LESSON MAKER PRO

Patterns in Context

Choose models, then check what they mean.

HIGH SCHOOL · MT.CORE.ALG.MOD.1

MT.CORE.ALG.MOD.1 "Model situations in context, with linear, quadratic, and exponential functions. This standard should incorporate cultural context relating to Montana Indigenous Peoples and local communities by: Determining if a set of data is best modeled..."

NAME _____ DATE _____

CHOOSE A MODEL

When x-values are equally spaced, constant first differences suggest a linear model. Constant second differences suggest a quadratic model, and constant ratios suggest an exponential model. If none stay constant, choose none. A model may fit most data without passing through every point, and a real situation may limit which x-values make sense.

WORKED EXAMPLE

Choose a model for the data and write its equation.

x	y
40	90
41	94
42	98
43	102

1. As x increases by 1, y increases by 4 each time.
2. The constant first difference means the model is linear: y = 4x + b.
3. Use (40, 90): 90 = 4(40) + b, so b = -70.

Answer: Linear; y = 4x - 70.

PRACTICE 4 problems

1 For x = 0, 1, 2, 3, the y-values are 2, 8, 14, 20. Choose linear, quadratic, exponential, or none. Give a numerical reason.

ANSWER _____

2 For x = 0, 1, 2, 3, the y-values are 3, 6, 15, 30. Choose linear, quadratic, exponential, or none. Give a numerical reason.

ANSWER _____

3 For x = 0, 1, 2, 3, the y-values are 2, 4, 8, 16. Choose linear, quadratic, exponential, or none. Give a numerical reason.

ANSWER _____

4 For x = 0, 1, 2, 3, the y-values are 2, 8, 15, 25. Choose linear, quadratic, exponential, or none. Give a numerical reason.

ANSWER _____

APPLY IT Show your work

1 A Blackfeet student group budgets for a community music night. The table shows the cost C, in dollars, for x snack packs. Write C(x), find C(6), and explain why x = 2.5 is not a valid order.

SNACK PACK BUDGET

Packs, x	Cost, C
0	18
1	23
2	28
3	33

ANSWER _____

2 A local robotics club records a toy drone's height h, in feet, each second. Choose a model, write h(x), and predict its height at x = 4.

DRONE HEIGHT

Seconds, x	Height, h
0	1
1	6
2	9
3	10

ANSWER _____

CHALLENGE One step up

A youth booth at a Montana community art fair models donations with D(x) = 3 + 5x, where x is hours since opening. Which recorded point is off the model? Explain why the model may still be useful.

RECORDED DONATIONS

Hours, x	Dollars
0	3
1	8
2	14
3	18
4	23

WORK SPACE AND ANSWER

Patterns in Context

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For x = 0, 1, 2, 3, the y-values are 2, 8, 14, 20. Choose linear, quadratic, exponential, or none. Give a numerical reason.	**Linear; the first differences are all 6.**
2	For x = 0, 1, 2, 3, the y-values are 3, 6, 15, 30. Choose linear, quadratic, exponential, or none. Give a numerical reason.	**Quadratic; the second differences are both 6.**
3	For x = 0, 1, 2, 3, the y-values are 2, 4, 8, 16. Choose linear, quadratic, exponential, or none. Give a numerical reason.	**Exponential; each y-value is twice the previous one.**
4	For x = 0, 1, 2, 3, the y-values are 2, 8, 15, 25. Choose linear, quadratic, exponential, or none. Give a numerical reason.	**None; first differences, second differences, and ratios are not constant.**

PART 2 · APPLY IT

1. **C(x) = 18 + 5x; C(6) = $48. An order must contain a whole number of packs.** The cost starts at $18 and rises $5 per pack. Substituting 6 gives 18 + 5(6) = 48.
2. **Quadratic; $h(x) = -x^2 + 6x + 1$; h(4) = 9 feet.** The first differences are 5, 3, 1, so the second differences are both -2. The quadratic matching the data gives h(4) = -16 + 24 + 1 = 9.

CHALLENGE

The point (2, 14) is off the model because D(2) = 13. The model matches the other four records, so it can still give useful estimates.

Accept equivalent equations and numerical reasons. For the challenge, accept explanations that distinguish an observed value from a model estimate.