LESSON MAKER PRO

Predict the Pattern

Use regression models to make and evaluate predictions.

HIGH SCHOOL · S.DA.4.2

S.DA.4.2 "Make predictions and draw conclusions from regression models (linear, exponential, quadratic) from two-variable quantitative data."

NAME _____ DATE _____

FROM MODEL TO PREDICTION

A regression model uses one variable, x, to predict another variable, y. Substitute the given x-value into the model, then decide whether the prediction makes sense in context. A prediction beyond the observed x-values is an extrapolation, so treat it with more caution.

WORKED EXAMPLE

A linear regression model is $y = 11x + 17$. Predict y when $x = 6$.

1. Substitute 6 for x: $y = 11(6) + 17$.
2. Multiply: $y = 66 + 17$.
3. Add: $y = 83$.

Answer: The predicted value of y is 83.

PRACTICE 6 problems

1 A linear regression model is $y = 3x + 8$. Predict y when $x = 5$.

ANSWER _____

2 The table shows data used to make a linear model. Continue the pattern to predict y when $x = 8$. Is this prediction an interpolation or an extrapolation?

OBSERVED DATA

x	y
3	19
4	23
5	27

ANSWER _____

3 An exponential regression model is $y = 5 \times 2^x$. Predict y when $x = 3$.

ANSWER _____

4 An exponential regression model is $y = 80 \times (1/2)^x$. Predict y when $x = 3$.

ANSWER _____

5 A quadratic regression model is $y = -(x - 3)^2 + 25$. Predict y when $x = 5$.

ANSWER _____

6 A quadratic regression model is $y = 2x^2 - 8x + 15$. Predict y when $x = 1$ and when $x = 3$. What do you notice?

ANSWER _____

APPLY IT Show your work

1 A student tracks the views on a new video at the end of each day. The table shows the early counts. A model for the views is $V = 40 \times 2^t$, where t is days after posting. Predict the views at the end of day 3. Should the student expect the model to stay accurate for many months? Explain briefly.

VIDEO VIEWS

Days after posting, t	Views, V
0	40
1	80
2	160

ANSWER _____

2 A school club models its ticket revenue for a dance with $R = -2p^2 + 32p$, where p is the ticket price in dollars and R is revenue in dollars. Predict the revenue at a price of $5 and at a price of $10. Which price gives more predicted revenue, and by how much?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two students propose models for the data in the table: Model A is $y = 5x + 9$, and Model B is $y = 3 \times 2^x$. Which model matches every observed value? Use that model to predict y when $x = 4$, and explain one reason to be cautious about the prediction.

OBSERVED DATA

x	y
0	3
1	6
2	12
3	24

WORK SPACE AND ANSWER

Predict the Pattern

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A linear regression model is $y = 3x + 8$. Predict y when $x = 5$.	**23**
2	The table shows data used to make a linear model. Continue the pattern to predict y when $x = 8$. Is this prediction an interpolation or an extrapolation?	**39; extrapolation**
3	An exponential regression model is $y = 5 \times 2^x$. Predict y when $x = 3$.	**40**
4	An exponential regression model is $y = 80 \times (1/2)^x$. Predict y when $x = 3$.	**10**
5	A quadratic regression model is $y = -(x - 3)^2 + 25$. Predict y when $x = 5$.	**21**
6	A quadratic regression model is $y = 2x^2 - 8x + 15$. Predict y when $x = 1$ and when $x = 3$. What do you notice?	**Both predictions are 9; the model predicts the same y-value at these two x-values.**

PART 2 · APPLY IT

1. **320 views; no, the early doubling pattern may not continue for many months.** Substitute $t = 3$ to get $V = 40 \times 8 = 320$. The data cover only the first two days, so a prediction many months later is a distant extrapolation.
2. **$110 at $5 and $120 at $10; the $10 price gives $10 more predicted revenue.** Substitute each price into the model: $R(5) = -2(25) + 32(5) = 110$, and $R(10) = -2(100) + 32(10) = 120$. The difference is $10.

CHALLENGE

Model B matches every observed value and predicts 48 when $x = 4$. Since 4 is outside the observed range of 0 to 3, this is an extrapolation.

Accept equivalent wording for extrapolation and for the caution that a model may not remain accurate beyond the observed data. In the challenge, Model A already disagrees with the observed value at $x = 0$.