Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

1. **In yhat=5+1x1-1x2, interpret coefficient 1 when x1 is study hours, x2 is prior practice score, and y is predicted quiz points.**

Reference: A multiple-regression slope compares predictions while holding the other included predictor fixed. It is an association unless causal conditions are separately justified.

2. **Using yhat=6+2x1-1x2, calculate residuals and SSE for rows (x1,x2,y): (1, 0, 9), (2, 2, 7), (3, 4, 8), (4, 1, 14), (5, 3, 12).**

Reference: For each printed row use residual y-yhat. Then SSE=sum residual^2. Use the supplied coefficients; do not refit them.

Show substitutions and residual signs; use only printed values.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

3. **For rows (x1,x2,y): (1, 1, 5), (2, 3, 7), (3, 0, 14), (4, 2, 13), (5, 4, 15), (6, 1, 22), write the least-squares objective in b0,b1,b2 for yhat=b0+b1x1+b2x2. Do not solve it.**

Reference: Substitute each row into sum[y-(b0+b1 x1+b2 x2)]^2. Keep every one of the 4-6 printed rows.

4. **A model predicts weekly plant growth y (cm) from sunlight x1 (hours/day) and water x2 (liters/week): yhat=5+4x1-1x2. Identify the response and both predictors.**

Reference: The response is the outcome on the left side. Predictors appear on the right side and are used to form predictions.

Show substitutions and residual signs; use only printed values.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

5. **For yhat=4+1x1-2x2 and observed row (x1,x2,y)=(1,0,4), calculate the prediction and residual y-yhat.**

Reference: Substitute both predictors into the supplied equation. Residual=observed-predicted, so its sign matters.

6. **For yhat=5+2x1-2x2 and observed row (x1,x2,y)=(1,1,5), calculate the prediction and residual y-yhat.**

Reference: Substitute both predictors into the supplied equation. Residual=observed-predicted, so its sign matters.

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Multiple Regression Introduction

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

7. **In yhat=6+3x1-2x2, interpret coefficient 3 when x1 is training sessions, x2 is baseline time, and y is predicted race time seconds.**

Reference: A multiple-regression slope compares predictions while holding the other included predictor fixed. It is an association unless causal conditions are separately justified.

8. **For rows (x1,x2,y): (1, 3, 1), (2, 0, 12), (3, 2, 13), (4, 4, 11), (5, 1, 22), write the least-squares objective in b0,b1,b2 for yhat=b0+b1x1+b2x2. Do not solve it.**

Reference: Substitute each row into sum[y-(b0+b1 x1+b2 x2)]^2. Keep every one of the 4-6 printed rows.

Show substitutions and residual signs; use only printed values.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Worked Answer Key

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

1. **In yhat=5+1x1-1x2, interpret coefficient 1 when x1 is study hours, x2 is prior practice score, and y is predicted quiz points.**

Reference: A multiple-regression slope compares predictions while holding the other included predictor fixed. It is an association unless causal conditions are separately justified.

Answer: Holding prior practice score fixed, one additional unit of study hours is associated with 1 more predicted units of quiz points

1. Compare two rows with the same x2 whose x1 values differ by 1: predictions differ by 1.
2. This coefficient statement alone is not a causal claim and is not a test of significance.

2. **Using yhat=6+2x1-1x2, calculate residuals and SSE for rows (x1,x2,y): (1, 0, 9), (2, 2, 7), (3, 4, 8), (4, 1, 14), (5, 3, 12).**

Reference: For each printed row use residual y-yhat. Then SSE=sum residual^2. Use the supplied coefficients; do not refit them.

Answer: residuals 1, -1, 0, 1, -1; SSE=4

1. (1,0,9): yhat=8, residual=1.
2. (2,2,7): yhat=8, residual=-1.
3. (3,4,8): yhat=8, residual=0.
4. (4,1,14): yhat=13, residual=1.
5. (5,3,12): yhat=13, residual=-1.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Worked Answer Key

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

3. **For rows (x1,x2,y): (1, 1, 5), (2, 3, 7), (3, 0, 14), (4, 2, 13), (5, 4, 15), (6, 1, 22), write the least-squares objective in b0,b1,b2 for yhat=b0+b1x1+b2x2. Do not solve it.**

Reference: Substitute each row into sum[y-(b0+b1 x1+b2 x2)]^2. Keep every one of the 4-6 printed rows.

Answer: [5-(b0+1b1+1b2)]^2 + [7-(b0+2b1+3b2)]^2 + [14-(b0+3b1+0b2)]^2 + [13-(b0+4b1+2b2)]^2 + [15-(b0+5b1+4b2)]^2 + [22-(b0+6b1+1b2)]^2

1. Each bracket is observed y minus the model prediction for one row.
2. The objective has 6 squared terms and is minimized over b0,b1,b2.

4. **A model predicts weekly plant growth y (cm) from sunlight x1 (hours/day) and water x2 (liters/week): yhat=5+4x1-1x2. Identify the response and both predictors.**

Reference: The response is the outcome on the left side. Predictors appear on the right side and are used to form predictions.

Answer: Response: weekly growth y. Predictors: sunlight x1 and water x2.

1. Units: y is centimeters, x1 is hours/day, and x2 is liters/week.
2. The equation supplies coefficients; it does not prove either predictor causes growth.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Worked Answer Key

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

5. **For yhat=4+1x1-2x2 and observed row (x1,x2,y)=(1,0,4), calculate the prediction and residual y-yhat.**

Reference: Substitute both predictors into the supplied equation. Residual=observed-predicted, so its sign matters.

Answer: yhat=5; residual=-1

1. yhat=4+1(1)-2(0)=5.
2. Residual=4-5=-1.

6. **For yhat=5+2x1-2x2 and observed row (x1,x2,y)=(1,1,5), calculate the prediction and residual y-yhat.**

Reference: Substitute both predictors into the supplied equation. Residual=observed-predicted, so its sign matters.

Answer: yhat=5; residual=0

1. yhat=5+2(1)-2(1)=5.
2. Residual=5-5=0.

Name _____ Score _____ Teacher _____ Date _____

Multiple Regression Introduction

Worked Answer Key

Use the supplied coefficients. Interpret one slope while holding the other predictor fixed; no coefficient inference is required.

7. **In yhat=6+3x1-2x2, interpret coefficient 3 when x1 is training sessions, x2 is baseline time, and y is predicted race time seconds.**

Reference: A multiple-regression slope compares predictions while holding the other included predictor fixed. It is an association unless causal conditions are separately justified.

Answer: Holding baseline time fixed, one additional unit of training sessions is associated with 3 more predicted units of race time seconds

1. Compare two rows with the same x2 whose x1 values differ by 1: predictions differ by 3.
2. This coefficient statement alone is not a causal claim and is not a test of significance.

8. **For rows (x1,x2,y): (1, 3, 1), (2, 0, 12), (3, 2, 13), (4, 4, 11), (5, 1, 22), write the least-squares objective in b0,b1,b2 for yhat=b0+b1x1+b2x2. Do not solve it.**

Reference: Substitute each row into sum[y-(b0+b1 x1+b2 x2)]^2. Keep every one of the 4-6 printed rows.

Answer: [1-(b0+1b1+3b2)]^2 + [12-(b0+2b1+0b2)]^2 + [13-(b0+3b1+2b2)]^2 + [11-(b0+4b1+4b2)]^2 + [22-(b0+5b1+1b2)]^2

1. Each bracket is observed y minus the model prediction for one row.
2. The objective has 5 squared terms and is minimized over b0,b1,b2.