

Technology Assignment -- Chapter 5 "The Line of Best Fit"

Name _____
Date _____

Sections: 5.6 and 6.7
Due: Day of Chapter 5 Test
Grade: 3 HW Grades
Assessment: These concepts will be included on the Chapter 5 Test

Assignment Details

1) Section 5.6 "Fit a Line to Data" **BY HAND**

- Students responsible for the concepts on pages 324-326. Suggest creating notes for yourself.
- Δ CW pg327 #s 3, 4, 5, 6, 9, 12, 19 (not collected; recommend taking notes)
- Students responsible for the concepts on pages 331-332. Suggest creating notes for yourself.
- Δ CW pg331 Example 1, Example 2, Practice #s 1-5 (not collected; recommend taking notes)

HW: Complete Section 5.6 of this handout.

2) Section 5.7 "Predicting with Linear Models" **USING TECHNOLOGY**

- Students responsible for the concepts on pages 335-338. Suggest creating notes for yourself.
- Δ CW pg338 #s 4, (#9 with algebra & graphing), 13,15,18(not collected; recommend taking notes)

HW: Complete Section 5.7 of this handout.

Chapter 5 TECHNOLOGY ASSIGNMENT

CW

5.6 FIT A LINE TO DATA BY HAND

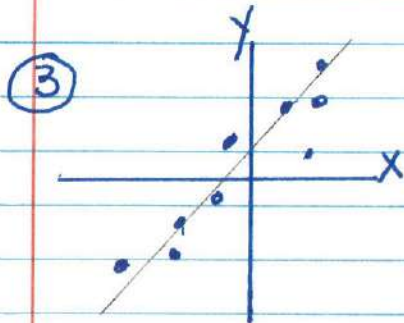
READ pgs 324-326

CW: pg 327 #'s 3-6, 9, 12, 19

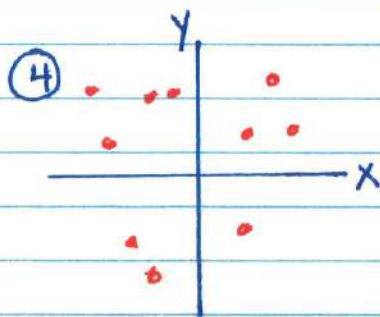
CORRELATIONS MEASURES THE STRENGTH OF THE RELATIONSHIP BETWEEN 2 NUMERIC VARIABLES.

- Look at a scatter plot to determine if there is a positive, negative or NO ASSOCIATION BETWEEN X and Y

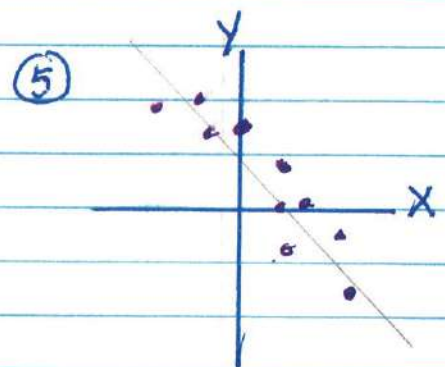
TIP: SKETCH A LINE



POSITIVE CORRELATION



NO LINEAR CORRELATION



NEGATIVE CORRELATION

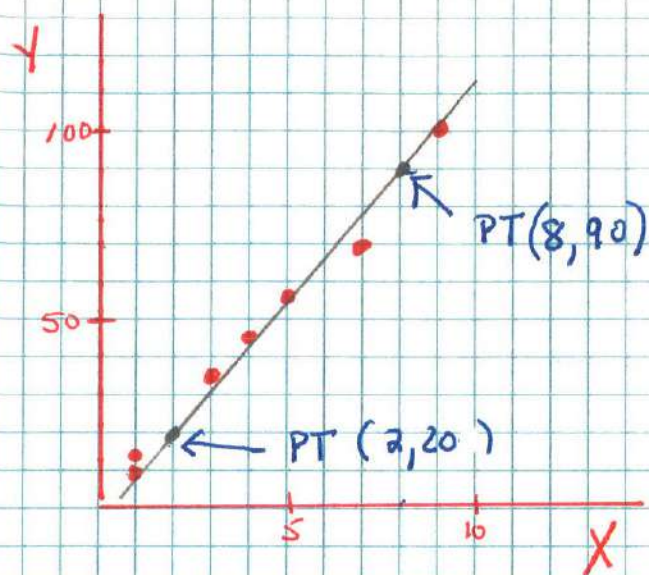
5.6 Pg 327 #6

We want to create a line of best fit (ESTIMATE IT)

