

Classwork/Homework:

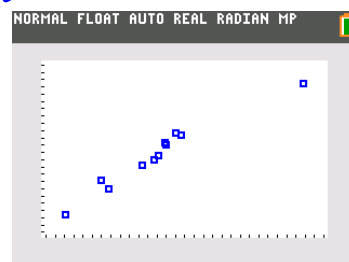
Calculating the Linear Model:

Step by Step Practice

(PKT Pg. 9)

Think:

- ① How is CO amt. related to amt. of tar?
- ② CO, Tar (both in mg)
- ③ Quantitative ✓
Straight Enough? ✓
Cutliers? ✓



Show:

$$\textcircled{1} \hat{CO} = 3.832 + .705 \text{ tar}$$

NORMAL FLOAT AUTO REAL RADIAN MP

LinReg

$y=a+bx$
 $a=3.831840265$
 $b=0.7050179732$
 $r^2=0.955848465$
 $r=0.9776750304$

Tell:

According to the model, each additional mg of tar would increase the amount of carbon monoxide by .705 mg.

Homework Answers:

Statistics Chapter 7 Calculating a Linear Model: Step by Step Practice - KEY

You may want to follow the Step-By-Step Example on page 168 to work through this problem

Carbon Monoxide (CO) is a poisonous, colorless, odorless gas produced as a result of incomplete burning of carbon-containing fuels. Cigarette smoke can contain high levels of CO. Below are tar and CO data for 10 brands of popular cigarettes. Question: How is the amount of carbon monoxide produced by these cigarettes related to their tar content?

Tar (mg)	14.1	16.0	29.8	8.0	4.1	15.0	8.8	12.4	16.6	14.9	13.7
CO (mg)	13.6	16.6	23.5	10.2	5.4	15.0	9.0	12.3	16.3	15.4	13.0

Think

Plan

- State the problem

Variables

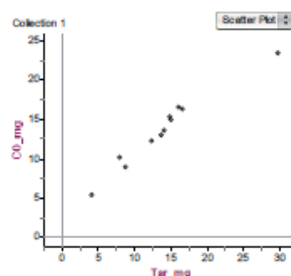
- Identify the variables and report the W's

Conditions

- Check the Straight Enough and Outlier conditions by making a picture. Never fit a linear model without looking at the scatterplot first.

I'll examine the relationship between the amount of carbon monoxide produced by these cigarettes and their tar content.

The variables are tar and carbon monoxide (both measured in mg).



The Straight Enough Condition is satisfied as the scatterplot shows. We should proceed with caution as there appears there could be one outlier.

Show	<p><i>Mechanics</i></p> <ul style="list-style-type: none"> Find the means and standard deviations. Find the correlation Find the slope, b Find the intercept, a Write the equation of the model using meaningful variable names 	<p>CO Mean = 13.663 mg SD = 4.706 mg</p> <p>Tar Mean = 13.945 SD = 6.526</p> <p>Correlation $r = 0.978$</p> $\text{slope} = \frac{rs_y}{s_x} = \frac{(0.978)(4.706)}{6.526} = 0.705$ <p>Intercept = 3.832 $\widehat{CO} = 3.832 + 0.705\text{Tar}$</p>
Tell	<p><i>Conclusion</i></p> <ul style="list-style-type: none"> Interpret what you have found in the context of the question. Discuss in terms of the variables and their units. 	<p>The model suggests that for each 1 mg increase of tar in a cigarette, we can expect an increased release of 0.705 mg of carbon monoxide.</p>

Name _____ Statistics Chapter 7: Regression Practice

For each problem:

- List the variables in (x,y) order where x is the explanatory variable and y is the response variable.
- Plot the data on your calculator and check the *Outlier* and *Straight Enough Conditions*.
- If data does not meet these conditions, do not proceed for that question. Otherwise, use your calculator to find the best fit linear model and make the prediction requested.

Blocks	5	0	4	2	1	7
Price	132	310	204	238	275	60.8

- A real estate agent collected prices of vacation cottages (in thousands of dollars) and how many blocks they are from the beach.

