

Pattern Detectives

Sort situations by how the output changes.

AI-F.LE.1 "Distinguish between situations that can be modeled with linear functions and with exponential functions."

NAME _____

DATE _____

LINEAR FUNCTION

A linear function changes by the same amount for each equal change in input. The amount may be added or subtracted.

A water tank holds 90 liters and drains 6 liters each minute. Its amount can be modeled by $W = 90 - 6t$.

EXPONENTIAL FUNCTION

An exponential function is multiplied by the same factor for each equal change in input. The factor may be greater than 1 or between 0 and 1.

A machine worth \$5,000 keeps 80% of its value each year. Its value can be modeled by $V = 5000(0.8)^t$.

1 SORT _____ 8 items

For each situation, circle ADDITIVE or MULTIPLY, then choose two item numbers and explain which change pattern helped you classify each one.

- | | | |
|---|--------------------------------|--------------------------------|
| 1. A taxi fare is \$3 plus \$2 for each mile traveled. | ☐ ADDITIVE | ☐ MULTIPLY |
| 2. A video game score triples after each level. | ☐ ADDITIVE | ☐ MULTIPLY |
| 3. A bacteria population becomes 1,000, then 2,000, then 4,000 each hour. | ☐ ADDITIVE | ☐ MULTIPLY |
| 4. A plant is 18 cm tall and grows 4 cm each week. | ☐ ADDITIVE | ☐ MULTIPLY |
| 5. A theater has 240 tickets left and sells 15 tickets each hour. | ☐ ADDITIVE | ☐ MULTIPLY |
| 6. A runner's distance increases 7 kilometers each hour. | ☐ ADDITIVE | ☐ MULTIPLY |
| 7. An account balance is multiplied by 0.92 each month. | ☐ ADDITIVE | ☐ MULTIPLY |
| 8. A rumor reaches twice as many people each day. | ☐ ADDITIVE | ☐ MULTIPLY |

2

PROVE IT

Explain your thinking

Pick two items from Part 1. For each one, tell how you knew where it belonged.

ITEM #

HOW I KNEW

ITEM #

HOW I KNEW

3

MAKE YOUR OWN

One of each

Write one new situation for an ADDITIVE pattern and one new situation for a MULTIPLY pattern.

ADDITIVE

MULTIPLY

CHALLENGE

A machine begins with 80 units of material. Model A loses 12 units each day, and Model B keeps 85% of its material each day. Classify both models and write an equation for each using x for days.

PART 1 • SORT

#	ITEM	CATEGORY	WHY
1	A taxi fare is \$3 plus \$2 for each mile traveled.	ADDITIVE	The cost increases by a constant \$2 per mile.
2	A video game score triples after each level.	MULTIPLY	The score is multiplied by 3 each level.
3	A bacteria population becomes 1,000, then 2,000, then 4,000 each hour.	MULTIPLY	The population is multiplied by 2 each hour.
4	A plant is 18 cm tall and grows 4 cm each week.	ADDITIVE	The height increases by a constant 4 cm each week.
5	A theater has 240 tickets left and sells 15 tickets each hour.	ADDITIVE	The number of tickets decreases by a constant 15 each hour.
6	A runner's distance increases 7 kilometers each hour.	ADDITIVE	The distance increases by a constant 7 kilometers each hour.
7	An account balance is multiplied by 0.92 each month.	MULTIPLY	The balance is multiplied by the same factor, 0.92, each month.
8	A rumor reaches twice as many people each day.	MULTIPLY	The number of people is multiplied by 2 each day.

PART 2 • PROVE IT

Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 • MAKE YOUR OWN (SAMPLE ANSWERS)

- **ADDITIVE:** A club starts with \$100 and collects \$30 each week.
- **MULTIPLY:** The amount of medicine in a body is multiplied by 0.75 each hour.

Challenge: Model A is ADDITIVE, or linear: $y = 80 - 12x$. Model B is MULTIPLY, or exponential: $y = 80(0.85)^x$.

Items 1, 4, 5, and 6 are ADDITIVE. Items 2, 3, 7, and 8 are MULTIPLY. In Part 2, accept explanations that identify a constant difference for linear situations or a constant factor for exponential situations.