LESSON MAKER PRO

Forecast or Far-Fetched?

Use linear trends to predict, then check whether the predictions make sense.

HIGH SCHOOL · FA.S.42

FA.S.42 "Know when it is and is not appropriate to use a linear model to make predictions about a data set beyond a given set of values. Explain extrapolation and interpolation and the impact both have on predicted values."

NAME _____ DATE _____

INSIDE OR OUTSIDE?

Interpolation predicts a value inside the range of observed data. Extrapolation predicts outside that range, so it is less reliable. Use a linear model when the data follow a roughly steady rate of change, and question any prediction that ignores a real-world limit or a changing trend.

WORKED EXAMPLE

A sticker shop charges $61 for 21 stickers and $73 for 25 stickers. If the price changes at a steady rate, predict the cost of 23 stickers. Is this interpolation or extrapolation?

1. Find the rate: (73 - 61)/(25 - 21) = 3 dollars per sticker.
2. From 21 to 23 stickers is an increase of 2 stickers.
3. Predict the cost: 61 + 2(3) = 67.

Answer: $67; interpolation, because 23 is between 21 and 25.

PRACTICE 6 problems

1 The table shows quiz scores after different amounts of study time. At the same rate, predict the score after 1.5 hours. Is this interpolation or extrapolation?

STUDY TIME AND QUIZ SCORE

Hours studied	Quiz score
0	40
1	48
2	56

ANSWER _____

2 The table shows data used while streaming at a steady rate. Predict the data used after 7 hours. Is this interpolation or extrapolation?

STREAMING DATA

Hours	Data used (GB)
1	2
3	6
5	10

ANSWER _____

3 Does a linear model fit these points? Explain using the change in y for each increase of 1 in x.

OBSERVED VALUES

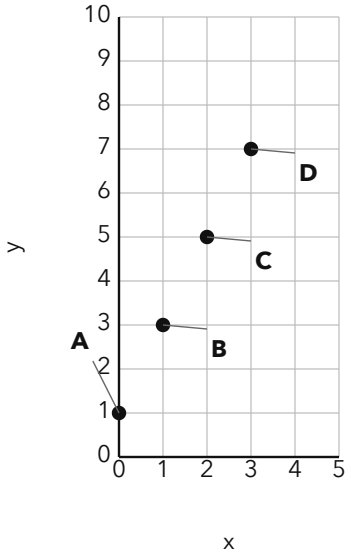
x	y
0	0
1	1
2	4
3	9

ANSWER _____

4 A phone's battery percentage followed the model y = 96 - 8x during the first 4 hours, where x is hours of use. What does the model predict after 15 hours? Explain whether that prediction is realistic.

ANSWER _____

5 The graph shows four measured points. If their linear pattern continues, predict y when x = 4. Is this interpolation or extrapolation?



ANSWER _____

6 A school club can sell at most 80 tickets. The table shows its ticket sales at the end of each day. If the pattern continues, how many tickets does a linear model predict by the end of day 6? Explain whether to trust that prediction.

TICKETS SOLD

Day	Total tickets sold
1	20
2	35
3	50

ANSWER _____

APPLY IT Show your work

1 A new game gets 80 downloads in its first hour, 120 by the end of hour 2, and 160 by the end of hour 3. If downloads keep increasing at that rate, predict the total after 2.5 hours and after 10 hours. Identify which prediction is extrapolation and explain why it is less reliable.

WORK SPACE

ANSWER _____

2 A rented scooter's battery is at 90% when a ride starts, 80% after 10 minutes, and 70% after 20 minutes. Use a linear model to predict the battery percentage after 100 minutes. Should a rider use this prediction to plan the ride? Explain.

WORK SPACE

ANSWER _____

CHALLENGE One step up

The table shows money saved for a concert ticket. Use the first three points to predict the amount at week 10. Then use the last three points to make a second prediction for week 10. Which prediction better reflects the recent trend? Explain why even that prediction is uncertain.

CONCERT SAVINGS

Week	Money saved ($)
0	10
2	16
4	22
6	25
8	28

WORK SPACE AND ANSWER

Forecast or Far-Fetched?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The table shows quiz scores after different amounts of study time. At the same rate, predict the score after 1.5 hours. Is this interpolation or extrapolation?	**52; interpolation.**
2	The table shows data used while streaming at a steady rate. Predict the data used after 7 hours. Is this interpolation or extrapolation?	**14 GB; extrapolation.**
3	Does a linear model fit these points? Explain using the change in y for each increase of 1 in x.	**No. As x increases by 1, y increases by 1, then 3, then 5, not by a constant amount.**
4	A phone's battery percentage followed the model y = 96 - 8x during the first 4 hours, where x is hours of use. What does the model predict after 15 hours? Explain whether that prediction is realistic.	**-24%; not realistic because a battery percentage cannot be negative.**
5	The graph shows four measured points. If their linear pattern continues, predict y when x = 4. Is this interpolation or extrapolation?	**9; extrapolation.**
6	A school club can sell at most 80 tickets. The table shows its ticket sales at the end of each day. If the pattern continues, how many tickets does a linear model predict by the end of day 6? Explain whether to trust that prediction.	**95 tickets; do not trust the prediction because it exceeds the limit of 80 tickets.**

PART 2 · APPLY IT

1. **140 downloads after 2.5 hours and 440 after 10 hours. The 10-hour prediction is extrapolation and is less reliable because the download rate may change.** Downloads increase by 40 per hour. Add 20 to the hour-2 total for 2.5 hours, and add 7(40) to the hour-3 total for 10 hours.
2. **-10%; no. A battery percentage cannot be negative, so the model is not suitable that far beyond the measured times.** The battery drops 10 percentage points every 10 minutes. In 100 minutes, the model predicts a drop of 100 percentage points from 90%.

CHALLENGE

The first three points predict $40 at week 10 because savings rose $3 per week. The last three predict $31 because savings rose $1.50 per week. The $31 prediction better reflects the recent trend, but it is still uncertain because week 10 is outside the observed range.

Accept equivalent explanations that distinguish predictions inside the observed range from those outside it. For the challenge, students should recognize the change in savings rate and note that the recent trend could change again.