Rate Detectives

Sort changes, then build a model.

8A.AF.I.26.c "Define exponential functions to represent situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another."

NAME _____ DATE _____

FIXED PERCENT

The same percent of the current value is added or removed each interval. A matching function is $y = a(1 + r)^t$ for growth or $y = a(1 - r)^t$ for decay, where a is the starting value, r is the percent as a decimal, and t counts intervals.

A colony starts with 200 microbes and grows 10% each hour: $M = 200(1.10)^t$, where t is hours.

FIXED AMOUNT

The same number of units is added or removed each interval, even if the percent changes. A matching function is $y = a + dt$, where a is the starting value, d is the change per interval, and t counts intervals.

A hiker starts 3 miles from camp and walks 2 miles farther away each hour: $D = 3 + 2t$, where t is hours.

1 SORT

8 items

For each situation, circle PERCENT if the change is a fixed percent each interval or AMOUNT if it is a fixed amount each interval.

1.	An account begins with $500 and grows 4% each year.	PERCENT	AMOUNT
2.	A snowbank starts 80 cm deep and shrinks 10% of its current depth each day.	PERCENT	AMOUNT
3.	A tank starts with 90 liters of water and drains 6 liters each minute.	PERCENT	AMOUNT
4.	A game starts at 800 points and gains 25% of its current points each round.	PERCENT	AMOUNT
5.	A jar starts with 40 buttons and gets 7 more buttons each week.	PERCENT	AMOUNT
6.	A store has 250 pencils and sells 12 pencils each day.	PERCENT	AMOUNT
7.	A phone costs $900 and loses 20% of its value each year.	PERCENT	AMOUNT
8.	A fish pond holds 1,000 liters of water and loses 2% of its water each week.	PERCENT	AMOUNT

2 PROVE IT

Explain your thinking

Choose one item from each category, explain how you knew where it belongs, and write a matching function for each using t for intervals.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new situation for each category, including a starting value, a change per interval, and a matching function.

PERCENT

AMOUNT

CHALLENGE

Change item 3 so its water decreases by a fixed percent instead of a fixed amount, then write a function using t for minutes.

ANSWER KEY

Rate Detectives

GRADE 8 · 8A.AF.I.26.c

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	An account begins with $500 and grows 4% each year.	**PERCENT**	Each year's increase is 4% of the current balance.
2	A snowbank starts 80 cm deep and shrinks 10% of its current depth each day.	**PERCENT**	Each day's decrease is 10% of the current depth.
3	A tank starts with 90 liters of water and drains 6 liters each minute.	**AMOUNT**	The tank loses a fixed 6 liters per minute.
4	A game starts at 800 points and gains 25% of its current points each round.	**PERCENT**	Each round's gain is 25% of the current score.
5	A jar starts with 40 buttons and gets 7 more buttons each week.	**AMOUNT**	The jar gains a fixed 7 buttons per week.
6	A store has 250 pencils and sells 12 pencils each day.	**AMOUNT**	The store loses a fixed 12 pencils per day.
7	A phone costs $900 and loses 20% of its value each year.	**PERCENT**	Each year's decrease is 20% of the current value.
8	A fish pond holds 1,000 liters of water and loses 2% of its water each week.	**PERCENT**	Each week's decrease is 2% of the water then in the pond.

PART 2 · PROVE IT

Task: Choose one item from each category, explain how you knew where it belongs, and write a matching function for each using t for intervals.
Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **PERCENT**: A bowl starts with 60 grams of dough, and its mass grows 5% each hour. $D = 60(1.05)^t$, where t is hours.
- **AMOUNT**: A box starts with 45 marbles and gets 3 more marbles each day. $M = 45 + 3t$, where t is days.

Challenge: The tank starts with 90 liters of water and loses 6% of its current water each minute. $V = 90(0.94)^t$, where t is minutes.

For Part 2, accept any one item from each category with a correct explanation and function. For example, item 1 is $B = 500(1.04)^t$, and item 3 is $V = 90 - 6t$.