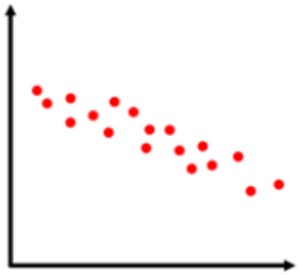
5.2 Best Fit Lines

PRACTICE

Determine if the data is linear or non-linear. Draw in the best fit model to represent the data.

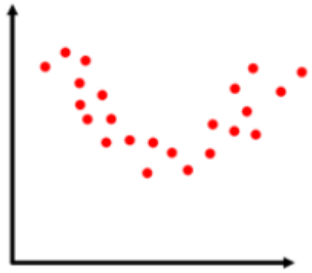
1.



The data is…

(Linear) Non-Linear

2.



The data is…

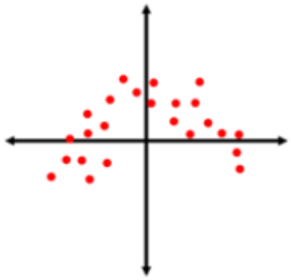
Linear (Non-Linear)

3.

The data is…

(Linear) Non-Linear

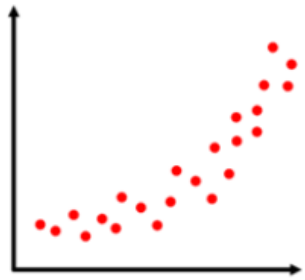
4.



The data is…

Linear (Non-Linear)

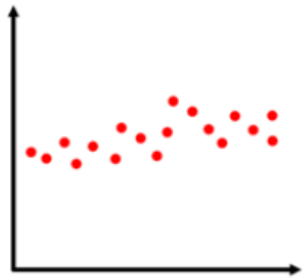
5.



The data is…

Linear (Non-Linear)

6.



The data is…

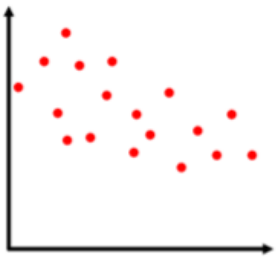
(Linear) Non-Linear

Determine if the data has a linear correlation. If so, describe as positive/negative and strong/moderate.

7.

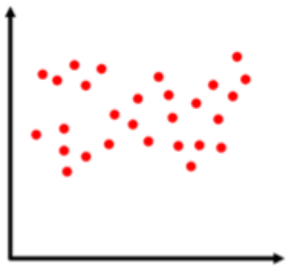
strong positive correlation

8.



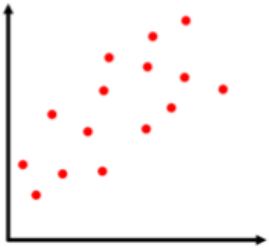
moderate negative correlation

9.



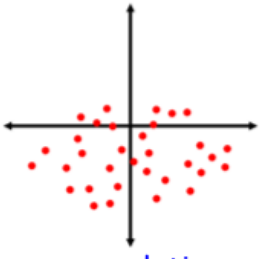
no correlation

10.



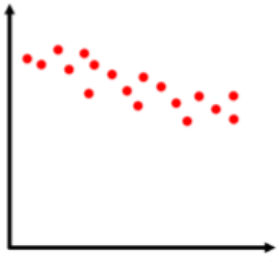
moderate positive correlation

11.



no correlation

12.

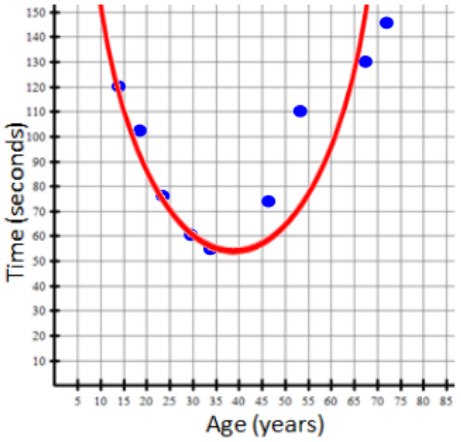


strong negative correlation

Construct a scatterplot and answer the questions.

