

## Activity 13

### Objectives

- ◆ To graph data of human fetal growth rate
- ◆ To interpolate using a best-fit model
- ◆ To compare human fetal size with that of other mammals
- ◆ To compare different methods of animal reproduction
- ◆ To compare altricial and precocial birds

## Growing Babies

### ***In this activity you will***

- observe some data about human fetal growth rates.
- graph the data.
- build a regression model based on the data.
- compare the data to other mammals.
- compare the data to non-mammal species.

### ***Introduction***

During what time in your life do you think you grew the fastest? Sometime along the way, everybody goes through what is commonly called a *growth spurt*. You may have gone to a family reunion and had one of your relatives pinch your cheek and tell you how much you have grown. If that ever happens again, just smile to yourself and think about when you were *really* growing fast. Unfortunately, your relatives weren't able to see you during that amazing growth spurt, because it happened before you were born! Unborn babies, no matter what species they are, grow at an incredible rate in order to get ready to survive in the world.

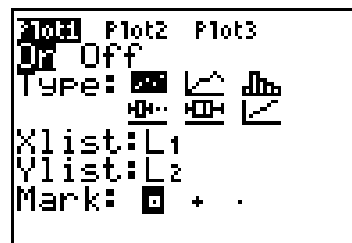
## Problem

How fast does a human fetus grow? How does this growth rate compare to other mammals? In the data table below are the ages and average masses of human fetuses at various stages of development.

Weeks of Development	Fetal Mass in Grams
12	28
16	88
20	256
24	510
28	907
36	2665
40	3204


## Procedure

1. Press **[STAT]** **[ENTER]**.
2. Press **[↑]** to move to the heading L1. Press **[CLEAR]** **[ENTER]**.
3. Follow the same procedure to clear L2 of all data.
4. Go back to L1, making sure that your cursor is in the first row of the list, and not at the very top. Enter the data from the first column of data (**Weeks of Development**) in the table above. To do this, type in the number and then press **[ENTER]** or press **[↓]**. Repeat this until you have entered all of the data in L1.
5. Enter the data from the second column, **Fetal Mass in Grams**, into L2. Make sure you have the same number of data entries in L1 as you do in L2.
6. Press **[2nd]** **[STAT PLOT]**. Press **[ENTER]** to select 1:Plot1. Set your TI-83 Plus as shown at the right.



7. Press **[2nd]** **[FORMAT]** and make sure the defaults are set.
8. Press the **[MODE]** key and make sure the defaults are set.
9. Press **[WINDOW]** and set an appropriate window for the data you have entered and wish to graph.
10. Press **[Y=]**. If there are any equations on this screen, press **[↓]** to place the cursor next to **Y1=**, and then press **[CLEAR]** to clear the equation. Repeat this sequence to clear all equations.

11. Press **GRAPH**, and then press **TRACE**. Press **◀** and **▶** to move from data point to data point.

 Answer questions 1 through 3 on the Data Collection and Analysis page.

12. Go to the Home screen by pressing **2nd** **QUIT**.

13. Press **STAT**, and then press **▶** to highlight **CALC**. You will see a list of regression models from which to choose. Press **▲** until **B:Logistic** is highlighted, and then press **ENTER**.


```
EDIT [DEL] TESTS
7:QuartReg
8:LinReg(a+bx)
9:LnReg
0:ExpReg
A:PwrReg
B:Logistic
C:SinReg
```

14. You will now be back on the Home screen. Type in **2nd** **[L1]** **,** **2nd** **[L2]** **,** **VARΣ** **▶** **ENTER** **ENTER** **ENTER**.

```
Logistic
y=c/(1+ae^(-bx))
a=1780.789503
b=.2294433074
c=3823.335363
```

You just told the TI-83 Plus to build a regression model (best-fit line) based on the data in **L1** (weeks of development) and **L2** (fetal mass), and then write the regression equation in **Y1**. To check this, press **Y=**. You should see an equation next to **Y1=**. The equation may look pretty intimidating, but do not let it worry you. You will be concerned with the graph, not with understanding the equation right now!

15. Press **GRAPH** to see your original data points and observe the best-fit line being drawn.
16. Press **TRACE** and then press **▲** or **▼**. Where is the cursor?
17. Press **◀** and **▶** and notice what is displayed at the bottom of the screen. What do these numbers mean?

 Answer questions 4 through 12 on the Data Collection and Analysis page.

