

Ch. 3 Describing Relationships

2 days on 3.1

4 days on 3.2

1 day Review

1 day Test on Ch. 2 ← Tuesday 10/9/18

3.1 day 1

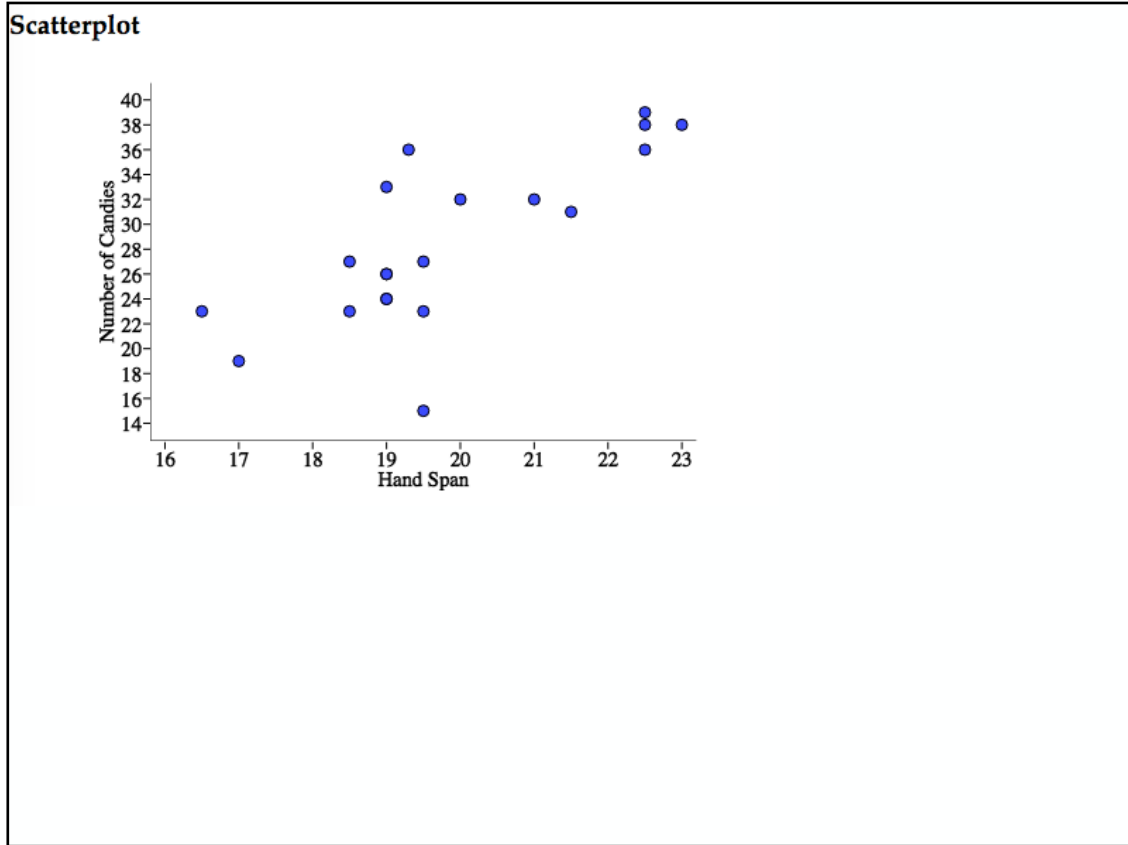
- ✓ DISTINGUISH between explanatory and response variables for quantitative data.
- ✓ MAKE a scatterplot to display the relationship between two quantitative variables.
- ✓ DESCRIBE the direction, form, and strength of a relationship displayed in a scatterplot and identify unusual features.

Candy Grab Activity

page 152

Hand Span (cm)	Number of Candies		
19.5	15	19	26
19	33	19	24
17	19	22½	39
21.5	31	19	24
19.3	36	19.5	27
18.5	27	19	26
20	32	16.5	23
21	32	22.5	36
19.5	23	22.5	38
23	38		
18.5	23		

