Name: _____ Date: _____

Scatter Plots and Line of Best Fit

MGSE9-12.S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MGSE9-12.S.ID.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use the given functions or choose a function suggested by the context. Emphasize linear and exponential models.
MGSE9-12.S.ID.6c Fit a linear function for a scatter plot that suggests a linear association.

The **best fitting line or curve** is the line that lies as close as possible to all the data points.

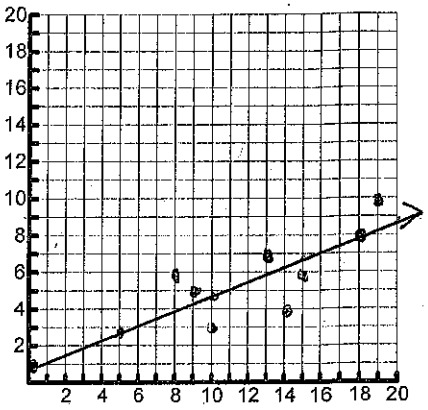
Regression is a method used to find the equation of the best fitting line or curve.

Extrapolation – the use of the regression curve to make predictions outside the domain of values of the independent variable.

Interpolation – Interpolation is used to make predictions within the domain of values of the independent variable.

1) The environment club is interested in the relationship between the number of canned beverages sold in the cafeteria and the number of cans that are recycled. The data they collected are listed below.

Beverage Can Recycling								
Number of Canned Beverages Sold	18	15	19	8	10	13	9	14
Number of Cans Recycled	8	6	10	6	3	7	5	4



a) Plot the points to make a scatter plot.

b) Find an equation of the line of best fit for the data.

y = .39x + 0.99 ; r = .705

c) Graph the line of best fit on the graph.

5	10	15	20
2.94	4.89	6.84	8.79

d) What does the slope of the line mean in context?

.39 cans are recycled for every beverage sold or 39 for every 100 sold.

e) What does the y-intercept of the line mean in context? Does it make sense?

If 0 canned beverages are sold, 1 can will be recycled. No, it does not make sense.

f) How would you describe the correlation between the two variables?

There is a strong, positive correlation.

g) If the cafeteria sold 16 canned beverages, how many cans would you expect to be recycled?

$y = .39(16) + 0.99 = 7.23$

Interpolation or extrapolation?

Interpolation. 16 is between 8-19.

7 cans

h) If the cafeteria 100 canned beverages, how many cans would you expect to be recycled?

$y = .39(100) + .99 = 39.99$

Interpolation or extrapolation?

Extrapolation. 100 is outside 8-19.

40 cans

i) If you wanted 50 cans to be recycled, how many beverages would have to be sold?

$50 = .39x + .99$
$-.99 \quad -.99$
$49.01 = .39x$

$\frac{49.01}{.39} = \frac{.39x}{.39}$

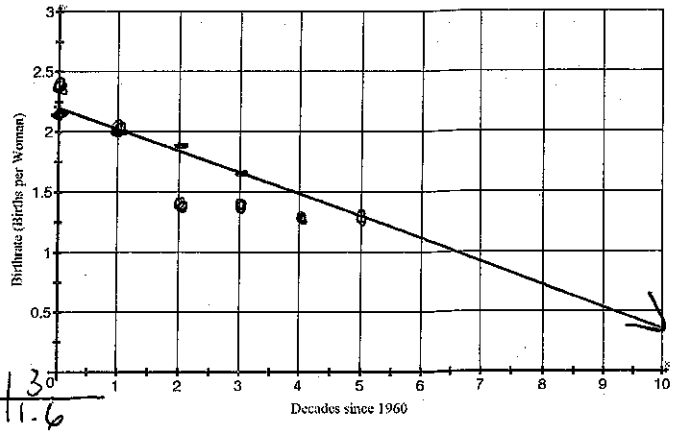
$125.67 = x$

126 beverages would have to be sold.

2) Ms. Astorian is teaching about the current birthrate trend in Europe. She wants to analyze numbers from Germany to use as an example for the rest of Europe. The data is found in the table below.

Year (t)	1960 $t=0$	1970 $t=1$	1980 $t=2$	1990 $t=3$	2000 $t=4$	2010 $t=5$
Birthrate (births per woman)	2.37	2.03	1.44	1.45	1.38	1.39

a) Plot the points to make a scatter plot.
For x, use the number of decades since 1960.
Example: 2000 is 4 decades from 1960, so x = 4.



b) Find an equation of the line of best fit for the data.
Once again, use the number of decades since 1960 for your x-values.

y = $-0.20x + 2.17$; r = -0.870

c) Graph the line of best fit on the graph. 0 | 2.2 ; 1 | 2 ; 2 | 1.8 ; 3 | 1.6

d) What does the slope of the line mean in context?
The birthrate is decreasing by .2 births per woman every decade.

e) What does the y-intercept of the line mean in context? Does it make sense?
There was a predicted birthrate of 2.17 in 1960. Yes, it makes sense

f) How would you describe the correlation between the two variables?
strong, negative

g) What was the expected birthrate 5 decades after 1960? What year is that?
$y = -0.20(5) + 2.17 = 1.17$ births/woman
$1960 + 5(10) = 2010$

Interpolation or extrapolation?
Interpolation. 5 is inside 0-5.

h) What was the expected birthrate 10 decades after 1960? What year is that?
$y = -0.20(10) + 2.17 = 0.17$ births/woman
$1960 + 10(10) = 2060$

Interpolation or extrapolation?
Extrapolation. 10 is outside 0-5.

i) How many decades after 1960 would you expect to have a birthrate of 1 birth per woman? What year is that?
$1 = -0.2x + 2.17$
$-2.17 \quad -2.17$
$-1.17 = -0.2x$
$\frac{-1.17}{-0.2} = \frac{-0.2x}{-0.2}$
$5.85 = x$
5.85 decades later.
$1960 + 5.85(10) = 2018.5$
in the year 2018

j) Extension Question: if this trend line were true farther into the past, what would you expect the birthrate in Germany was in 1800?
$1960 + x = 1800$
$x = -160$
$x = -16$ decades
$y = -0.20(-16) + 2.17$
$y = 5.37$ births/woman