Section 4.2: Linear models – building linear functions from data

Don't do any graphs in this section by hand. Just write see calculator for any questions that ask you to sketch a graph.

The correlational coefficient (r) is the statistical technique used to measure strength of linear association, r, between two continuous variables, i.e. closeness with which points lie along the regression line, and lies between -1 and +1

- if r = 1 or -1 it is a perfect linear relationship
- if r = 0 there is no linear relationship between x & y

Conventionally:

$|r|>0.8$ => very strong relationship

$0.6 \leq |r|$ strong relationship

$0.4 \leq |r|$ moderate relationship

$0.2 \leq |r|$ weak relationship

You will need to turn "diagnostics on" for the problems in this section.

Here are the steps:

1. Press [MODE].
2. Use the arrow keys to highlight STAT **DIAGNOSTICS ON** and press [ENTER].
3. Use the arrow keys to highlight FUNCTION and press [ENTER]. The first screen shows this procedure.

Round all answers to 2 decimals, unless stated otherwise.

#1-6: Use the data provided in the table to complete the following:

a) Create a scatter plot of the data

b) Use the linear regression feature on your calculator to find the equation of the line of best fit.

c) What is the value of r?

d) How strong is the linear relationship?

e) If there is a very strong relationship use the equation to predict the y-value that corresponds to x = 10.

1)

x	1	2	3	4	5	6	7
y	3	10	12	11	15	17	20

2)

x	1	2	3	4	5	6	7
y	4	10	10	13	12	20	24

3)

x	1	2	3	4	5	6	7
y	30	35	11	5	2	0	-4

4)

x	1	2	3	4	5	6	7
y	50	30	20	15	5	5	0

5)

x	1	2	3	4	5	6	7
y	30	40	0	70	-20	50	-40

6)

x	1	2	3	4	5	6	7
y	50	100	-20	200	-60	-30	0

7) As Earth's population continues to grow, the solid waste generated by the population grows with it. Governments must plan for disposal and recycling of ever-growing amounts of solid waste. Planners can use data from the past to predict future waste generation and plan for enough facilities for disposing of and recycling the waste.

(Don't graph by hand. Write see Calculator for you answer.)

Given the following data on the waste generated in the USA from 1980 - 2020

Year	Amount of plastic waste in thousands of tons
1980	6,830
1990	17,130
2000	25,550
2010	31,400
2020 (est)	37,500

a) Make a scatterplot of the data, letting *x* represent the number of years since 1980. Use x = 0 to represent 1980.
b) Use a graphing calculator to fit a linear function to the data. (round to 2 decimals if appropriate)
c) How strong is the linear relationship?
d) Graph the function of best fit with the scatterplot of the data.
e) Predict the average tons of plastic waste in the USA 2030.

8) The table shows the alcohol content and number of calories in a 12-ounce beer of various brands

Brand	Alcohol content	Calories
Big Sky Scape Goat Pale Ale	4.70%	163
Sierra Nevada Harvest Ale	6.70%	215
Steel Reserve	8.10%	222
Coors Light	4.15%	104
Genesee Cream Ale	5.10%	162
Sierra Nevada Summerfest Beer	5.00%	158
Big Sky I.P.A.	6.20%	195

a) Make a scatterplot of the data, (you can leave the alcohol content written as a percent)
b) Use a graphing calculator to fit a linear function to the data. (round to 2 decimals)
c) How strong is the linear relationship?
d) Graph the function of best fit with the scatterplot of the data.
e) Predict the number of calories in a 12-ounce beer that has a 5.5% alcohol content.

9) The table below shows the monthly rainfall and number of umbrellas sold at a large retail store in Miami, Florida.

Month	Rainfall in inches	Number of umbrellas sold
January	1.6	150
February	2.3	250
March	3	300
April	3.1	325
May	5.3	700
June	9.7	1100
July	6.5	800
August	8.9	900
September	9.9	1150
October	6.3	750
November	3.3	320
December	2	175

a) Make a scatterplot of the data, (L1 should be the rainfall, L2 umbrellas sold)
b) Use a graphing calculator to fit a linear function to the data. (round to 2 decimals)
c) How strong is the linear relationship?
d) Graph the function of best fit with the scatterplot of the data.
e) Predict the number of umbrellas that will be sold in a month where it rains 8 inches. (round to nearest umbrella)

10) The table shows the average high temperature and the monthly electric bill in Phoenix for a family living in a 1900 square foot house.

Month	Average high temperature	Electric bill
January	69	60
February	72	64
March	80	60
April	87	121
May	93	185
June	106	220
July	108	291
August	107	255
September	101	205
October	90	150
November	77	65
December	67	60

a) Make a scatterplot of the data, (L1 should be the rainfall, L2 umbrellas sold)
b) Use a graphing calculator to fit a linear function to the data. (round to 2 decimals)
c) How strong is the linear relationship?
d) Graph the function of best fit with the scatterplot of the data.
e) Predict the monthly electric bill in a month where the average high temperature is 110 degrees. (round to the nearest dollar)