LESSON MAKER PRO

Model the Trend

Build, use, and test linear models.

HIGH SCHOOL · MM.M.A.1

MM.M.A.1 "Use the full Mathematical Modeling Cycle or Statistical Problem-Solving Cycle to answer a real-world problem of particular student interest, incorporating standards from across the course."

NAME _____ DATE _____

THE MODELING CYCLE

A linear model assumes a constant rate of change. Divide the change in output by the change in input to find the rate, then use a data pair to find the starting value. Make a prediction and check whether the constant-rate assumption makes sense.

WORKED EXAMPLE

A bike rental has the costs shown. Assume a linear cost. Predict the cost for 11 hours.

BIKE RENTAL

Hours	Cost
3	$19
9	$43

1. Rate: (43 - 19)/(9 - 3) = 4 dollars per hour.
2. Starting cost: 19 - 4(3) = 7 dollars.
3. Model: C = 4x + 7. At 11 hours, C = 4(11) + 7 = 51.

Answer: $51, if the hourly rate stays constant.

PRACTICE 4 problems

1 A ride costs $16 for 2 miles and $24 for 6 miles. Assuming a linear cost, find the cost per mile.

ANSWER _____

2 An app charges $12 to join and $2 per download. Write a model for total cost C after x downloads.

ANSWER _____

3 A club has 20 members at week 0 and 28 at week 8. Use a linear model to predict its members at week 12.

ANSWER _____

4 A model predicts 29 sign-ups, but 23 people sign up. Find actual minus predicted, and say whether the model overpredicts or underpredicts.

ANSWER _____

APPLY IT Show your work

1 A gaming café charges $18 for 2 hours and $33 for 5 hours. Build a linear cost model C for x hours, predict the cost for 8 hours, and state one assumption.

WORK SPACE

ANSWER _____

2 A team nets $24 on 12 shirts and $64 on 20 shirts. Build a linear profit model P for x shirts. How many shirts would bring $104 profit? Is this interpolation or extrapolation?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Use the first three rows to model orders O after x weeks. Test your model with the last row. Would you trust it to predict week 20? Explain.

ONLINE SHOP ORDERS

Week	Orders
0	12
2	16
6	24
10	26

WORK SPACE AND ANSWER

ANSWER KEY

Model the Trend

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A ride costs $16 for 2 miles and $24 for 6 miles. Assuming a linear cost, find the cost per mile.	**$2 per mile**
2	An app charges $12 to join and $2 per download. Write a model for total cost C after x downloads.	**C = 12 + 2x**
3	A club has 20 members at week 0 and 28 at week 8. Use a linear model to predict its members at week 12.	**32 members**
4	A model predicts 29 sign-ups, but 23 people sign up. Find actual minus predicted, and say whether the model overpredicts or underpredicts.	**-6 sign-ups; the model overpredicts.**

PART 2 · APPLY IT

1. **C = 5x + 8; $48 for 8 hours. Assume the hourly rate stays constant.** The rate is (33 - 18)/(5 - 2) = $5 per hour, and the starting cost is 18 - 5(2) = $8.
2. **P = 5x - 36; 28 shirts; extrapolation.** Profit rises by $40 over 8 shirts, so the rate is $5 per shirt. Solve 5x - 36 = 104 to get x = 28, beyond the observed sales.

CHALLENGE

O = 2x + 12. At week 10, the model predicts 32 orders, which is 6 more than the actual 26. I would not trust a week 20 prediction because growth may have slowed.

Accept equivalent equations and clear assumptions. For the challenge, accept a qualified week 20 prediction if the student cites the model's error.