Function Sort

Look for a constant rate of change.

8.AF.D.15 "Compare properties of functions represented algebraically, graphically, numerically in tables, or by verbal descriptions. a. Distinguish between linear and non-linear functions."

NAME _____ DATE _____

LINEAR	NONLINEAR
When the input increases by equal amounts, the output changes by the same amount each time. The graph is a straight line. $p(t) = 11t + 23$	When the input increases by equal amounts, the output does not always change by the same amount. The graph is not a straight line. $q(t) = t^3$

1 SORT

8 items

For Part 1 SORT, circle LINEAR or NONLINEAR for each item; for Part 2 PROVE IT, choose two numbered items, one from each category, and explain how you know.

1. $f(x) = 4x - 9$ — LINEAR / NONLINEAR

2. A tank starts with 50 liters of water and loses 3 liters each minute. — LINEAR / NONLINEAR

3. $g(x) = x^2 + 2x$ — LINEAR / NONLINEAR

4. For inputs 0, 1, 2, 3, the outputs are 5, 9, 13, 17. — LINEAR / NONLINEAR

5. The area of a square depends on its side length. — LINEAR / NONLINEAR

6. For inputs 0, 1, 2, 3, the outputs are 1, 2, 4, 8. — LINEAR / NONLINEAR

7. A rental costs $12 plus $5 for each hour. — LINEAR / NONLINEAR

8. $h(x) = -2x + 6$ — LINEAR / NONLINEAR

2 PROVE IT

Explain your thinking

Choose two numbered items, one from each category, and explain how you know.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Part 3 MAKE YOUR OWN: Write one new linear function and one new nonlinear function.

LINEAR

NONLINEAR

CHALLENGE

Write a linear rule and a nonlinear rule that give the same outputs for inputs 0 and 1 but different outputs for input 2; show all three outputs for both rules.

ANSWER KEY

Function Sort

GRADE 8 · 8.AF.D.15

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	f(x) = 4x - 9	**LINEAR**	The rule has a constant rate of change of 4.
2	A tank starts with 50 liters of water and loses 3 liters each minute.	**LINEAR**	The amount decreases by 3 liters each minute.
3	g(x) = x^2 + 2x	**NONLINEAR**	The squared term makes the rate of change vary.
4	For inputs 0, 1, 2, 3, the outputs are 5, 9, 13, 17.	**LINEAR**	Each increase of 1 in the input adds 4 to the output.
5	The area of a square depends on its side length.	**NONLINEAR**	Area equals side length squared, so the rate of change varies.
6	For inputs 0, 1, 2, 3, the outputs are 1, 2, 4, 8.	**NONLINEAR**	The output changes are 1, 2, and 4, which are not constant.
7	A rental costs $12 plus $5 for each hour.	**LINEAR**	The cost increases by $5 each hour.
8	h(x) = -2x + 6	**LINEAR**	The rule has a constant rate of change of -2.

PART 2 · PROVE IT

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

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **LINEAR**: r(n) = 6n - 14
- **NONLINEAR**: s(n) = n^2 + 5

Challenge: Linear: f(x) = 3x + 4 gives 4, 7, 10 for inputs 0, 1, 2. Nonlinear: g(x) = 3x + 4 + x(x - 1) gives 4, 7, 12 for those inputs.

For the numerical items, compare output changes across equal input steps. Accept other valid rules for Part 3 and the challenge if they meet every condition.