13. People of various ages are timed solving a puzzle.

Age (years)	14	18	24	30	34	47	54	68	72
Time (seconds)	120	104	75	60	55	75	110	130	145



a. The data is…

Linear (Non-Linear)

b. Draw in a best fit line/curve.

c. Estimate the time it would take for 40 year old to solve the puzzle.

using the best fit curve, around 53 seconds

d. How old would you expect a person to be that took 90 seconds to solve the puzzle?

using the best fit curve, around 18 years old and 58 years old

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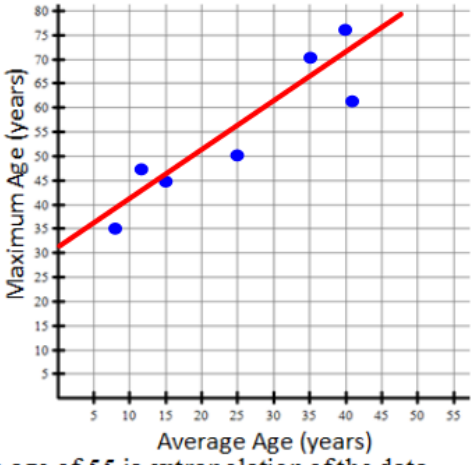
14. The table shows the average age and maximum age of various animals at a zoo.

Average (years)	12	25	15	8	35	40	41	20
Maximum (years)	47	50	40	35	70	77	61	54



a. The data is…

(Linear) Non-Linear

b. Draw in a best fit line/curve.

c. Estimate the maximum age of an animal with average age of 33 years old.

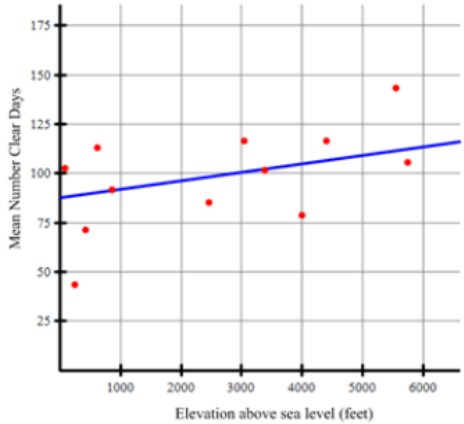
using the best fit line, around 64 years old

d. Explain why predicting the maximum age of an animal with average age of 55 is extrapolation of the data.

The data set is from 8 to 41 years old. Predicting outside of this range is uncertain. Since 55 is higher than 41, this is extrapolation of the data.

Use the scatterplot and equation for the best fit line/curve to answer the following.

15. The scatterplot shows the elevation above sea level in feet of selected cities and their mean number of clear days per year. The equation of the best fit line is $y = 83 + 0.008x$ and is shown graphed below.



a. Use the equation of best fit to predict the mean number of clear days for Denver "The Mile High City" 5280 feet above sea level.

$y = 83 + 0.008(5280)$

$y = 125.24$ days

b. Use the equation of best fit to predict the height above sea level for a city with a mean of 90 clear days per year.

$90 = 83 + 0.008x$

$-83 \quad -83$

$7 = 0.008x$

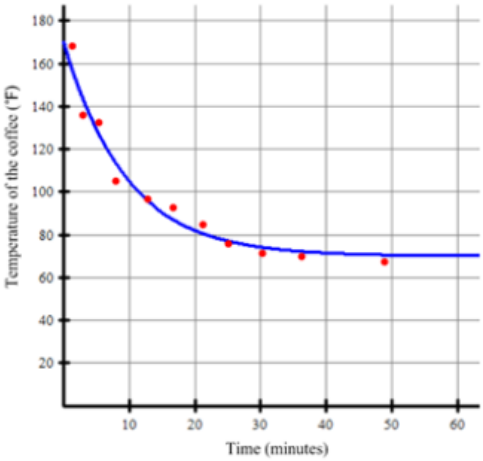
$0.008 \quad 0.008$

$x = 875$ feet

c. Describe the relationship between the elevation of a city and the mean number of clear day per year.

Linear. As the elevation above sea level gets higher, so does the mean number of clear days. Positive correlation.

16. The scatterplot shows the temperature of a cup of coffee in Fahrenheit left on the counter measured over various times in minutes. The equation of the best fit curve is $y = 100(0.9)^x + 70$ and is graphed below.



a. Use the equation of best fit to predict the temperature of the coffee after 12 minutes.

$y = 100(0.9)^{12} + 70$

$y = 98.24\,°F$

b. The actual temperature of the coffee at 20 minutes was 86°F. How far off is the model's prediction at this time? (round to hundredths)

$y = 100(0.9)^{20} + 70$

$y = 82.16°F$

86 actual

$-\ 82.16$ predicted

3.84°F off

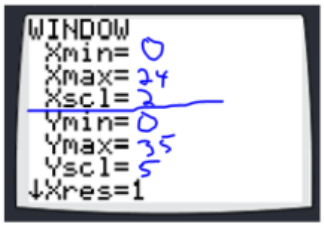
c. Describe the relationship between the time and the temperature of the coffee.