X	1	1	3	4	5	6	9
Y	10	12	33	46	59	70	102

STEP 1

CREATE A SCATTER PLOT (label axis)



STEP 2 PICK A LINE

WITH 2 POINTS THAT YOU THINK IS THE "BEST FIT LINE"

STEP 3 FIND SLOPE

$$M = \frac{\Delta Y}{\Delta X} = \frac{90 - 20}{8 - 2} = \frac{70}{6}$$

$$M \approx 11.67$$

ROUND TO 2 DECIMALS

STEP 4 $Y - Y_1 = M(X - X_1)$

$M \approx 11.67$
 $P_1(2, 20)$

$$\begin{aligned} Y - 20 &= 11.67(X - 2) \\ Y - 20 &= 11.67X - 23.34 \end{aligned}$$

+20 +20

S/I

ESTIMATED

STEP 5 PUT IN SLOPE-INTERCEPT

$$Y = 11.67X - 3.34$$

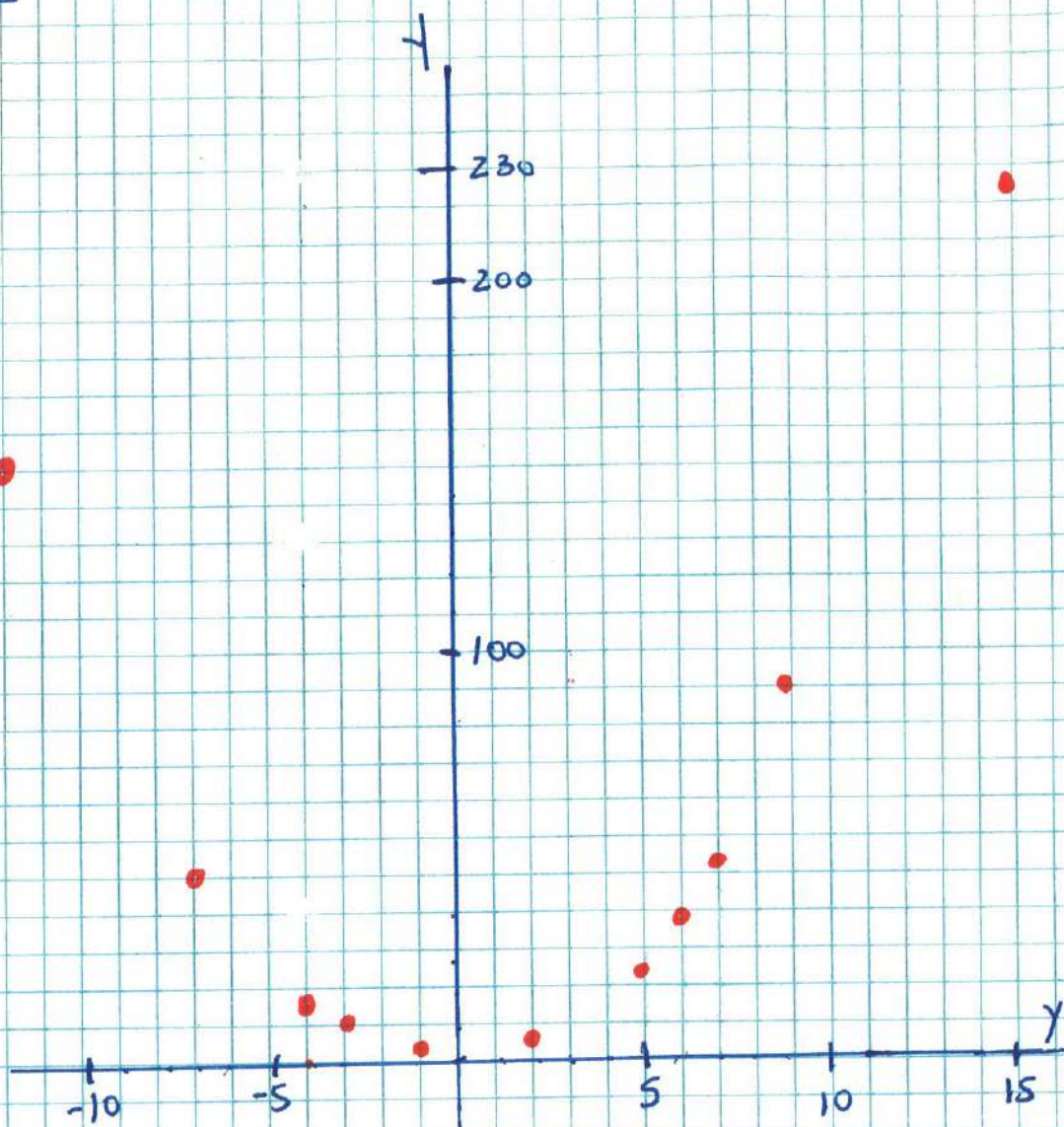
THIS EQUATION MODELS THE LINEAR RELATIONSHIP BETWEEN X and Y

TRUE LSRL EQ: $\hat{y} = 11.5X - .3$

P6328

#12

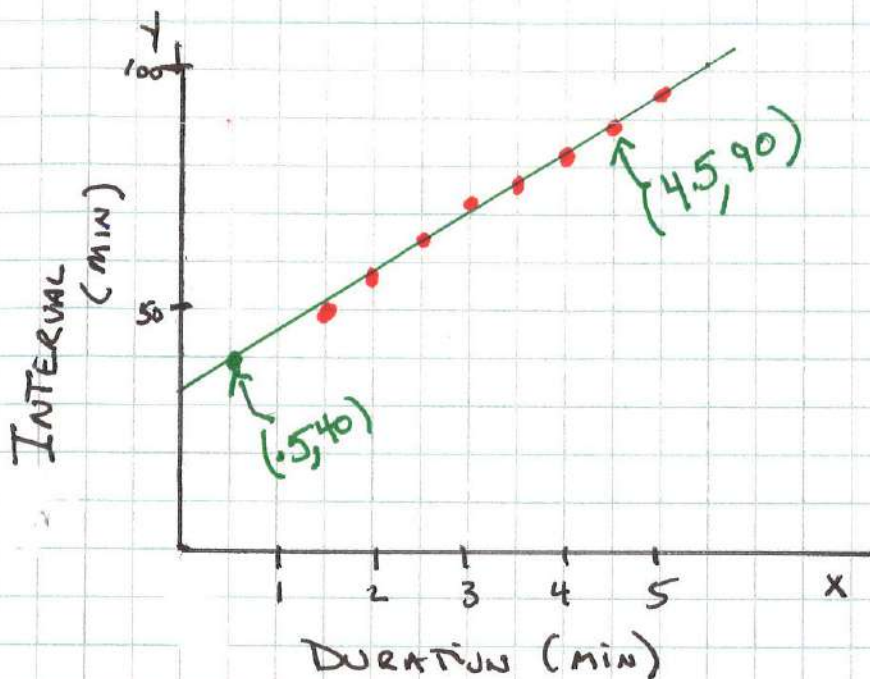
X	Y
-12	150
-7	50
-4	15
-3	10
-1	1
2	5
5	22
6	37
7	52
9	90
15	220



THE PATTERN OF THE POINTS IS NOT LINEAR (IT IS A U-SHAPE) AND THERE IS NO LINEAR CORRELATION, THEREFORE A LINEAR MODEL WOULD NOT BE APPROPRIATE.