9,

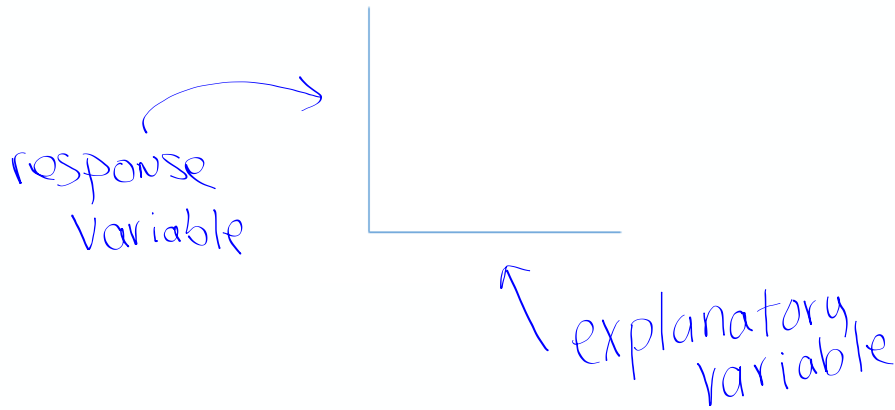


Explanatory and Response Variables

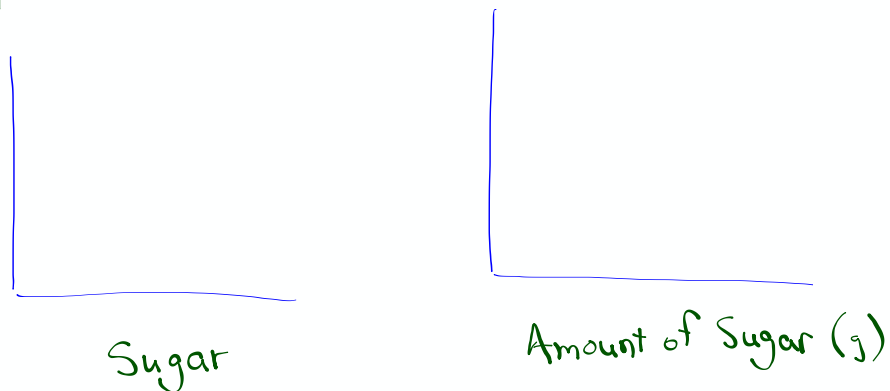
Most statistical studies examine data on more than one variable. Analysis of relationships between two variables builds on the same tools we used to analyze one variable.

Pick Up
Class Notes

A **response variable** measures an outcome of a study.
An **explanatory variable** may help predict or explain changes in a response variable.



A variable should have values that are capable of varying.



A **response variable** measures an outcome of a study.
An **explanatory variable** may help predict or explain changes in a response variable.

Note: In many studies, the goal is to show that changes in one or more explanatory variables actually *cause* changes in a response variable. However, other explanatory-response relationships don't involve direct causation.

Displaying Relationships: Scatterplots

A **scatterplot** shows the relationship (association) between two quantitative variables measured on the same individuals. The values of one variable appear on the horizontal axis, and the values of the other variable appear on the vertical axis. Each individual in the data set appears as a point in the graph.

↳ the only choice for displaying the "distribution" of pairs.

