Growth With Limits

Sort situations by how their growth changes.

F.LE.A.1.d "Distinguish between situations that can be modeled with exponential functions and logistic functions."

NAME _____ DATE _____

EXPONENTIAL GROWTH	LOGISTIC GROWTH
The amount grows by the same percent each time period. The model has no fixed maximum that slows its growth.	Growth speeds up at first, then slows as the amount approaches a fixed maximum. Limited space or resources keep it from growing forever.
A savings account earns 4% interest each year, with no limit on its balance.	The number of fish in a pond rises, then grows more slowly as it nears the pond's limit of 600 fish.

1 SORT

8 items

For Part 1, circle UNCAPPED or CAPPED for each situation; for Part 2, choose two numbered items and explain how you knew where each belonged.

1.	1. The number of copies of a digital file triples each hour, with no storage limit in the model.	UNCAPPED CAPPED
2.	2. An app gains users quickly at first, but weekly gains shrink as it nears its pool of 10,000 possible users.	UNCAPPED CAPPED
3.	3. A yeast culture grows slowly, then quickly, then levels off near 50,000 cells as food runs low.	UNCAPPED CAPPED
4.	4. The number of people who have heard a rumor is multiplied by 1.5 each hour; the model assumes no population limit.	UNCAPPED CAPPED
5.	5. In a simulation, a crystal's mass doubles each day, with no maximum size.	UNCAPPED CAPPED
6.	6. Internet connections spread slowly through a town, then quickly; weekly gains shrink as the total nears 4,000 eligible homes.	UNCAPPED CAPPED
7.	7. A game score triples after every round, and the rules set no maximum score.	UNCAPPED CAPPED
8.	8. The number of filled arena seats rises rapidly, then grows more slowly as it nears the 6,000-seat capacity.	UNCAPPED CAPPED

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 modeled by exponential growth and one modeled by logistic growth. For each, tell what grows and why the model fits.

UNCAPPED

CAPPED

CHALLENGE

A service's total subscribers rise by 20% each week for four weeks, then increase more slowly and level off near a limit of 20,000 subscribers. Which model fits the first four weeks, and which fits the entire growth period? Explain.

ANSWER KEY

Growth With Limits

HIGH SCHOOL · F.LE.A.1.d

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	1. The number of copies of a digital file triples each hour, with no storage limit in the model.	**UNCAPPED**	The number triples each hour, and the model has no maximum.
2	2. An app gains users quickly at first, but weekly gains shrink as it nears its pool of 10,000 possible users.	**CAPPED**	Growth slows as the number of users approaches a fixed limit.
3	3. A yeast culture grows slowly, then quickly, then levels off near 50,000 cells as food runs low.	**CAPPED**	Growth changes pace and levels off because food is limited.
4	4. The number of people who have heard a rumor is multiplied by 1.5 each hour; the model assumes no population limit.	**UNCAPPED**	The total grows by a constant factor, with no limit in the model.
5	5. In a simulation, a crystal's mass doubles each day, with no maximum size.	**UNCAPPED**	The mass doubles each day, and no maximum is set.
6	6. Internet connections spread slowly through a town, then quickly; weekly gains shrink as the total nears 4,000 eligible homes.	**CAPPED**	Growth speeds up, then slows as it approaches the number of eligible homes.
7	7. A game score triples after every round, and the rules set no maximum score.	**UNCAPPED**	The score grows by a constant factor without a set maximum.
8	8. The number of filled arena seats rises rapidly, then grows more slowly as it nears the 6,000-seat capacity.	**CAPPED**	Growth slows as the number of filled seats approaches capacity.

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)

- **UNCAPPED**: In a simulation, an invasive vine's area triples each month with no space limit. Exponential growth fits because the area grows by the same factor each month.
- **CAPPED**: A library club gains members quickly, then more slowly as it nears its 40-person limit. Logistic growth fits because membership approaches a fixed maximum.

Challenge: Exponential growth fits the first four weeks because the total rises by the same percent each week. Logistic growth fits the entire period because growth slows as the number of subscribers approaches 20,000.

For Part 2, a valid explanation for item 3 cites slowing growth near the food limit; a valid explanation for item 7 cites tripling each round with no maximum score. Accept other explanations that identify both the growth pattern and whether the situation has a fixed limit.