = 632.096(0.564)^t$ Quadratic: $h = -9.857t^2 + 3.343t + 249.6$

b. Here are the graphs of the residuals.

Linear: Exponential: Quadratic:







c. Write a sentence or two explaining which model is best and why.

The quadratic regression equation is the best model since the residuals are closest to zero.

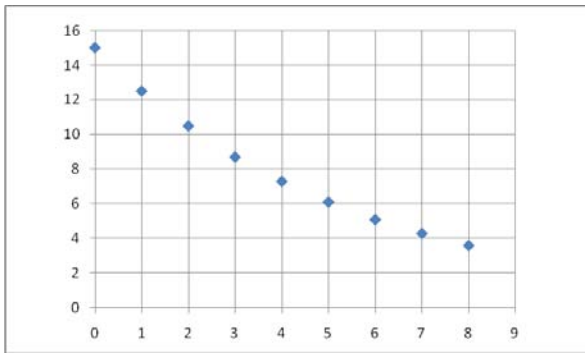
d. Use your model to predict the height of the rock at 3.5 seconds.

$$h = -9.857(3.5)^2 + 3.343(3.5) + 249.6$$
$$h = 140.55225$$

2. The concentration of aspirin in a patient's body since they initially took the medication is given in the table below.

Hours since medication taken	0	1	2	3	4	5	6	7	8
Mg of Aspirin per 100 cc of Blood	15	12.5	10.5	8.7	7.3	6.1	5.1	4.3	3.6

a) Make a scatterplot of the data.



b) Find each regression equation, and use them to complete the following table of residuals.

Hours Since Medication Taken	Mg of Aspirin per 100cc of Blood	Linear Predicted	Linear Error	Exponential Predicted	Exponential Error	Quadratic Predicted	Quadratic Error
0	15	13.696	1.304	14.944	0.056	14.867	0.133
1	12.5	12.302	0.198	12.501	-0.001	12.595	-0.095
2	10.5	10.909	-0.409	10.458	0.042	10.574	-0.074
3	8.7	9.516	-0.816	8.748	-0.048	8.804	-0.104
4	7.3	8.122	-0.822	7.318	-0.018	7.285	0.015
5	6.1	6.729	-0.629	6.122	-0.022	6.017	0.083
6	5.1	5.336	-0.236	5.121	-0.021	5.001	0.099
7	4.3	3.942	0.358	4.284	0.016	4.235	0.065
8	3.6	2.549	1.051	3.584	0.016	3.721	-0.121

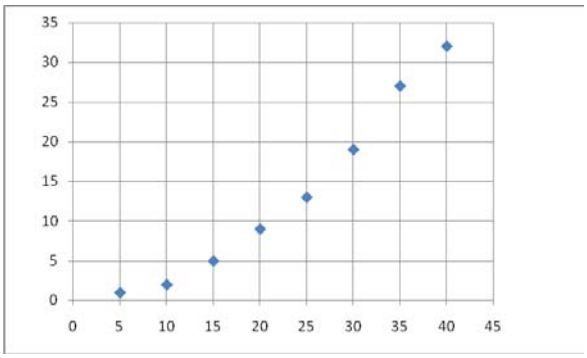
c) Which, if any, of a linear, exponential, or quadratic model seems to model these data? Justify your answer.

While all have very small errors, the exponential errors are the smallest, therefore, the exponential model is the best model for this data.

3. The diameter and breaking strengths of various 3 ply polypropylene ropes are given in the table below.

Rope Diameter	5	10	15	20	25	30	35	40
Breaking Strength (x 1000 lbs)	1	2	5	9	13	19	27	32

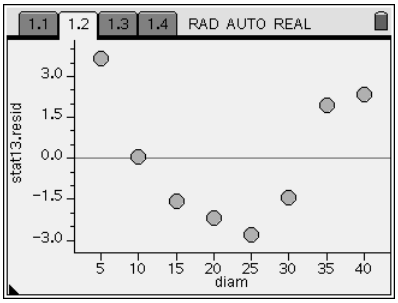
a. Make a scatterplot of the data, plotting number of years since 1980 on the *x*-axis.



