Worksheet #1 - Linear Regression

In this activity, we will use linear regression to find a model for predicting the price of a used car, using some real-world data.

These are the asking prices for some used Toyota Corollas advertised in newspaper classifieds on October 1, 2006.

Model Year	Asking Price
2004	\$10,950
2003	\$9,400
2001	\$8,990
1998	\$5,800
1997	\$5,850
1994	\$3,800
1989	\$1,500

1 Create a new table that shows the *Asking Price* (in dollars) as a function of the *Age* of the car (measured in years).

Age	Asking Price

2 Enter the table from question 1 into your calculator as lists. Then use linear regression on your calculator to find a line of best fit. What is the equation for that line? (Round your coefficients to 2 decimal places.)

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1 Create a new table that shows the *Asking Price* (in dollars) as a function of the *Age* of the car (measured in years).

Age	Asking Price
2	10,950
3	9,400
5	8,900
8	5,800
9	5,850
12	3,800
17	1,500

2 Enter the table from question 1 into your calculator as lists. Then use linear regression on your calculator to find a line of best fit. What is the equation for that line? (Round your coefficients to 2 decimal places.)

$y = -624.1x + 11,593$

3 What is the slope of the line you found in part 2? What does that number represent in the context of this question? That is, what does the slope have to do with the price of the car?

4 Use the equation for your line of best fit to estimate the asking price of a 2002 Corolla, a 1995 Corolla, and a 1985 Corolla. (Round your answers to the nearest dollar.)

5 What is the correlation coefficient, r, for your linear regression? What does this tell you about the line of best fit? Why?

6 If you were selling a 2002 Corolla, do you think the price you predicted in part 4 would be reasonable? How about for a 1995 model? What about a 1985 model? Why?

3 What is the slope of the line you found in part 2? What does that number represent in the context of this question? That is, what does the slope have to do with the price of the car?

-624.11

The car is depreciating $624.11 per year

4 Use the equation for your line of best fit to estimate the asking price of a 2002 Corolla, a 1995 Corolla, and a 1985 Corolla. (Round your answers to the nearest dollar.)

A 2002 → 4
B 1995 → 11
C 1985 → 21

$y = -624x + 11,592$

A) $-624(4) + 11,592 = \$9096$

B) $-624(11) + 11,592 = \$4728$

? C) $-624(21) + 11,592 = -\$1512$

5 What is the correlation coefficient, r, for your linear regression? What does this tell you about the line of best fit? Why?

0.987 It is a strong positive correllation.

6 If you were selling a 2002 Corolla, do you think the price you predicted in part 4 would be reasonable? How about for a 1995 model? What about a 1985 model? Why?

2002 yes
1995 yes
1985 No

For each of the following, write the prediction equation and then solve the problem. Include r-value

9. A student who waits on tables at a restaurant recorded the cost of meals and the tip left by single diners.

Meal Cost	$4.75	$6.84	$12.52	$20.42	$8.97
Tip	$0.50	$0.90	$1.50	$3.00	$1.00

If the next diner orders a meal costing $10.50, how much tip should the waiter expect to receive?

Equation_____ Tip expected_____

10. The table below gives the number of hours spent studying for a science exam (x) and the final exam grade (y).

X	2	5	1	0	4	2	3
Y	77	92	70	63	90	75	84

Predict the exam grade of a student who studied for 6 hours.

Equation_____ Grade expected_____

11. The table below shows the lengths and corresponding ideal weights of sand sharks.

Length	60	62	64	66	68	70	72
Weight	105	114	124	131	139	149	158

Predict the weight of a sand shark whose length is 75 inches.

Equation_____ Weight expected_____

12. The table below gives the height and shoe sizes of six randomly selected men.

Height	67	70	73.5	75	78	66
Shoe size	8.5	9.5	11	12	13	8

If a man has a shoe size of 10.5, what would be his predicted height?

Equation_____ Height expected_____

For each of the following, write the prediction equation and then solve the problem.

9. A student who waits on tables at a restaurant recorded the cost of meals and the tip left by single diners.

r ≈ .99

x Meal Cost	$4.75	$6.84	$12.52	$20.42	$8.97
y Tip	$0.50	$0.90	$1.50	$3.00	$1.00

If the next diner orders a meal costing $10.50, how much tip should the waiter expect to receive?

$y = .16(10.5) - .37$

Equation $y = .16x - .37$ Tip expected $\$1.38$

10. The table below gives the number of hours spent studying for a science exam (x) and the final exam grade (y).

r ≈ .99

X	2	5	1	0	4	2	3
Y	77	92	70	63	90	75	84

Predict the exam grade of a student who studied for 6 hours. $y = 6(6) + 64$

Equation $y = 6x + 64$ Grade expected 100

11. The table below shows the lengths and corresponding ideal weights of sand sharks.

r ≈ .99

x Length	60	62	64	66	68	70	72
y Weight	105	114	124	131	139	149	158

Predict the weight of a sand shark whose length is 75 inches. $4.4(75) - 156$

Equation $y = 4.4x - 156$ Weight expected 174 lbs.

