Changing Rules

Sort functions by how their outputs change.

PA.A.1.2 "Use linear functions to represent and model mathematical situations."

NAME _____ DATE _____

LINEAR FUNCTION

When the input increases by 1, the output changes by the same amount each time.

A runner travels at a steady speed: $d(t) = 6t$, where t is hours and d is kilometers.

NONLINEAR FUNCTION

When the input increases by 1, the output does not change by the same amount each time.

The distance a falling object travels is $d(t) = 5t^2$, where t is seconds and d is meters.

1 SORT

8 items

For each numbered situation, circle LINEAR or NONLINEAR.

1. A gym charges $12 to join plus $5 per visit: $C(v) = 12 + 5v$. LINEAR NONLINEAR

2. A plant starts at 6 cm and grows 2 cm per week: $H(w) = 6 + 2w$. LINEAR NONLINEAR

3. A circle's area depends on its radius: $A(r) = \pi r^2$. LINEAR NONLINEAR

4. A tank starts with 80 L and loses 4 L per minute: $V(t) = 80 - 4t$. LINEAR NONLINEAR

5. A $100 balance doubles each year: $B(y) = 100(2^y)$. LINEAR NONLINEAR

6. A cube's volume depends on its edge length: $V(e) = e^3$. LINEAR NONLINEAR

7. In one month, a streaming plan costs $9 plus $2 per movie: $C(m) = 9 + 2m$. LINEAR NONLINEAR

8. A $60 bill is split equally among p people: $C(p) = 60/p$, where p is a positive whole number. LINEAR NONLINEAR

2 PROVE IT

Explain your thinking

Pick two numbered items and explain how you know each category.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new situation and function rule for each category.

LINEAR

NONLINEAR

CHALLENGE

A bike rental costs $6 plus $4 per hour. Write a function for the cost after h hours, classify it, and find the cost for 3 hours.

ANSWER KEY

Changing Rules

GRADE 8 · PA.A.1.2

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	A gym charges $12 to join plus $5 per visit: C(v) = 12 + 5v.	**LINEAR**	Each additional visit adds $5.
2	A plant starts at 6 cm and grows 2 cm per week: H(w) = 6 + 2w.	**LINEAR**	Each additional week adds 2 cm.
3	A circle's area depends on its radius: $A(r) = \pi r^2$.	**NONLINEAR**	The squared radius does not produce a constant change in area.
4	A tank starts with 80 L and loses 4 L per minute: V(t) = 80 − 4t.	**LINEAR**	Each additional minute removes 4 L.
5	A $100 balance doubles each year: $B(y) = 100(2^y)$.	**NONLINEAR**	Doubling produces larger increases as the balance grows.
6	A cube's volume depends on its edge length: $V(e) = e^3$.	**NONLINEAR**	The cubed edge length does not produce a constant change in volume.
7	In one month, a streaming plan costs $9 plus $2 per movie: C(m) = 9 + 2m.	**LINEAR**	Each additional movie adds $2.
8	A $60 bill is split equally among p people: C(p) = 60/p, where p is a positive whole number.	**NONLINEAR**	Adding one person does not change each person's cost by a constant amount.

PART 2 · PROVE IT

Task: Pick two numbered items and explain how you know each category.
Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **LINEAR**: A baker makes 8 rolls per batch. The number of rolls is R(b) = 8b.
- **NONLINEAR**: A rectangle's width is 3 units more than its length. Its area is A(l) = l(l + 3).

Challenge: C(h) = 6 + 4h; linear; C(3) = $18.

For Part 2, accept explanations based on constant or changing output differences. For example, item 2 adds 2 cm each week, while item 5 doubles, so its yearly increases grow.