GEOLOGY
(OLD FAITHFUL)

DURATION (min)	1.5	2.0	2.5	3.0	3.5	4.0	4.5
INTERVAL (min)	50	57	65	71	76	82	89



LABEL X + Y AXIS

NOTE: POINT YOU
PICK DO NOT
NEED TO BE
ANY OF THE
GIVEN DATA POINTS

TIP Draw line
so 2 points
are on EXACT
Grid lines

FIND EQUATION OF YOUR ESTIMATED "BEST FIT LINE"

① pts (1.5, 40) (4.5, 90) $m = \frac{90 - 40}{4.5 - 1.5} = \frac{50}{3}$ $m = 12.5$

② P/S $y - 40 = 12.5(x - 1.5)$

$$\begin{array}{rcl} y - 40 & = & 12.5x - 6.25 \\ +40 & & +40 \end{array}$$

③ S/I $\rightarrow$ $y = 12.5x + 33.75$ ← ESTIMATED
BEST FIT
LINE

$\hat{y} = 12.64x + 32.04$ ← ACTUAL TICALC
GENERATED
BEST FIT LINE

Perform Linear Regression

QUESTION How can you model data with the best-fitting line?

The line that most closely follows a trend in data is the *best-fitting line*. The process of finding the best-fitting line to model a set of data is called *linear regression*. This process can be tedious to perform by hand, but you can use a graphing calculator to make a scatter plot and perform linear regression on a data set.

2ND CATALOG
Diagnostic ON

EXAMPLE 1 Create a scatter plot

The table shows the total sales from women's clothing stores in the United States from 1997 to 2002. Make a scatter plot of the data. Describe the correlation of the data.

	YR0	YR1	YR2	YR3	YR4	YR5
Year	1997	1998	1999	2000	2001	2002
Sales (billions of dollars)	27.9	28.7	30.2	32.5	33.1	34.3

X = Years since 1997
Y = Sales \$'s

STEP 1 Enter data

Press **STAT** and select Edit. Enter years since 1997 (0, 1, 2, 3, 4, 5) into List 1 (L_1). These will be the x-values. Enter sales (in billions of dollars) into List 2 (L_2). These will be the y-values.

STEP 2 Choose plot settings

Press **2ND Y=** and select Plot1. Turn Plot1 On. Select scatter plot as the type of display. Enter L_1 for the Xlist and L_2 for the Ylist.

STAT
> EDIT
> L1 → Xvar
> L2 → Yvar

L1	L2	L3
0	27.9	
1	28.7	
2	30.2	
3	32.5	
4	33.1	
L(0)=27.9		

Plot1	Plot2	Plot3
On	Off	
Type		
XList:L1		
YList:L2		
Mark:		

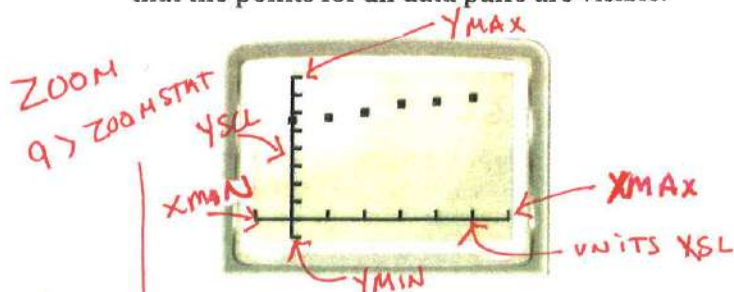
2ND) STATPLOT
1: PLOT1
> ON
TYPE []

STEP 3 Make a scatter plot

Press **ZOOM** 9 to display the scatter plot so that the points for all data pairs are visible.

STEP 4 Describe the correlation

Describe the correlation of the data in the scatter plot.



The data have a positive correlation. This means that with each passing year, the sales of women's clothing tended to increase.

SET THE WINDOW TO MAKE EASY TO PLOT

WINDOW X: 0, 6, 1
Y: 1, 50, 10 → **GRAPH**

MODELING DATA The correlation coefficient r for a set of paired data measures how well the best-fitting line fits the data. You can use a graphing calculator to find a value for r .

For r close to 1, the data have a strong positive correlation. For r close to -1 , the data have a strong negative correlation. For r close to 0, the data have relatively no correlation.

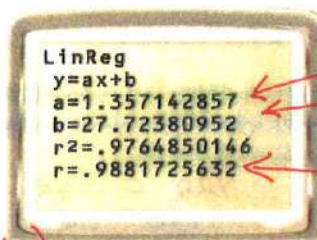
EXAMPLE 2 Find the best-fitting line

Find an equation of the best-fitting line for the scatter plot from Example 1. Determine the correlation coefficient of the data. Graph the best-fitting line.