12. The table below gives the height and shoe sizes of six randomly selected men.

r ≈ .99

x Height	67	70	73.5	75	78	66
y Shoe size	8.5	9.5	11	12	13	8

If a man has a shoe size of 10.5, what would be his predicted height? $.4(10.5) - 19.8$

Equation $y = .4x - 19.8$ Height expected 72.1 in.

$\frac{8}{3.5}$ $\frac{11}{4.5}$ $\frac{4.5}{11}$ 2 $\frac{1}{7.7}$

$10y = 4x + 180$

$y = .4x + 9$

$10.5 = .4x - 19.8$

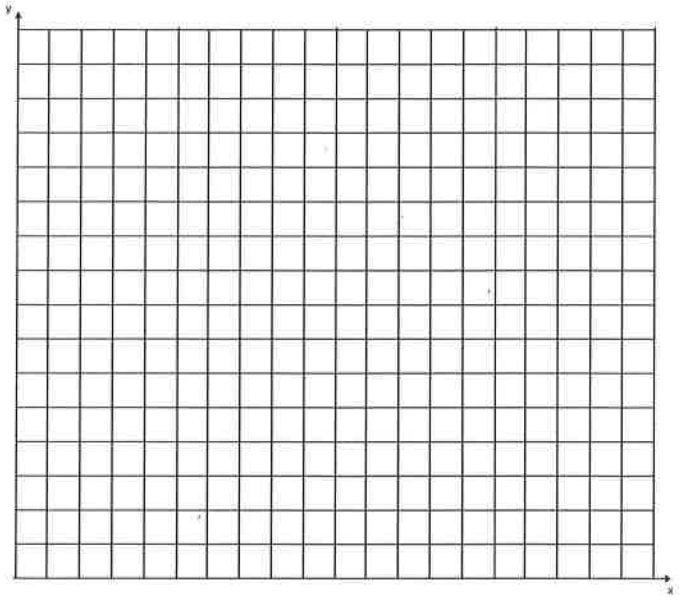
$y - 12 = .4(x - 75)$

$10y - 120 = 4x - 30$

2. Anthropologists use a linear model that relates femur length to height. The model allows an anthropologist to determine the height of an individual when only a partial skeleton (including the femur) is found. In this problem we find the model by analyzing the data on femur length and height for the ten males given in the table.

Femur Length (cm)	Height (cm)
50.1	178.5
48.3	173.6
45.2	164.8
44.7	163.7
44.5	168.3
42.7	165.0
39.5	155.4
38.0	155.0

(a) Make a scatter plot of the data.



(b) Find and graph a linear regression equation that models the data.

Equation:_____

(c) An anthropologist finds a femur of length 58 cm. How tall was the person?

(d) If a person is 151cm tall, what does the model predict for their femur length?

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X y

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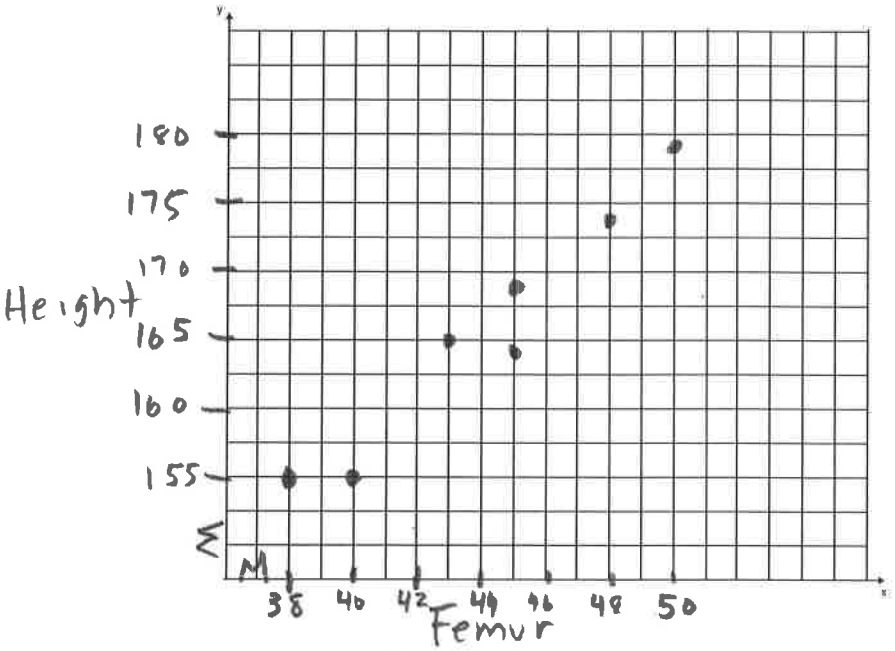


(b) Find and graph a linear regression equation that models the data.

