How to Weigh an Alligator

Objectives

- Using the data below develop a model from which the weight of an alligator can be predicted from its length.
- Provide mathematical justification for the model you chose.
- Use the model to predict and interpret alligator data.

Many wildlife populations are monitored by taking aerial photographs. Information about the number of animals and their whereabouts is important to protecting certain species and ensuring the safety of surrounding human populations. In addition, it is sometimes possible to monitor certain characteristics of the animals. The length of an alligator can be estimated quite accurately from aerial photographs or from a boat. However, the alligator's weight is much more difficult to determine. Would you like to try and convince an alligator to hop on a scale?

Listed below is data on the length and weight of observed alligators.

(Source: http://exploringdata.cqu.edu.au/datasets.htm)

Length in inches	Weight in pounds
58	28
61	44
63	33
68	39
69	36
72	38
72	61
74	54
74	51
76	42
78	57
82	80
85	84
86	83
86	80
86	90
88	70
89	84
90	106
90	102
94	110
94	130
114	197
128	366
147	640

Independent Variable _____ Dependent Variable _____

Entering the Data

1. Go into the EDIT menu by pressing $\boxed{\text{STAT}}$ $\boxed{\text{ENTER}}$.

2. Enter your Independent data into L_1 and your Dependent data into L_2.

   If there is already data in your lists using your arrows go to the top of the list and press $\boxed{\text{CLEAR}}$ $\boxed{\text{ENTER}}$.

3. When your data is in your lists it should look like the screen below.

L1	L2	L3	3
58	28		
61	44		
63	33		
68	39		
69	36		
72	38		
72	61		

L3(1)=

Plotting the Data

1. Begin by going to the STAT PLOTS menu by pressing $\boxed{\text{2nd}}$ $\boxed{\text{Y=}}$.

2. Choose Plot1 by pressing $\boxed{1}$ or $\boxed{\text{ENTER}}$. Your screen will look like the one below.

```
Plot1  Plot2  Plot3
On  Off
Type:
Xlist:L1
Ylist:L2
Mark:  □  +  ■
```
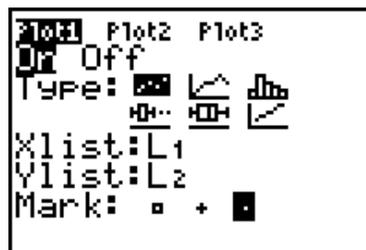
3. This screen offers many options for plotting data. ⌣ indicates a scatter plot. Highlight the icon by moving left and right with the arrow keys and pressing $\boxed{\text{ENTER}}$.

4. Xlist is asking where your independent data is located. We entered our independent data into L_1. If L_1 is not listed press $\boxed{\text{2nd}}\boxed{1}$ to write L_1.

5. Ylist is asking where your dependent data is located. We entered our dependent data into L_2. If L_2 is not listed press $\boxed{\text{2nd}}\boxed{2}$ to write L_2.

6. The final option Mark is a choice of which mark (small box, plus sign, or small dot) you would like to have to calculator make to represent each data point. Choose one by placing your cursor over it and pressing $\boxed{\text{ENTER}}$.

Viewing the Data

1. If you press $\boxed{\text{GRAPH}}$ the data will be graphed in the last window you used. This may be an appropriate window, but is most likely not.

2. The calculator will select the appropriate window based on your data by going to the Zoom menu (press $\boxed{\text{ZOOM}}$) and selecting choice 9 ZoomStat. To select choice 9 either press $\boxed{9}$, or using your arrows, move down to choice 9 and press $\boxed{\text{ENTER}}$.

3. Your screen should look like the one below.
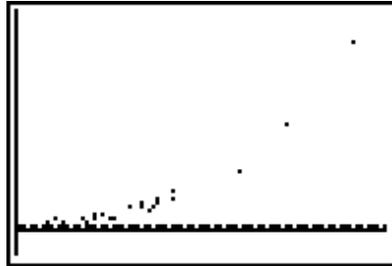
Creating a Model

1. Before creating a model, enable the calculator's diagnostic function by entering the catalog, press $\boxed{\text{2nd}}\boxed{\text{CATALOG}}$.

2. Use the arrow keys to scroll down to DiagnosticOn.

Hint: By pressing $\boxed{x^{-1}}$ the catalog will skip directly to the "D's" in the list! What a time saver!

3. Press $\boxed{\text{ENTER}}$.

4. Press $\boxed{\text{ENTER}}$. Your calculator will reply done.

5. Each regression is run the same way, you simply choose a different regression type.

6. Enter the STAT menu by pressing $\boxed{\text{STAT}}$.

7. Arrow to the right using the arrow keys to highlight CALC. This will bring down a menu as shown below.

```
EDIT CALC TESTS
1█1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7↓QuartReg
```

8. Choose the type of regression you would like to run. For example if a linear regression is needed either press ④ or arrow down to LinReg (ax+b) and press ENTER. This will automatically take you back to the home screen.

```
LinReg(ax+b)
```

9. Tell the calculator where your independent data is located by pressing 2nd①.

10. Type a comma, by pressing ,; this button is located directly above the ⑦.

11. Tell the calculator where your dependent data is located by pressing 2nd②.

12. Type a comma, by pressing ,; this button is located directly above the ⑦.

13. Tell the calculator where to store the equation of the model by pressing VARS arrow over to Y-Vars, press ENTER on Function then press ENTER on Y_1.

14. Your screen will look like the one below.

```
LinReg(ax+b) L1,
L2,Y1█
```

15. Press $\boxed{\text{ENTER}}$. Your screen will look like the one below.
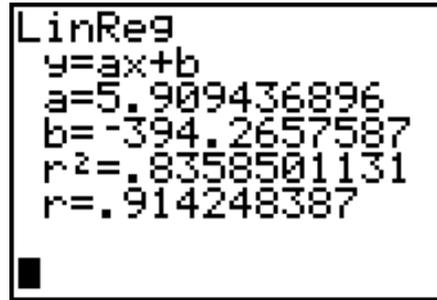
```
LinReg
 y=ax+b
 a=5.909436896
 b=-394.2657587
 r²=.8358501131
 r=.914248387

■
```

16. To view the equation of the linear regression model press $\boxed{\text{Y=}}$.

17. To view the graph of the data with the linear model drawn in press $\boxed{\text{GRAPH}}$.

How to Weigh an Alligator

Name _____

Date _____

Choosing and Using a Model

1. Create a linear model, a quadratic model, an exponential model, and a power model of the data. Record below the equation and the r^2 value of each model.

Model	Equation	r^2 value
Linear		
Quadratic		
Exponential		
Power Model		

Answer the following questions on a separate piece of paper.

2. Based on your results above which model do you believe is the most accurate way to model this data? Provide justification for your choice.

3. Using your model find the y – intercept. Explain using words like length and height, what does the y – intercept mean in real life. Does your answer make sense? Explain.

4. Use your model to find the weight of an alligator 100 inches long. Find the weight of an alligator 20 inches long.

5. The longest alligator recorded in Florida's Everglade National Park was 17 feet 5 inches (http://www.nps.gov/archive/ever/eco/gator.htm). According to your model how much did the alligator weigh?

6. What limitations does your model have in predicting data?