Algebra RH

Essential Question: How do we recognize what type of regression equation can be used to model data?

Do Now:

The following data shows the number of species of mammals on the International Union for Conservation of Nature's "Red List" of endangered species during the years 2004 to 2012.

Year	2004	2006	2007	2008	2009	2010	2011	2012
Species	352	348	349	448	449	450	447	446

a) Using a linear regression model, find the equation of the line of best fit. (Show all values displayed by the calculator if there are no rounding directions)

$y = 15.79197995x - 31305.09273$

b) Using your equation, how many species are expected to be in danger in 2016?

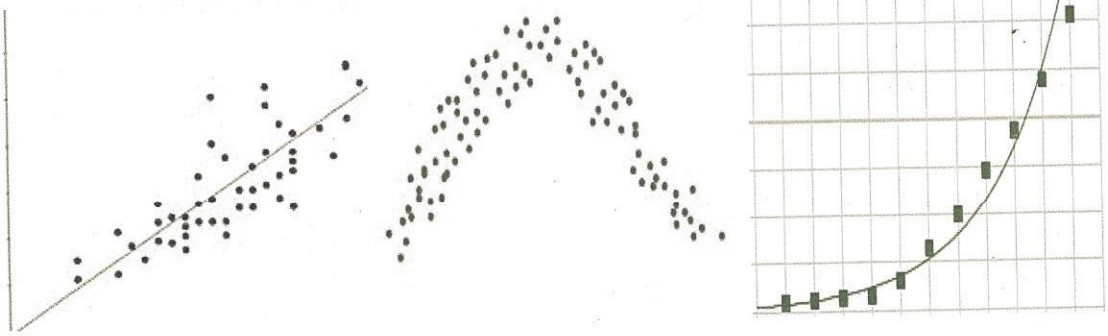
$y = 15.79197995(2016) - 31305.09273$ $\quad x = 2016$

$y = 531.5388492 \approx 531$ species

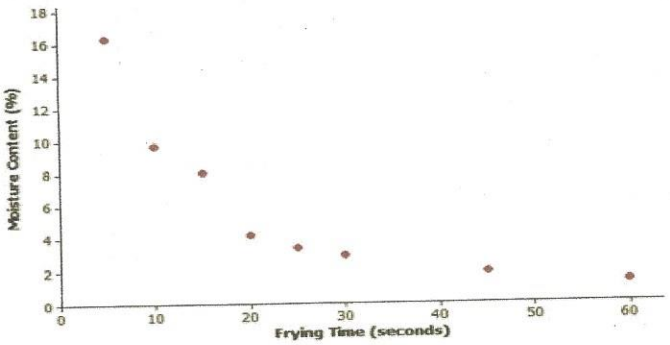
The data from a scatterplot can form a shape that indicates what type of equation should be used to approximate the relationship between the two variables.

Choosing a Linear, Quadratic, and Exponential Model

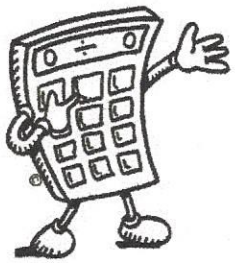
Linear	Quadratic	Exponential
$y = mx + b$	$y = ax^2 + bx + c$	$y = ab^x$



Once you view the scatterplot of a graph, you can determine what model best approximates the data. If a set of data takes on the shape of an exponential growth or decay, use an **exponential regression equation** for the data set. *See graph below.*



Calculator Corner
Remember, in order to create a scatterplot:



1) STAT PLOT (2^{nd} $y=$) #1 ENTER
2) Turn On and Choose Scatter Plot
3) Use STAT EDIT to enter data into L_1 and L_2
4) ZOOM #9 (ZOOM STAT) [*view the graph and decide which model to use*]

To create the equation for your function:

STAT → CALC
#4 **LinReg** (linear)

#5 **QuadReg** (quadratic)
#0 **ExpReg** (exponential)

Examples:

1. A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

Time (hrs)	x	0	2	4	6	8	10	12	16
Number of Organisms	y	25	36	52	68	85	104	142	260

a) Determine the exponential regression equation model for these data, rounding all values to the nearest ten-thousandth.

strategy: circle your rounding directions!

$y = 27.203(1.151)^x$

b) Using this equation, predict the number of single-celled organisms, to the nearest whole number, at the end of the 18th hour.

$x = 18$

$y = 27.203(1.151)^{18}$

$y = 341.9578886$

$y = 342$

Approximately 342 organisms will exist at the end of the 18th hour.

2. About a year ago, Joey watched an online video of a band and noticed that it had been viewed only 843 times. One month later, Joey noticed that the band's video had 1708 views. Joey made the table below to keep track of the cumulative number of views the video was getting online.

exponential relationship

each month, the number of views doubles (approximately)

Months Since First Viewing	Total Views
0	843
1	1708
2	forgot to record
3	7124
4	14,684
5	29,787
6	62,381

← you can't enter incomplete data (if you left this box empty, you would see 'dimension error' on your calculator)

a) Write a regression equation that best models these data. Round all values to the nearest hundredth. Justify your choice of regression equation.

$y = ab^x \ (x \neq 0)$

$a: 836.4705\ldots$

$b: 2.0472\ldots$

total views → $y = 836.47\,(2.05)^x$ ← # of months

836.47: initial number of views

2.05: common ratio

b) As shown in the table, Joey forgot to record the number of views after the second month. Use the equation from part a to estimate the number of full views of the online video that Joey forgot to record.

2nd month

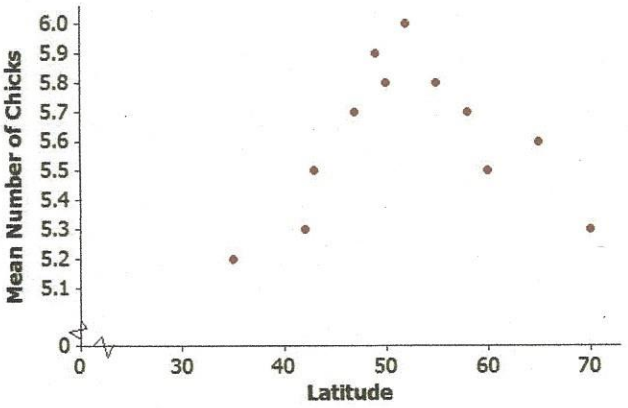
$x = 2$

$y = 836.47\,(2.05)^2$

$y = 3515.265\ldots$

≈ 3515 views

3. Biologists conducted a study of the nesting behavior of a type of bird called a flycatcher. They examined a large number of nests and recorded the latitude for the location of the nest and the number of chicks in the nest.



a) What type of model (*linear, quadratic or exponential*) would best describe the relationship between latitude and mean number of chicks?

the data increases, then decreases

b) One model that could be used to describe the relationship between mean number of chicks and latitude is $y = 0.175 + 0.21x - 0.002x^2$, where x represents the latitude of the location of the nest and y represents the number of chicks in the nest.

Use the quadratic model to complete the following table.

x *Latitude*	30	40	50	60	70
y *Mean Number of Chicks*	4.675	5.375	5.675	5.575	5.075

c) Based on this quadratic model, what is the best latitude for hatching the most flycatcher chicks? Justify your response.

looking at the graph, at approximately 52° latitude showed the most fly catcher chicks

52.5° is the best latitude

x	y
51	5.683
52	5.687
53	5.687
54	5.683

the maximum (turning) point is between 52° and 53°

TAKE AWAY

Models can be used to answer questions about how two variables are related (*bivariate data*).

Linear, Quadratic and Exponential equations are common models that can be used to describe the relationship between two variables.