

Name: _____

Lesson 2.7: Modeling with Toolkit Functions

1.) Use CODAP to open the data set titled **Homeownership in the US**.

“The homeownership rate is the proportion of occupied households, which are occupied by the owners.” The homeownership rate peaked in 2004 at 69.2%”

Source: "Homeownership rate in the United States from 1990 to 2019." statistica.com, www.statista.com/statistics/184902/homeownership-rate-in-the-us-since-2003/. Accessed 24 June 2020.

Use Year as the independent variable and Homeownership as the dependent variable.

a) Analyze the data.

b) No data was given for 1997. Use your model to find what your model suggests the rate of homeownership was in the US in 1997. Use your model (Equation); show your algebraic work.

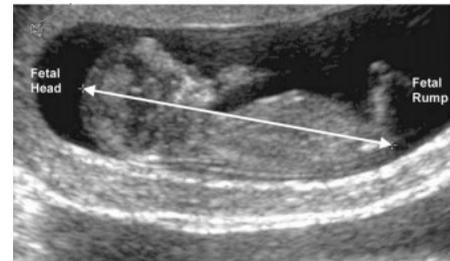
2.) Use CODAP to open the data set titled **Fetal Crown-Rump Length & Gestational Age**.

The most common way to refer to the age of a human fetus is gestational age. On average, babies are born when their gestational age is 280 days.

Source: American Pregnancy Association, Pregnancy Week 1 & 2
<https://americanpregnancy.org/week-by-week/1-and-2-weeks-pregnant/>,
Accessed July 5, 2020.

Health care providers often do an ultrasound and measure the crown-rump length (length from head to butt). They have a formula that uses the crown-rump length to determine the gestational age. They subtract the gestational age in days from 280 days, to determine in how many days the baby is expected to be born. That is the typical way the due date is established when the crown-rump length is about 110 mm or shorter.

Image Source: Developing an eye for ultrasound, tonygood4, <https://tonygood4.wordpress.com/2013/02/03/developing-and-eye-for-ultrasound/>, Accessed July 5, 2020.



a) The data set gives paired Crown-rump Length and Gestational Age for ethnically Chinese fetuses (see data set for the source). Use the data set to find an appropriate model that predicts gestational age, given the crown-rump length.

b) According to your model, if the crown-rump length is 72 mm on February 19th, what is the due date? It might be helpful to use an online “days from date calculator”. Show your algebraic work.

3.) Use CODAP to open the data set titled **Car MPG vs. Weight**.

When determining which function to use to model a scatterplot, mathematicians often use the concept of “end behavior”. They ask, what happens at the left end of the scatterplot (as the values of the independent variable get smaller and smaller), and what happens at the right end of scatterplot (as the values of the independent variable get larger and larger). This approach uses the context to guide the modeler (that’s you!) when choosing which function is most likely to be appropriate. When taking into account end behavior, it is helpful for a modeler to ask if you would expect the appropriate function to have a vertical and/or horizontal asymptote.

Using the data set you’ve already opened, make a scatter plot using Weight as the independent variable and Fuel Efficiency as the dependent variable.

a) At first glance, does it seem that a linear model might be appropriate?

b) Now, take into account end behavior. Does a linear model seem appropriate?

c) Find an appropriate model for this data set.

4.) Use CODAP to open the data set titled **Stream Velocity vs. Rock Diameter**.

The faster the river or stream flows, the larger the rock it will carry downstream.

a.) Find an appropriate model that predicts rock diameter based on stream velocity using the data.

b) A bowling ball has a diameter of about 217 mm. According to your model, what is the minimum velocity a stream needs to flow in m/sec in order to move a rock the size of a bowling ball? Show all of your algebraic work.

c) The velocity you found in part b) was in m/sec. What is the same velocity in miles per hour?

5.) Use CODAP to open the data set titled **Light Intensity**.

It makes sense that as you get further away from a light source the intensity of the light diminishes, but what is the relationship? The intensity of a light was measured in mW/cm^2 at distances from 120 cm to 210 cm away from the light source and the results are recorded in the table.

a) Use the data to find an appropriate model to predict light intensity given the distance away from the source.

b) According to your model, what would the intensity be when the light source is 220 cm away? Show all of your algebraic work.

6.) Use CODAP to open the data set titled **CD Sales**.

Compact discs (CDs) first became publicly available in 1983 and their popularity rose until about 1999 when Napster (peer-to-peer music site) and 2001 when the first iPod changed the music industry.

Source: The Life and Times of the Late, Great CD, Digital Trends, Ryan Waniata, <https://www.digitaltrends.com/features/the-history-of-the-cds-rise-and-fall/>, Accessed 7/6/2020.

a) Use the CD Sales data set and find an appropriate model with Year as the independent variable as CD Sales (millions) as the dependent variable.

b) In about what year and month does your model suggest was the peak of CD Sales? You will need to convert a decimal year to year and month. Hint: Feb 1, 2000 can be thought of as the year $2000 + 1/12$ or about 2000.08, March 1, 2000 is about $2000 + 2/12$ or about 2000.17.