STEP 1 Perform regression

Press **STAT**. From the CALC menu, choose LinReg(ax+b). The a - and b -values given are for an equation of the form $y = ax + b$. Rounding these values gives the equation $y = 1.36x + 27.7$. Because r is close to 1, the data have a strong positive correlation.

STAT
 $\rightarrow$ **CALC**
 $\rightarrow$ **4 LINREG**



a = slope
 b = y-intercept

CORRELATION COEF
 $r = .988$

means we have a strong positive association between year and sales

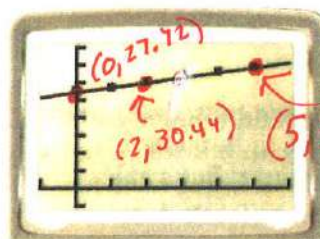
STEP 2 Draw the best-fitting line

Press **Y=** and enter $1.36x + 27.7$ for y_1 . Press **GRAPH**.

(Round to 2 Decimals)

a = slope = 1.36
 b = y-int = 27.72

$$y = 1.36x + 27.72$$



Your Notes

STEP 3

FIND 2 POINTS TO DRAW YOUR Best fit Line on the scatter plot

2ND **TABLE**

X	Y
0	27.72 ← y-int
2	30.44
5	34.52

Sometimes you may need to use **ASK** option

$\rightarrow$ **2ND** **TBLSET**

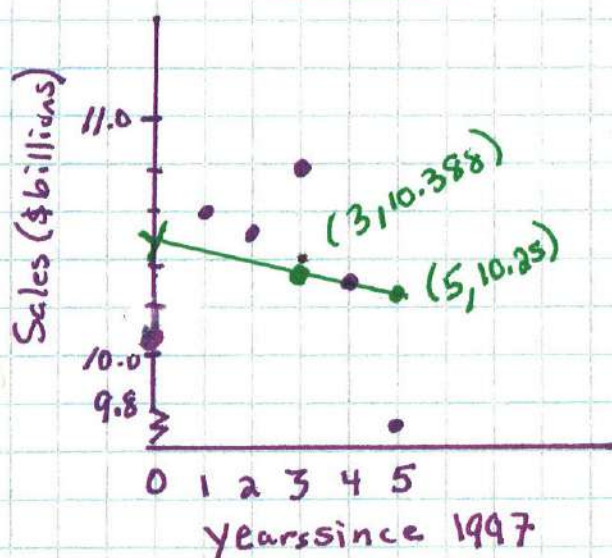
INDPNT **ASK**

2ND **TABLE**

X	YEAR	Sales (y)
0	1997	10.1
1	1998	10.6
2	1999	10.5
3	2000	10.8
4	2001	10.3
5	2002	9.9

X = # of years since 1997
Y = Sales (\$ billions)

#1 Scatter plot



CORRELATION: The graph is unclear

so find the CORR COEF.

(STAT) CALC > 4

$$r = -.26$$

Since the sign is negative and "r" is close to 0, we have a weak negative association between sales and year.

#4

#2
STAT
> CALC
> 4 LIN REG
a = slope
b = y intercept

BEST FIT REGRESSION LINE

$$Y = -.046X + 10.48$$

#3 DRAW THE REGRESSION LINE ON THE SCATTERPLOT

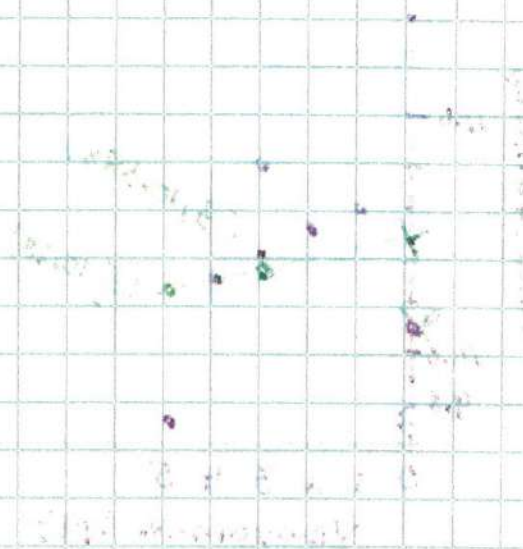
* plot the y intercept (0, 10.48) and label Y
* put the EQ in $Y =$ to find 2 more points

