

2011 AP[®] STATISTICS FREE-RESPONSE QUESTIONS

5. Windmills generate electricity by transferring energy from wind to a turbine. A study was conducted to examine the relationship between wind velocity in miles per hour (mph) and electricity production in amperes for one particular windmill. For the windmill, measurements were taken on twenty-five randomly selected days, and the computer output for the regression analysis for predicting electricity production based on wind velocity is given below. The regression model assumptions were checked and determined to be reasonable over the interval of wind speeds represented in the data, which were from 10 miles per hour to 40 miles per hour.

Predictor	Coef	SE Coef	T	P
Constant	0.137	0.126	1.09	0.289
Wind velocity	0.240	0.019	12.63	0.000

S = 0.237 R-Sq = 0.873 R-Sq (adj) = 0.868

- (a) Use the computer output above to determine the equation of the least squares regression line. Identify all variables used in the equation.
- (b) How much more electricity would the windmill be expected to produce on a day when the wind velocity is 25 mph than on a day when the wind velocity is 15 mph? Show how you arrived at your answer.
- (c) What proportion of the variation in electricity production is explained by its linear relationship with wind velocity?
- (d) Is there statistically convincing evidence that electricity production by the windmill is related to wind velocity? Explain.