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How to Make a Scatterplot

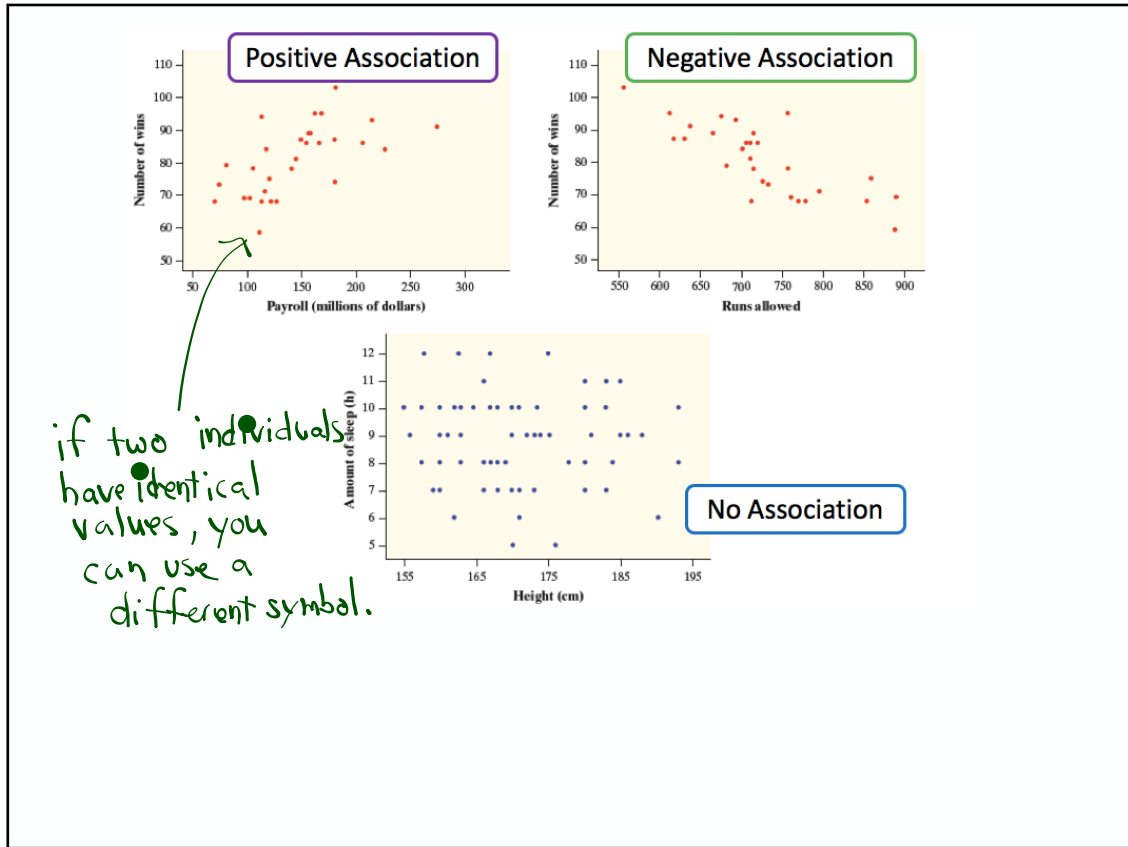
- **Label the axes.**
The Explanatory variable goes on the horizontal (X-axis). The response variable goes on the vertical axis. If there is no explanatory variable, either variable can go on the horizontal axis.
- **Scale the axes.**
- **Plot individual data values.**

2. Track and field day! Each member of a small statistics class ran a 40-yard sprint and then did a long jump (with a running start). The table below shows the sprint time (in seconds) and the long-jump distance (in inches):

Sprint time (sec)	Long-jump distance (in.)
5.41	171
5.05	184
7.01	90
7.17	65
6.73	78
5.68	130
5.78	173
6.31	143
6.44	92
6.50	139
6.80	120
7.25	110

Use your Graphing Calculator to make a scatterplot of the relationship between sprint time and long-jump distance. Instructions are on page 159 in your book. *(Note: It will be possible, but unlikely, that you will be asked on an AP Exam to produce a scatterplot. More often you will be asked to interpret the scatter plot)*

Describing a
Scatterplot



To describe a scatterplot, follow the basic strategy of data analysis from Chapter 1: look for patterns and important departures from those patterns.

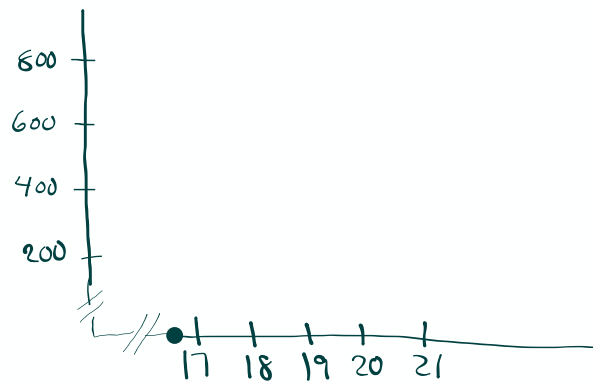
Two variables have a **positive association** when above-average values of one variable tend to accompany above-average values of the other variable and when below-average values also tend to occur together.

Two variables have a **negative association** when above-average values of one variable tend to accompany below-average values of the other variable.

There is **no association** between two variables if knowing the value of one variable does not help us predict the value of the other variable.

Examples of Associations
that you can think of

If $(0,0)$ is not the bottom
left point ●●



SOCV

3. How to Describe a Scatter Plot..... **DUFS**

D irection

U nusual features

F orm

S trength

Next Page

D

Direction: A scatterplot can show a positive association, negative association, or no association.

U

Unusual features: Look for outliers that fall outside the overall pattern and distinct clusters of points.

F

Form: A scatterplot can show a linear form or a nonlinear form. The form is linear if the overall pattern follows a straight line. Otherwise, the form is nonlinear.

