Rate Detectives

Can one linear function fit the values?

A1P.AF.H.24.b "Define linear functions to represent situations in which one quantity changes at a constant rate per unit interval relative to another."

NAME _____ DATE _____

CONSTANT RATE

When the input increases by one unit, the output changes by the same amount each time. A linear function, such as y = mx + b, can match the values.

Museum tickets cost $7 for one visitor, $14 for two visitors, and $21 for three visitors. The cost is c(n) = 7n.

CHANGING RATE

When the input increases by one unit, the output changes by different amounts. No single linear function can match all the values.

A square garden has an area of 1 m², 4 m², and 9 m² when its side length is 1 m, 2 m, and 3 m.

1 SORT

8 items

Circle CONSTANT or CHANGING for each item, then pick one item from each category and explain how its output changes in each one-unit interval.

1.	A bike rental costs $12 for 1 hour, $17 for 2 hours, and $22 for 3 hours.	CONSTANT CHANGING
2.	A toy rocket is 4 m high after 1 second, 11 m high after 2 seconds, and 15 m high after 3 seconds.	CONSTANT CHANGING
3.	A plant has 3 leaves on day 0, 5 leaves on day 1, and 9 leaves on day 2.	CONSTANT CHANGING
4.	A game score is 40 after round 1, 35 after round 2, and 30 after round 3.	CONSTANT CHANGING
5.	A bakery packs 6 cookies in 1 box, 12 cookies in 2 boxes, and 18 cookies in 3 boxes.	CONSTANT CHANGING
6.	A train travels 32 km in 1 hour, 64 km in 2 hours, and 96 km in 3 hours.	CONSTANT CHANGING
7.	A bathtub holds 9 L at minute 0, 17 L at minute 1, and 28 L at minute 2.	CONSTANT CHANGING
8.	A phone battery is at 90% after 0 hours, 80% after 1 hour, and 70% after 2 hours.	CONSTANT CHANGING

2 PROVE IT

Explain your thinking

Pick one item from each category and explain how its output changes in each one-unit interval.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new real-world example for each category, using outputs at three consecutive input values.

CONSTANT _____

CHANGING _____

CHALLENGE

Choose a CHANGING item and change exactly one output to make its rate constant; name the item, state your change, and write a linear function for the revised values.

ANSWER KEY # Rate Detectives

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	A bike rental costs $12 for 1 hour, $17 for 2 hours, and $22 for 3 hours.	**CONSTANT**	The cost rises by $5 for each additional hour.
2	A toy rocket is 4 m high after 1 second, 11 m high after 2 seconds, and 15 m high after 3 seconds.	**CHANGING**	The height increases by 7 m, then 4 m.
3	A plant has 3 leaves on day 0, 5 leaves on day 1, and 9 leaves on day 2.	**CHANGING**	The number of leaves increases by 2, then 4.
4	A game score is 40 after round 1, 35 after round 2, and 30 after round 3.	**CONSTANT**	The score falls by 5 each round.
5	A bakery packs 6 cookies in 1 box, 12 cookies in 2 boxes, and 18 cookies in 3 boxes.	**CONSTANT**	The total rises by 6 cookies per box.
6	A train travels 32 km in 1 hour, 64 km in 2 hours, and 96 km in 3 hours.	**CONSTANT**	The distance increases by 32 km each hour.
7	A bathtub holds 9 L at minute 0, 17 L at minute 1, and 28 L at minute 2.	**CHANGING**	The amount of water increases by 8 L, then 11 L.
8	A phone battery is at 90% after 0 hours, 80% after 1 hour, and 70% after 2 hours.	**CONSTANT**	The battery percentage falls by 10 percentage points each hour.

PART 2 · PROVE IT

Task: Pick one item from each category and explain how its output changes in each one-unit interval.
Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **CONSTANT**: A swimmer completes 2 laps in 1 minute, 4 laps in 2 minutes, and 6 laps in 3 minutes.
- **CHANGING**: A player earns 10 coins at level 1, 25 coins at level 2, and 45 coins at level 3.

Challenge: Item 3: Change 9 leaves on day 2 to 7 leaves. The revised values increase by 2 leaves per day, so L(d) = 2d + 3 for days 0, 1, and 2.

For Part 2, explanations should compare changes across both one-unit intervals. For example, item 1 rises by $5 in each interval, while item 2 rises by 7 m and then 4 m.