Section 4.3

Diagnostics on the Least-squares Regression Line

Objectives

- Compute and interpret the coefficient of determination
- Perform residual analysis on a regression model
- Identify influential observations

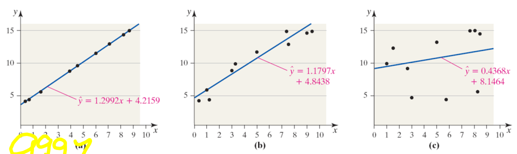
The **coefficient of determination, R^2**, measures the proportion of total variation in the response variable that is explained by the least-squares regression line.

$0 \le R^2 \le 1$

If $R^2 = 0$ the line has no explanatory value

If $R^2 = 1$ means the line explains 100% of the variation in the response variable.

To determine R^2 for the linear regression model simply square the value of the linear correlation coefficient.



99.9%

99.99% of the variability in y is explained by the least-squares regression line
94.7% of the variability in y is explained by the least-squares regression line
9.4% of the variability in y is explained by the least-squares regression line

Find and interpret the coefficient of determination for the drilling data.

$r^2 = .597$

59.7%

Depth at Which Drilling Begins, x (in feet)	Time to Drill 5 Feet, y (in minutes)
35	5.88
50	5.99
75	6.74
95	6.1
120	7.47
130	6.93
145	6.42
155	7.97
160	7.92
175	7.62
185	6.89
190	7.9

So, 59.7 % of the variability in drilling time is explained by the least-squares regression line.

(1) Scatter Plot L1 L2 x y Stat Plot

(2) Correlation Coefficient Stat, Calc, Lin Reg

$r = .773$

(3) Is it Linear? $n = 12$ C.V. $= .576$ $|.773| > .576$ yes it is Linear

(4) Find the least-squares Reg Line.

$\hat{y} = .012x + 5.527$

(5) Predict the drilling time for 75 feet.

$.012(75) + 5.527$

6.427

Good estimate since 75 is within the scope of the data.

(6) At 75 feet we know the drilling time to be 6.74 minutes. Is our drilling time above or below the average drilling time at that depth?

Observed

6.427 (predicted)

Above

(7) Interpret the slope.

Slope: .012 For every foot increase in depth the drilling time increases by .012.

(8) Interpret the y-intercept.

y-int = 5.527 Drilling at ground level.

(9) What proportion of variability is explained in the time of drilling?

$r^2 = .597$