S

Strength: A scatterplot can show a weak, moderate, or strong association. An association is strong if the points don't deviate much from the form identified. An association is weak if the points deviate quite a bit from the form identified.

How to Describe a Scatterplot

To describe a scatterplot, make sure to address the following characteristics in the context of the data:

- **Direction:** A scatterplot can show a positive association, negative association, or no association.

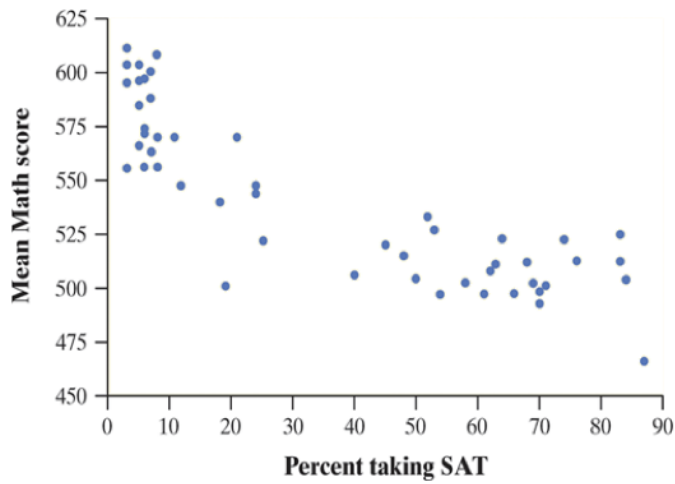


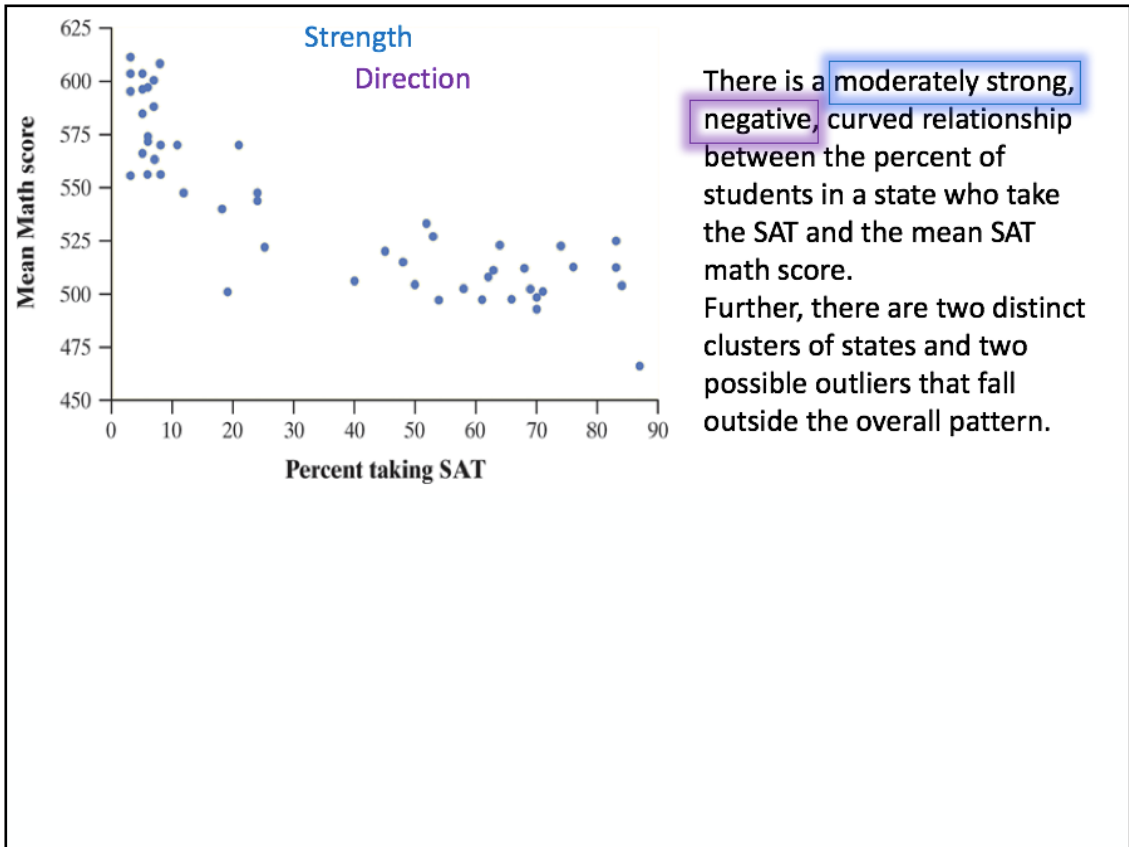
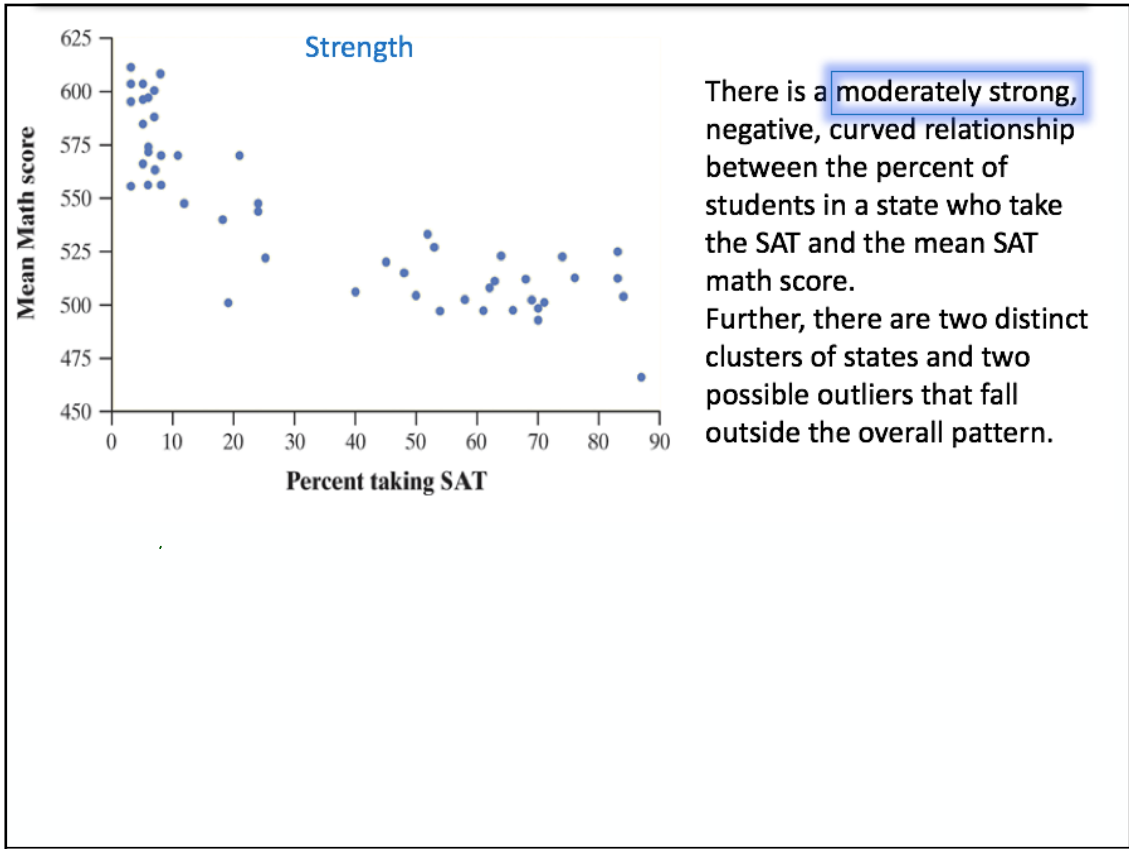
CAUTION:

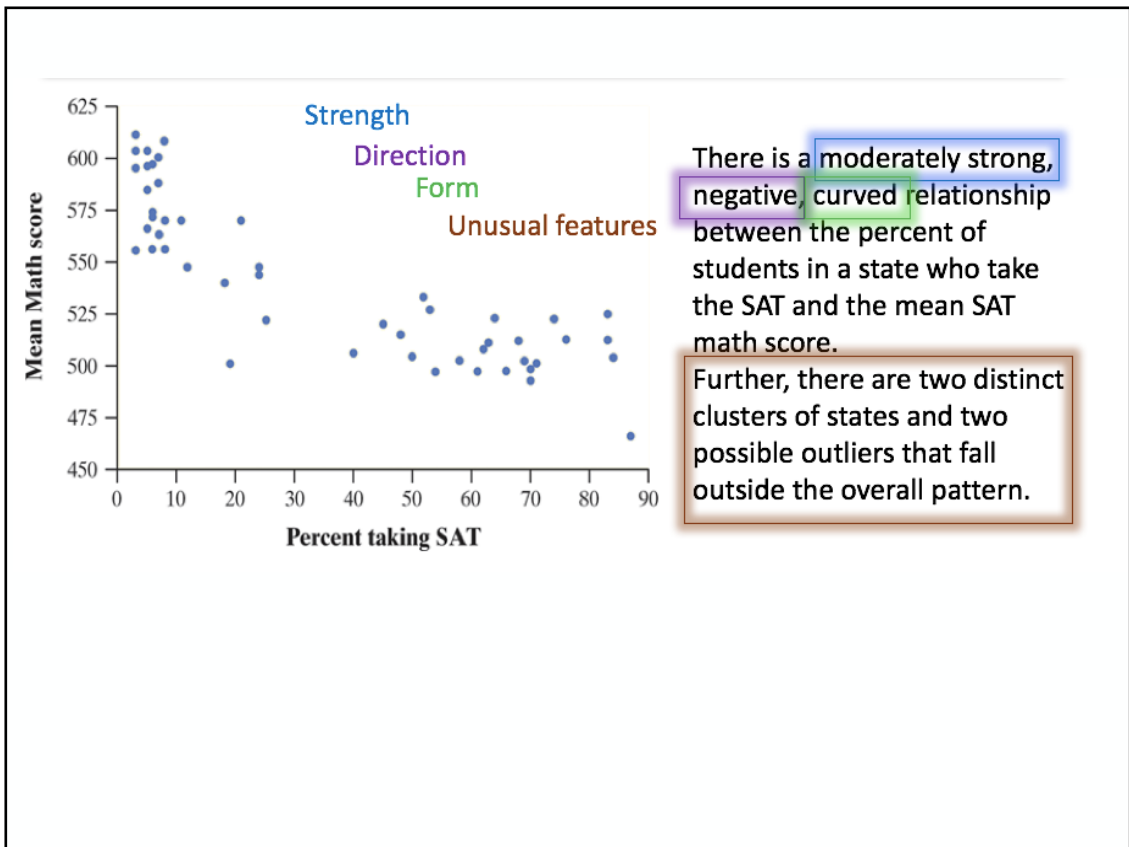
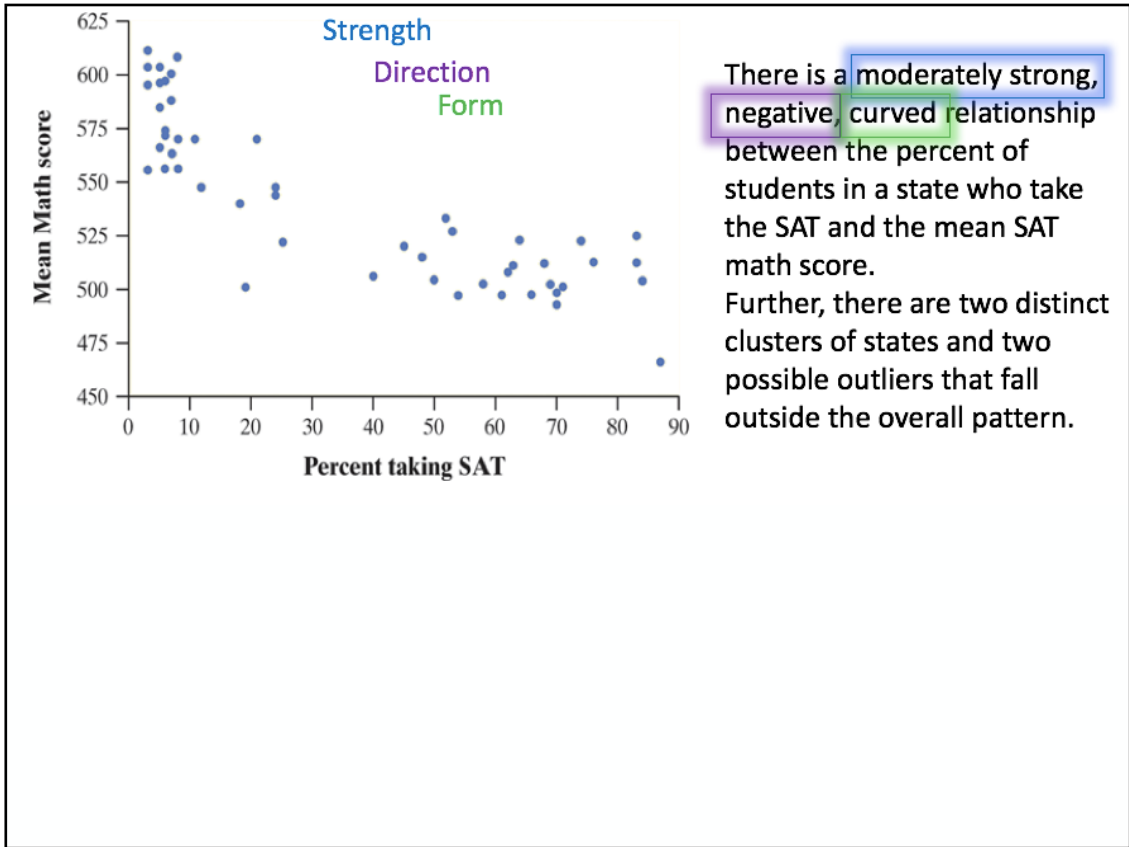
- When **describing** the association shown in a scatterplot, write **in the context of the problem**.
This means that you need to use both variable names in your description.
- **Unusual features:** Look for outliers that fall outside the overall pattern and distinct clusters of points.