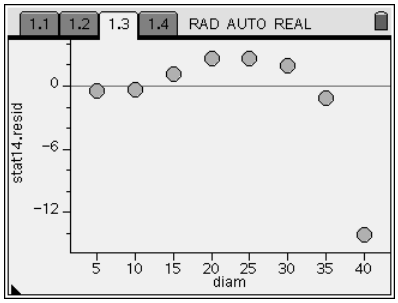
b. Use the following table of residuals to create a residual plot for each regression.

Rope Diameter	Breaking Strength (x 1000 lbs)	Linear Predicted	Linear Error	Exponential Predicted	Exponential Error	Quadratic Predicted	Quadratic Error
5	1	-2.667	3.667	1.435	-0.435	0.583	0.417
10	2	1.952	0.048	2.356	-0.356	2.417	-0.417
15	5	6.571	-1.571	3.868	1.132	5.179	-0.179
20	9	11.190	-2.190	6.350	2.650	8.869	0.131
25	13	15.810	-2.810	10.425	2.575	13.488	-0.488
30	19	20.429	-1.429	17.116	1.884	19.036	-0.036
35	27	25.048	1.952	28.101	-1.101	25.512	1.488
40	32	29.667	2.333	46.137	-14.137	32.917	-0.917

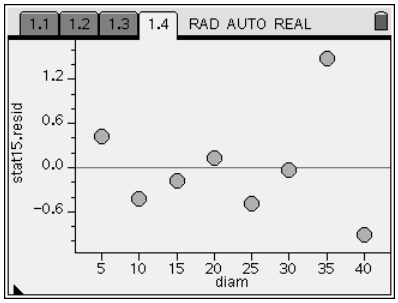
Linear Residual Plot



Exponential Residual Plot



Quadratic Residual Plot



c. Which, if any, of a linear, exponential or quadratic, model seems to model these data? Justify your answer.

Since the quadratic residual plot has most of the points close to zero, then quadratic model is the best. Notice the exponential plot was good at the beginning, then took off toward the end.

4. The population of Nevada from 1985 to 1994 is given in the table below.

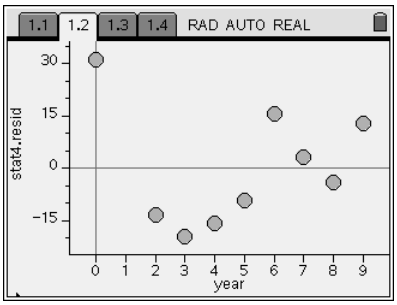
Year	1985	1987	1988	1989	1990	1991	1992	1993	1994
Population (thousands)	951	1023	1075	1137	1202	1285	1331	1382	1457

a. Find each Model:

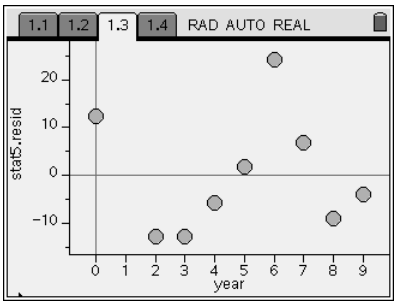
Linear: $y = 58.279x + 919.858$ Exponential: $y = 938.763(1.050)^x$ Quadratic: $y = 1.493x^2 + 44.504x + 940.087$

b. Here are the graphs of the residuals.

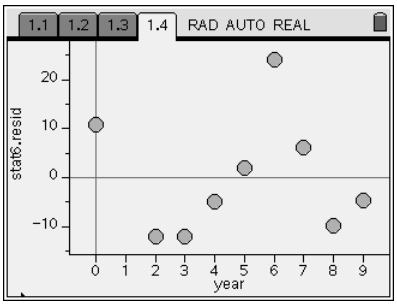
Linear:



Exponential:



Quadratic:



c. Which, if any, of a linear, exponential or quadratic, model seems to model these data? Justify your answer.

Since none of the residual plots have errors that are close to zero, and the exponential and quadratic errors are almost exactly the same then none of these models seem to fit the data better than the other.