Math 3201

7.5 Logarithmic Regression

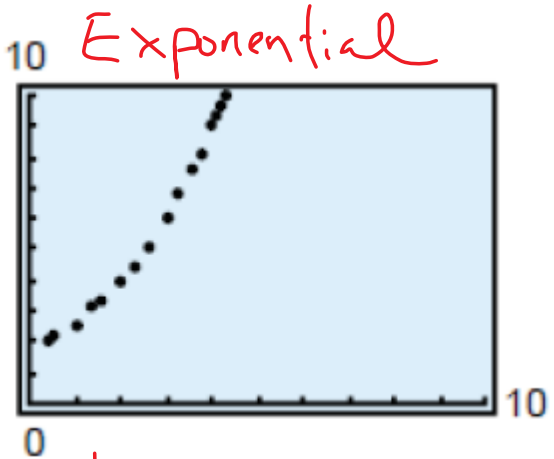
In the previous units on Polynomials and Exponentials, we worked with linear, polynomial and exponential regressions. We will now use logarithmic regression to model a function of the form $y = a + b\ln x$ to a set of data.

Although we will be given the type of regression to perform on a set of data, ask students why do you think a particular model would be a good fit for the particular data set.

As you work through problems, reflect on the following:

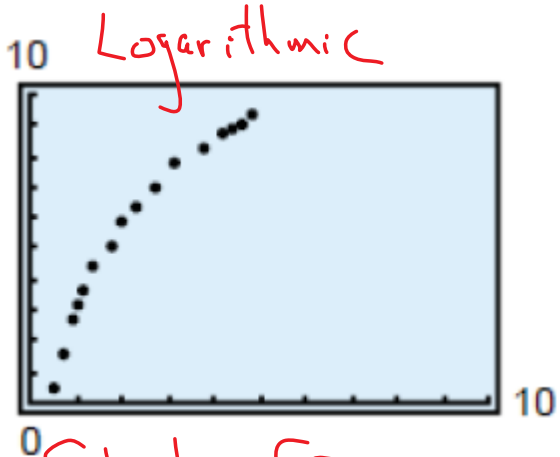
- the domain of a logarithmic function is restricted to the set of positive real numbers
- logarithmic regressions are mostly used for phenomena that grow quickly at first and then slow down over time but the growth continues to increase without bound For example, the length of cod fish over time.
- exponential regressions are typically used on phenomena where the growth begins slowly and then increases very rapidly as time increases. For example, bacteria growth.

Example 1:
Which scatter plot appears to model an exponential function and which models a logarithmic function. Explain your reasoning.



Exponential

Starts slowly, then increases rapidly.



Logarithmic

Starts off increasing rapidly, then slows.

Example 2:
Using Desmos Graphing, ask students to determine the equation of the logarithmic regression for the data.

(A) Create a scatter plot and a graph of the model.

x	0.5	0.7	0.9	1.0	1.2	1.4	1.8	2.0	2.3	2.7	3.2	3.8
y	0.5	1.6	2.7	3.1	3.7	4.4	5.1	5.8	6.4	7.0	7.7	8.3

The command for logarithmic regression in desmos is: y1~a+blnx1, which appears as:

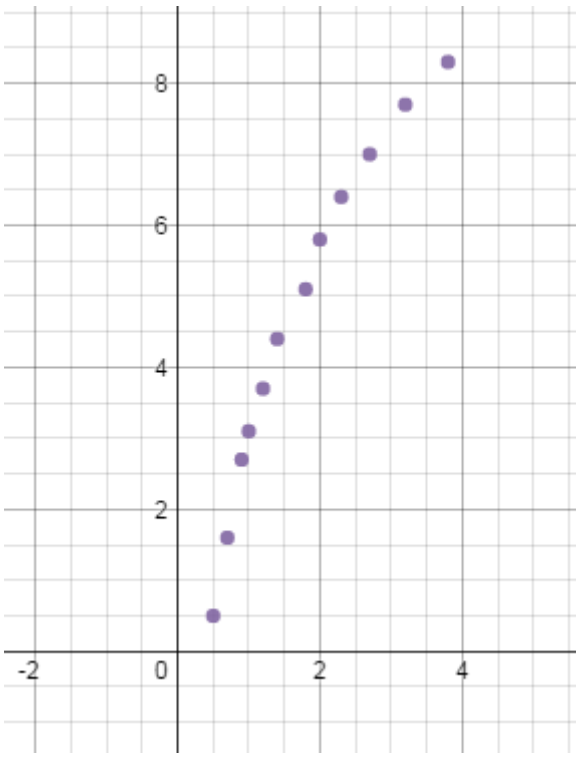
$$y_1 \sim a + b \ln x_1$$

With parameters:

PARAMETERS
$a = 3.0751$ $b = 3.904$

a=3.0751 b=3.904

And graph:



(B) Write the logarithmic equation.

$y = 3.0751 + 3.904 \ln x$

(C) Find $y(3)$.

$y(3) = 3.0751 + 3.904 \ln(3)$

$= 7.36$

(D) Is this an example of interpolation of extrapolation?

(E) Find $y(5)$.

$y(5) = 3.0751 + 3.904 \ln(5)$

$= 9.36$

(F) Is this an example of interpolation of extrapolation?

Textbook Questions: page 466 -467 #1, 2, 3