(Blocks , Price (\$/1000))

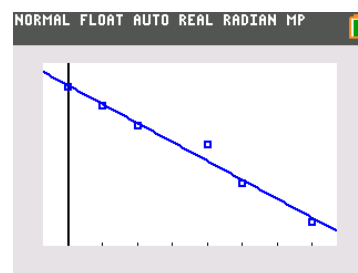
Conditions met? yesModel: $\widehat{\text{Price}} = 313.309 - 34.740 \text{ Blocks}$

Predict the price of a house 3 blocks from the

beach: $\widehat{\text{Price}} = 313.309 - 34.740(3)$

$$= 209.099$$

\$209,099



NORMAL FLOAT AUTO REAL RADIAN MP

LinReg

y=a+bx
a=313.3090909
b=-34.73971292
r²=0.9749126653
r=-0.9873766583

Price/gal	\$1.345	\$1.408	\$1.537	\$1.580
year since 2000	1	2	3	4

2. The New York State average of price of gasoline for 2001 through 2004. We are interested in how the price is changing.

(Years Since 2000, Price/gal)

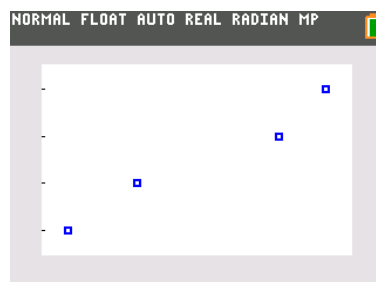
Conditions met? yes

Model: $\hat{\text{Price}} = 1.259 + .0834 \text{ Year}$

What does this model predict for the price of gas for this year? ²⁰¹⁹ How accurate is this model compared to reality?

$$\hat{\text{Price}} = 1.259 + .0834(19)$$

$\hat{\text{Price}} = \$2.84/\text{gal}$ No too far up.



L1	L2	L3	L4	L5	2
1.345	1				
1.408	2				
1.537	3				
1.58	4				

L2(1)=1

NORMAL FLOAT AUTO REAL RADIAN MP
LinReg
 $y=a+bx$
 $a=1.259$
 $b=.0834$
 $r^2=0.9651652652$
 $r=0.9824282494$

Price	\$8	\$9	\$10	\$11	\$12	\$13
Profit	\$501	\$852	\$910	\$765	\$452	\$210

3. A T-shirt shop experiments with different prices of their shirts each week to find the price that maximizes their profit.

(_____ , _____)

Conditions met? _____

Model: _____

Predict the profit when charging a price of \$15
per shirt. _____

Percent	37.1	34.1	32.1	28.8	25.7	25.5
Year	1980	1984	1989	1993	1997	2000

4. The percent of adults married before the age of 25 in the US over several years. We are interested in how this percent is changing.

(,)

Conditions met? _____

Model: _____

What percent of adults married before 25 years old does this model predict for 2001?

Quiz Practice

Book pg. 167

Do the Math



CCSS
8.F.3
8.F.4
HS.S.ID.7

When we use a linear model to describe the relationships between two variables, the model's equation often reveals important details about that relationship. Take for example the cost of a pizza in dollars, c , modeled by the equation, $\hat{c} = 8 + 1.5t$, where t is the number of toppings. This intercept suggests that the cost of a pizza with no toppings is \$8 (the intercept of the graph). And the slope reveals that the cost increases by \$1.50 for each additional topping.

9. For each model described below, explain what the slope and intercept mean (in context, as always!).
 - a) $\hat{c} = 25 + 2w$, where c is the cost of shipping a package (in dollars) and w is the weight of the package (in pounds).
 - b) $\hat{F} = 40 + \frac{1}{4}c$, where F is temperature in degrees Fahrenheit and c is the number of chirps a cricket makes in 1 minute. (Believe it or not, this generally is true for crickets in temperatures between 55°F and 100°F.)
 - c) $\hat{P} = 15 + 0.1m$, where P is your cell phone plan's monthly charge (in dollars) and m is the number of minutes you used.
 - d) $\hat{C} = 11 - 0.5h$, where C is how tall a candle is (in inches) after it has been burning for h hours.
10. For each of the following situations, create a linear equation that models the relationship between the variables. (Be sure to define your explanatory and response variables.)
 - a) Renting a car costs \$19.99 plus 25 cents for each mile you drive the car. Write an equation that models your rental cost.
 - b) A football player breaks free and has an open field to the goal line 80 yards away. He can run 9 yards per second. Write an equation that models how far he has left to run for the touchdown.
 - c) On Tuesdays a family restaurant hosts "Kid's Night" where an adult who purchases a full-price meal for \$12 can buy children's dinners for an additional \$2.50 per kid. Write an equation that models the total cost for an adult who brings several children to Kid's Night.
 - d) You invest \$500 to purchase supplies to bake pies. You sell each pie you bake for \$8. Write an equation to model your profit.

(Check your answers on page 193.)

Homework:

Finish this Worksheet

(#3 and 4)

And Quiz Review
(Book pg. 167)