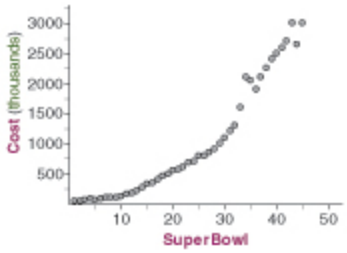
Name:_____ Date:_____ Period:_____

Chapter 13 Review

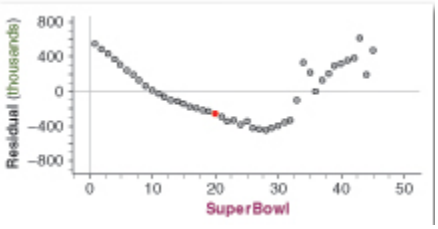
The Cost of a Super Bowl Ad



The Super Bowl is not only the championship game for the NFL, it is also one of the most watched television events of the year. Because the viewing audience is so large, television networks can charge enormous amounts of money for each 30-second commercial. The scatterplot shows the cost (in thousands of dollars) of a 30-second Super Bowl ad, starting with Super Bowl 1 in 1967.

1.) Describe the association you see in the scatterplot.

2.) A least-squares regression line was calculated using x = Super Bowl number and y = cost. The equation of the least-squares regression line is y = -568,440 + 68,779x. Predict the cost of an ad in Super Bowl 1. How reasonable is your prediction?



Using the equation of the least-squares regression line, the residual plot was constructed

3.) If you were to use the equation of the least-squares regression line to predict the cost of a 30-second ad in Super Bowl 20, will your prediction be too low or too high? Explain.

4.) Based on the residual plot, is a linear model appropriate for this association? Explain.

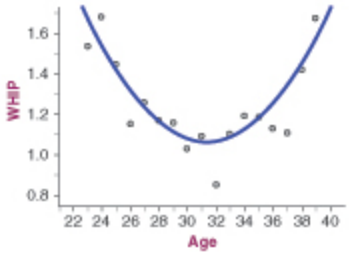
Modeling Bob Gibson's Career Trrajectory

YEAR	AGE	WHIP	YEAR	AGE	WHIP
1959	23	1.533	1968	32	0.853
1960	24	1.673	1969	33	1.102
1961	25	1.443	1970	34	1.190
1962	26	1.151	1971	35	1.185
1963	27	1.257	1972	36	1.129
1964	28	1.169	1973	37	1.108
1965	29	1.157	1974	38	1.417
1966	30	1.027	1975	39	1.670
1967	31	1.089			

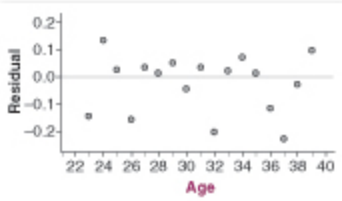
Hall-of-Fame pitcher Bob Gibson of the St. Louis Cardinals was one of the most dominant pitchers during the 1960s. The table below shows his age and WHIP* for each year of his career, beginning in 1959.

*WHIP stands for Walks plus hits per inning pitched and low values indicate better pitching performances.

$$\text{WHIP} = \frac{\text{walks + hits}}{\text{Innings pitched}}$$



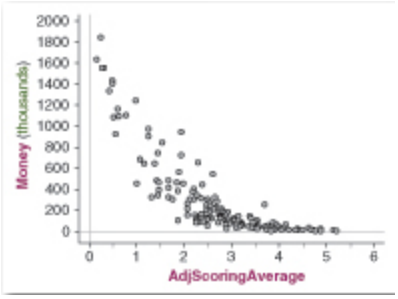
1.) Using the quadratic model: $y = 0.0089x^2 - 0.5583x + 9.8111$, calculate and interpret the residual for his famous 1968 season.



2.) Based on the residual plot, assess the appropriateness of the model.

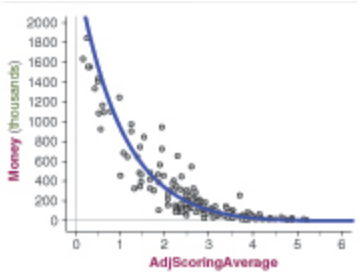
3.) According to the model, at what age did Gibson peak? That is, at what age was his predicted WHIP the lowest? Does this match what happened in real life?

Earnings on the LPGA Tour

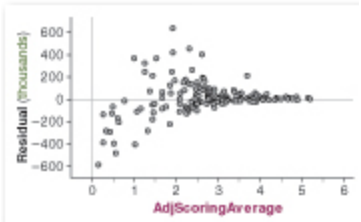


Earlier in the chapter, we looked at the relationship between scoring average and money earned by the 146 golfers on the LPGA tour in 2009. Here again is the scatterplot showing this association, using adjusted scoring average as the explanatory variable. The adjusted scoring average is the number of strokes above 70, so that an adjusted value of 2 strokes corresponds to an actual value of 72 strokes.

1.) Describe the association between adjusted scoring average and money earned.



2.) The graph of the exponential model $y = 2{,}644{,}520\ (0.33)^x$ is shown on the scatterplot below, along with the corresponding residual plot. Use these graphs to discuss if the exponential model is appropriate.



3.) Use the exponential model to calculate and interpret the residual for Jiyai Shin, who had a scoring average of 70.26 and earned a tour-leading $1,839,564.

4.) Interpret the base of the exponential model.

5.) Interpret the coefficient of the exponential model.

Will They Make the Playoffs?

In the NHL, is there an association between the average number of goals scored per game and making the playoffs? Using the data from the 30 NHL teams in the 2010-2011 regular season, the following logistic model was calculated using the average number of goals scored per game as the explanatory variable and playoffs (1 = made the playoffs, 0 = missed the playoffs) as the response variable.

$$P = \frac{e^{-17.27 + 6.222x}}{1 + e^{-17.27 + 6.222x}}$$

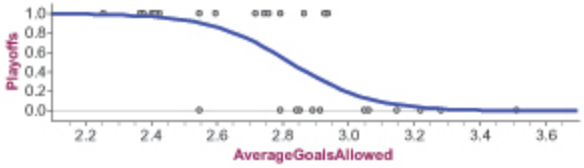
1.) Does the equation of the logistic model reveal a positive or negative association between average goals scored and making the playoffs? Explain how you know.

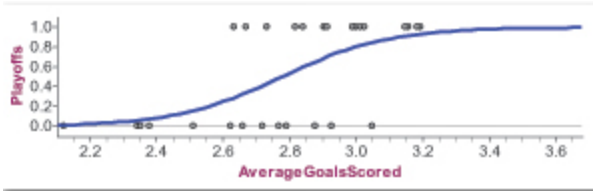
2.) Calculate and interpret the value of p when a team averages 3 goals scored per game.

3.) Calculate the value of p when x = 2.2, 2.4, 2.6, 2.8 and 3.2.

Offense vs. Defense in the NHL

Which variable is a better predictor of making the NHL playoffs, goals scored or goals allowed? The scatterplots below show the actual data and the corresponding logistic model for the predicted probability of making the playoffs for each relationship.





1.) Briefly describe the direction of each association.

2.) Which variable has a stronger association with making the playoffs, average goals scored or average goals allowed? Explain.

3.) If the owner of a team wants to have at least a 90% chance of making the playoffs, what is the largest number of goals they can allow, on average? Explain.