Just
Watch
☺

The scatterplot shows the association between mean SAT Math score and percent of students who take the SAT for the 50 U.S. states. Describe the association shown by the scatterplot.



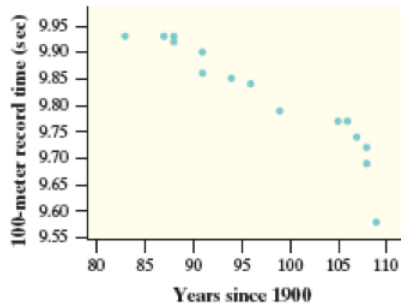




4. World records for sprints and marathons.

Describe the relationship in each of the following contexts. (Use DUFFS)

- (a) The scatterplot shows the relationship between the years since 1900 and the 100-meter sprint record time (in seconds) for the years 1983 to 2010.

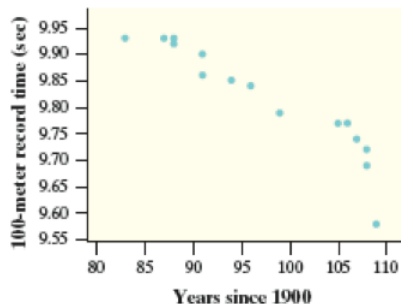


The direction is negative, the form is slightly curved, the association is strong, and there seems to be one possible outlier.

4. World records for sprints and marathons.

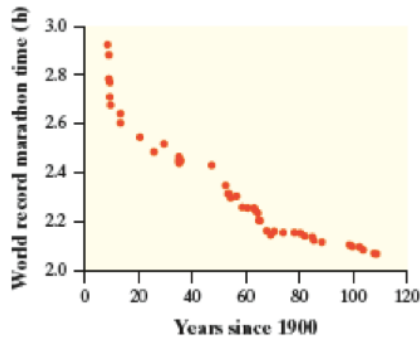
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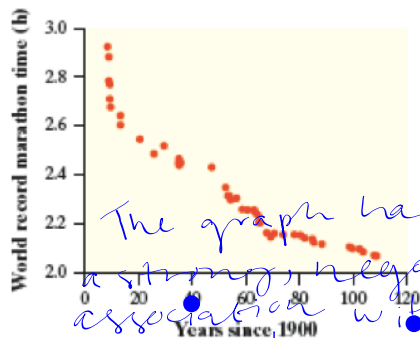
There is a fairly strong, negative, linear relationship between the years since 1900 and the 100-meter sprint record time. Usain Bolt's 9.58 sec time in 2009 is a clear outlier.

(b) The scatterplot shows the relationship between the year and the world record time for the marathon (hours).



The graph has a strong, negative association with a curved shape. There are no outliers and the data has a greater density between 1950 and 1980.

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The graph has a strong, negative association with a curved shape. There are no outliers and the data has a greater density between 1950 and 1980.

There is a strong, negative non-linear relationship between years since 1900 and record marathon time.

There are no obvious outliers.

Assignment:

3.1

1, 3, 5, 9, and 11