Non-linear. As time goes on, the temperature of the coffee decreases to room temperature. This is expontential decay.

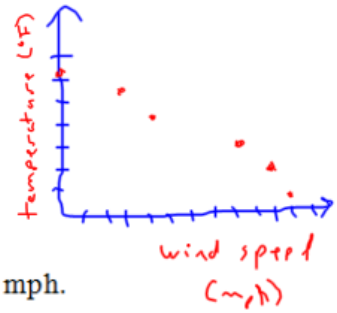
Construct a scatterplot on a graphing calculator of the data below. State the window that you used to view the graph. Make a rough sketch and answer the questions.

17.

wind speed (mph)	0	6	9	12	17	20	22
temperature (°F)	32	28	22	18	16	10	3



SKETCH:



a. The equation of the best fit line is $y = -1.2x + 33$. Graph in calculator.

b. Use the best fit line from above to predict temperature when the wind speed is 10 mph.

$y = -1.2(10) + 33$

$y = 21°F$

c. Use the best fit line from above to predict the wind speed when the temperature is 14°F ?

$14 = -1.2x + 33$

$-33 \qquad -33$

$-19 = -1.2x$

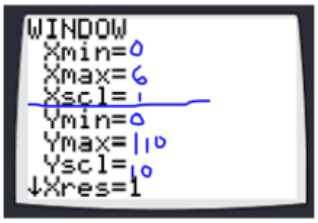
$\frac{-19}{-1.2} = \frac{-1.2x}{-1.2}$

$x = 15.8\overline{3}$ mph

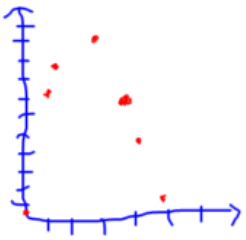
Construct a scatterplot on a graphing calculator of the data below. State the window that you used to view the graph. Make a rough sketch and answer the questions.

18. A ball is thrown into the air.

time (sec)	0	1	1.5	3	4	4.5	5
height (ft)	6	71	89	100	68	43	7



SKETCH:



a. The equation of the best fit curve is $y = -16x^2 + 80x + 6$. Graph in calculator.

b. Use the best fit curve from above to predict the height of the ball at 2 seconds.

$y = -16(2)^2 + 80(2) + 6$

$y = -16(4) + 160 + 6$

$y = 102$ ft

c. How far off is the model's prediction of the height of the ball at 3 seconds?

$y = -16(3)^2 + 80(3) + 6$

$y = -16(9) + 240 + 6$

Predicted − Actual

$y = 102$ ft $- 100 =$ 2 ft off

d. Use the best fit curve from above to predict the height of the ball at 8 seconds. What is wrong with this prediction?

$y = -16(8)^2 + 80(8) + 6$

$y = -16(64) + 640 + 6$

$y = -378$ ft

The prediction is negative! Zero represents the ground so the ball would be 378 underground. Oops, we extrapolated the data. 8 seconds is outside of the data set. Can only safely predict from 0-5 seconds

Solve the following.

19. $2(y+1) - 7 = 9$

$2y + 2 - 7 = 9$

$2y - 5 = 9$

$+5 \quad +5$

$\frac{2y}{2} = \frac{14}{2}$

$y = 7$

20. $\frac{7}{3x} + 3 = 7$

$-3 \quad -3$

$3x \cdot \frac{7}{3x} = 4 \cdot 3x$

$\frac{7}{12} = \frac{12x}{12}$

$x = \frac{7}{12}$

21. $2x - 3y = 15$

$y = 2x - 1$

$2x - 3(2x-1) = 15$

$2x - 6x + 3 = 15$

$-4x + 3 = 15$

$-4x = 12$

$x = -3$

$y = 2(-3) - 1$

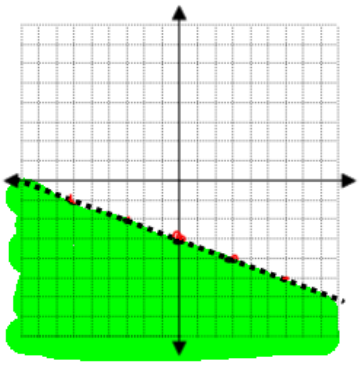
$y = -6 - 1$

$y = -7$

$(-3, -7)$

Graph the following.

22. $y < -\frac{1}{3}x - 3$



23. $2x + 3y = 12$

$y = 2$

$y = -\frac{2}{3}x + 4$

$(3, 2)$