USE THE TABLE FEATURE (2ND) TABLE and

pick 2 points - 1 at the low or middle of X and 1 at the high end of X

X	0	1	2	3	4	5
Y	10.48	10.43	10.40	10.37	10.30	10.25

#5 This line of best-fit
should not be used to
model predicting sales of
men's clothes. **BECAUSE
THERE IS RELATIVELY NO
CORRELATION BETWEEN
SALES AND YEARS.**



Section 5.7 "Predicting with Linear Models"

USING TECHNOLOGY

- Students responsible for the concepts on pages 335-338. Suggest creating notes for yourself.
- Δ CW pg338 #s 4, 7 (by graphing & with algebra), 13, 15, 18 (not collected; recommend taking notes)

LINEAR INTERPOLATION Make a scatter plot of the data. Find the equation of the best-fitting line. Approximate the value of y for $x = 5$.

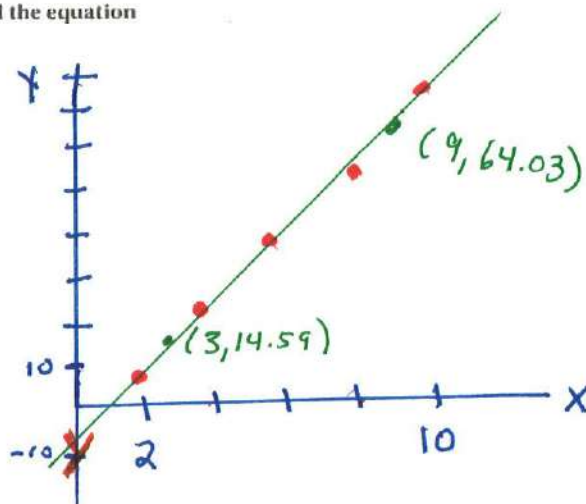
4.

x	2	4	6	8	10
y	6.2	22.5	40.2	55.4	72.1

$r = .999$ super strong CORREL. COEF.

BEST FIT LINE

$$y = 8.24x - 10.13$$



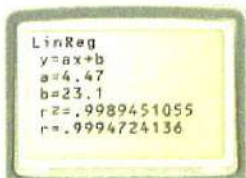
FIND y when $x=5$

$$y = 8.24(5) - 10.13$$

$$y = 31.07$$

15. **ERROR ANALYSIS** Describe and correct the error in finding an equation of the best-fitting line using a graphing calculator.

Equation of the best-fitting line is $y = 23.1x + 4.47$.



ERROR - THEY MIXED UP "a" and "b"

CORRECTION: $y = 4.47x + 23.1$

Section 5.7 "Predicting with Linear Models"

ZERO OF A FUNCTION Find the zero of the function.

9. $f(x) = \frac{1}{8}x + 2$

ZERO's are ordered pairs $(x, 0)$

1) FINDING ZERO'S USING ALGEBRA

Replace $f(x)$ with zero and solve for x

$$y \Leftrightarrow f(x) = \frac{1}{8}x + 2$$

$\Downarrow$

$$0 = \frac{1}{8}x + 2$$

$$\begin{array}{r} -2 \qquad -2 \\ \hline \end{array}$$

$$(8) -2 = \frac{1}{8}x (8)$$

$$x = -16$$

ZERO $(-16, 0)$

2) FINDING ZERO'S BY GRAPHING

put $f(x)$ into TI Calc

$Y=$ enter $y_1 = \frac{1}{8}x + 2$

then

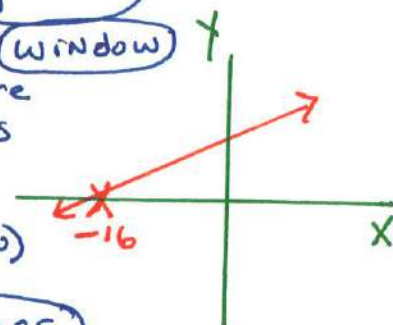
graph

then set **Window**

to see where line crosses

x-axis

($x_{min} = -20$)



then **TRACE**

to $x = -15.9$ $y = .011$

Go to table

2ND Table $\rightarrow$

NOTICE The

point $(-16, 0)$

$\nwarrow$ This is the Zero

13. **ERROR ANALYSIS** Describe and correct the error made in finding the zero of the function $y = 2.3x - 2$.