Equation: $y = 1.9x + 80.6$

(c) An anthropologist finds a femur of length 58 cm. How tall was the person?

(d) If a person is 151cm tall, what does the model predict for their femur length?

$y = 1.9(58) + 80.6$

$= 190.8$ cm

$151 = 1.9x + 80.6$

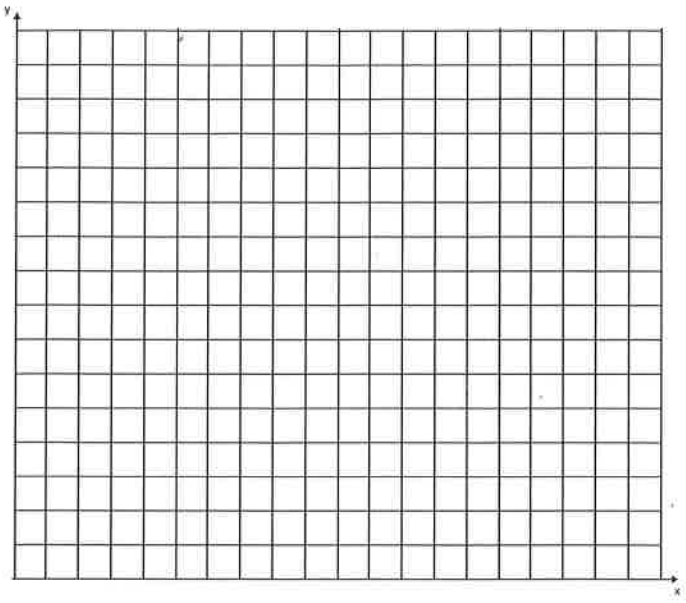
$1.9x = 70.4$

$x = 37$ cm

3. A convenience store manager notices that sales of soft drinks are higher on hotter days, so he assembles the data in the table.

High Temperature (°F)	Number of cans sold
55	340
58	335
64	410
68	460
70	450
75	610
80	735
84	780

(a) Make a scatter plot of the data.



(b) Find and graph a linear regression equation that models the data.

Equation:_____

(c) Use the model to predict soft-drink sales if the temperature is 95°F.

(d) What does the model predict for the temperature if the number of cans sold was only 95?

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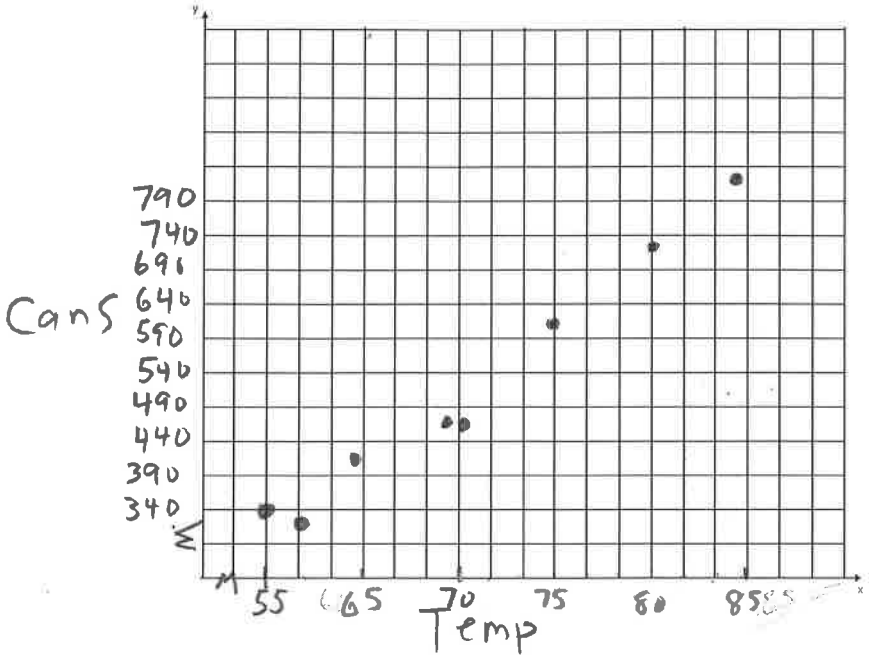

(b) Find and graph a linear regression equation that models the data.

Equation: $y = 16.4x - 621.8$

(c) Use the model to predict soft-drink sales if the temperature is 95°F.

$y = 16.4(95) - 621.8 = \boxed{936.2}$ cans

(d) What does the model predict for the temperature if the number of cans sold was only 95?

$95 = 16.4x - 621.8$

$16.4x = 716.8$

$\boxed{x = 43.7^\circ}$