

Use JMP to answer the following questions. Instructions for how to find the relevant values in JMP are included in Chapter 4 of your Lecture Guide.

1. A company wishes to study the relationship between sales volume and the amount of money spent on advertisements. The following data are collected.

Advertising (thousand dollars)	Sales Volume (thousand dollars)
100	400
200	550
300	800
400	1200

- (a) Identify the **explanatory** and **response** variables.

Explanatory: Amount spent on advertising (in thous. dollars), Response: Sales volume (in thous. dollars)

- (b) Find and interpret the **correlation coefficient** in context of the problem.

$r = 0.9783$. There is a strong, positive linear relationship between amount spent on ads and sales volume.

- (c) Using **Table II** in Chapter 4 of your Lecture Guide, determine whether there is a linear relationship between the two variables.

Critical value for $n = 4$: 0.950

$|r| = |0.9782| = 0.9783 > 0.950 \Rightarrow$ There is a linear relationship.

- (d) What is the least-squares **regression equation**?

$$\hat{y} = 75 + 2.65x$$

- (e) Interpret the **slope** of the regression equation.

For every additional one thousand dollars (\$1,000) spent on advertising, sales volume is predicted to increase on average by 2.65 thousand dollars (\$2,650).

- (f) Does the **y-intercept** of the regression equation have a valid interpretation in this context? If so, interpret it. If not, explain why.

The y-intercept of $b_0 = 75$ does not have a valid interpretation in this context because zero thousand dollars is outside the range of observed advertising expense amounts.

- (g) Find the **predicted** sales volume when \$400,000 are spent on advertising.

$$\hat{y} = 75 + 2.65(400) = 1135 \text{ thousand dollars } (\$1,135,000)$$

- (h) Find the **residual** for when \$400,000 are spent on advertising.

$$y - \hat{y} = 1200 - 1135 = 65 \text{ thousand dollars}$$

2. An economist wants to determine the relationship between one's FICO score (a measure of credit score) and the interest rate of a 36-month auto loan. The data in the table below represent the interest rate (in percent) that a bank might offer on a 36-month auto loan for a sample of various FICO score.

FICO Score	545	595	640	675	705	750
Interest Rate (%)	18.982	17.967	12.218	8.612	6.680	5.150

- (a) Identify the **explanatory** and **response** variables.

Explanatory: FICO score, Response: Interest rate on a 36-month auto loan (in percent)

- (b) Find and interpret the **correlation coefficient** in context of the problem.

$r = -0.9759$. There is a strong, negative linear relationship between FICO score and interest rate.

- (c) Using **Table II** in Chapter 4 of your Lecture Guide, determine whether there is a linear relationship between the two variables.

Critical value for $n = 6$: 0.811

$|r| = |-0.9759| = 0.9759 > 0.811 \Rightarrow$ There is a linear relationship.

- (d) What is the least-squares **regression equation**? Round values to three decimal places.

$$\hat{y} = 61.369 - 0.076x$$

- (e) Interpret the **slope** of the regression equation.

For every additional point on someone's FICO score, the interest rate on a 36-month auto loan is predicted to decrease on average by 0.076%.

- (f) Does the **y-intercept** of the regression equation have a valid interpretation in this context? If so, interpret it. If not, explain why.

The y-intercept of $b_0 = 61.369$ does not have a valid interpretation because a FICO score of zero is not within the range of observed credit scores.

- (g) Find the **predicted** sales volume for someone with a FICO score of 640.

$$\hat{y} = 61.369 - 0.076(640) = 12.729\%$$

- (h) Find the **residual** for someone with a FICO score of 640.

$$y - \hat{y} = 12.218 - 12.729 = -0.511\%$$

The interest rate for someone with a FICO score of 640 is actually 0.511% less than the regression equation predicts.