$$\begin{array}{l} y = 2.3(0) - 2 \\ y = -2 \end{array}$$



ERROR: SET x TO ZERO

CORRECTION: SET y of $f(x)$ to zero AND solve for x .

$$\begin{array}{r} 0 = 2.3x - 2 \\ +2 \qquad +2 \\ \hline 2 = 2.3x \\ \hline 2.3 \quad 2.3 \quad x \approx .87 \end{array}$$

Section 5.7 "Predicting with Linear Models"

ZERO OF A FUNCTION Find the zero of the function.

7. $f(x) = 7.5x - 20$

Zero's are $(x, 0)$

This zero has a decimal

1) FINDING ZERO'S USING ALGEBRA

Put "0" in for $f(x)$
and solve for x .

$$y \Rightarrow f(x) = 7.5x - 20$$

$$0 = 7.5x - 20$$

Solve

$$\frac{20}{7.5} = \frac{7.5x}{7.5}$$

$$x = 2 \frac{2}{3}$$

OR

$$x \approx 2.67$$

2) FINDING ZERO'S BY GRAPHING

$$y = 7.5x - 20$$

TURN
STAT PLOTS
OFF * ZOOM 6: STANDARD

* USE TRACE TO
FIND THE X INT
 $(x, 0)$

(2ND) CALC
2: Zero

LB

RB

GUESS (ignore)

ENTER

$$\underline{x = 2.666} \quad \underline{y = 0}$$

13. **ERROR ANALYSIS** Describe and correct the error made in finding the zero of the function $y = 2.3x - 2$.

$$\begin{aligned} y &= 2.3(0) - 2 \\ y &= -2 \end{aligned}$$



Section 5.7 "Predicting with Linear Models"

PROBLEM SOLVING

EXAMPLE 1
on p. 335
for Ex. 18

- 18. SAILBOATS** Your school's sailing club wants to buy a sailboat. The table shows the lengths and costs of sailboats.

Length (feet)	11	12	14	14	16	22	23
Cost (dollars)	600	500	1900	1700	3500	6500	6000

- Make a scatter plot of the data. Let x represent the length of the sailboat. Let y represent the cost of the sailboat.
- Find an equation that models the cost (in dollars) of a sailboat as a function of its length (in feet).
- Approximate the cost of a sailboat that is 20 feet long.

 for problem solving help at classzone.com



a. SCATTERPLOT – DEFINE X & Y

- X = LENGTH OF SAILBOAT (FT)
- Y = COST OF SAILBOAT (\$)

b. REGRESSION EQUATION

$$Y = 513.43X - 5,257.78$$

c. ESTIMATING

$X = 20 \text{ ft} \rightarrow Y = 513.43(20) - 5257.78$

$Y = \$5010.80$

The estimated cost of a 20 ft sailboat is about \$5,010.80.

d. WHAT IS THE MEANING OF THE Y-INTERCEPT IN CONTEXT OF THIS PROBLEM?

$B = \$5,257.78$ THE Y-INTERCEPT IS TYPICALLY THE STARTING POINT (WITH $X=0$). IN THIS CASE THE Y-INTERCEPT IS NEGATIVE AND

e. WHAT IS THE MEANING OF THE SLOPE IN CONTEXT OF THIS PROBLEM?

$m = \$513.43$

THEREFORE meaning less.

THE SLOPE IS THE RATE OF CHANGE.

IN THIS EXAMPLE, FOR EVERY INCREASE OF 1 FOOT IN THE LENGTH OF A SAIL BOAT, THE COST OF THE SAIL BOAT INCREASE ABOUT \$513.43.

5.7 Predict with Linear Models 339