# Data Collection and Analysis

Name \_\_\_\_\_

## Activity 13: Growing Babies

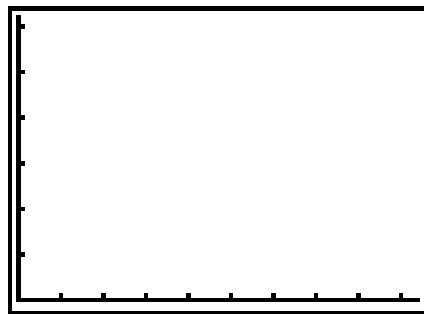
Date \_\_\_\_\_

### *Data Analysis*

1. Describe the trend you see when looking at the graph.

2. Does the data appear to be linear? Explain.

3. Sketch your graph below. Remember to label your axes.



4. All of the masses in the table on the first page of this activity are given in grams. The table is duplicated below. Convert these masses to kg and write these numbers next to the masses given in the table. Record masses in decimal notation, rounding to two decimal places.

<b>Weeks of Development</b>	<b>Fetal Mass in Grams</b>	<b>Fetal Mass in kg</b>
12	28	
16	88	
20	256	
24	510	
28	907	
36	2665	
40	3204	

5. According to your graph, what would be the mass of a baby born at 38 weeks?
6. According to your graph, what would be the mass of a baby born at 26 weeks?
7. According to your graph, what would be the mass of a baby born at 43 weeks?

8. If a woman's mass is 64 kg before she becomes pregnant, and she has a 3.2 kg baby, how did the newborn's mass compare to its mother's mass before her pregnancy? Express your comparison in a percentage.
9. Using the same percentage you calculated above, predict the answer to the following problem:  
If a sow (a female pig) has a mass of 110 kg before pregnancy, and she delivers 11 piglets, each of equal mass, what would you expect the mass of each piglet to be at birth?
10. If a cow (female) elephant has a mass of 2.3 metric tons before her pregnancy, what would you expect the mass of her single calf to be at birth? Use the same percentages you used in the problems above.
11. Think about the different methods of animal reproduction, and the varying degrees of parental care offered by animals to their babies. When fish spawn, the female may produce thousands of eggs, while mammals tend to have very few offspring by comparison. Why?

12. All birds lay eggs as a part of their reproductive strategy. However, not all species of birds lay the same number of eggs. Robins, sparrows, hawks, and blue jays are examples of *altricial* birds, while chickens, ducks, geese, and turkeys are examples of *precocial* birds. When altricial birds hatch, they are helpless and must rely completely on their parents for survival. Precocial birds, on the other hand, are much more self-sufficient after hatching, relying on their parents mainly for protection.

Where do altricial birds usually build their nests? Why?

Where do precocial birds usually build their nests? Why?

In comparing altricial and precocial birds, predict the number of eggs that you might see if you looked into the nest of each type of bird. Explain your answer.

## Teacher Notes



### Activity 13

### Growing Babies

#### Objectives

- ◆ To graph data of human fetal growth rate
- ◆ To interpolate using a best-fit model
- ◆ To compare human fetal size with that of other mammals
- ◆ To compare different methods of animal reproduction
- ◆ To compare altricial and precocial birds

#### Concepts

- ◆ Fetal growth rates
- ◆ Animal reproduction

#### Data Analysis – Answer Key

1. Fetal mass increases slowly at first, and then increases very rapidly in the second trimester. After the second trimester, the mass starts to level off.
2. No; it has a definite curve in it.
3. X-axis: weeks of development  
Y-axis: mass
4. See table below.

Weeks of Development	Fetal Mass in Grams	Fetal Mass in kg
12	28	.03
16	88	.09
20	256	.26
24	510	.51
28	907	.91
36	2665	2.67
40	3204	3.20

5. Approximately 2961.2 grams (2.96 kg).
6. Approximately 687 grams (0.69 kg).
7. Approximately 3500 grams (3.50 kg).
8. The newborn's mass is 5% of its mother's mass before her pregnancy.
9. Each piglet has a mass of .5 kg.
10. Her calf has a mass of 127 kg.



- 11.** Survival rate is higher in mammals, and they provide a higher degree of care. Fish lay large numbers of eggs, have large numbers of offspring, but provide little or no care for the babies.
- 12.** Altricial birds usually build their nests in trees because it offers more protection for helpless babies.

Precocial birds usually build their nests on the ground so the babies can find food.

Precocial birds tend to lay more eggs because the degree of parental care offered is much less. Altricial birds have fewer babies because the adults must completely care for them.

