

Growth or Fade

Read the multiplier, then classify the exponential change.

MA.912.AR.5.3 "Given a mathematical or real-world context, classify an exponential function as representing growth or decay."

NAME _____

DATE _____

EXPONENTIAL GROWTH

For a positive starting amount, an exponential factor greater than 1 gives growth. Each equal time period multiplies the previous amount by the same factor.

A pond begins with 200 fish and increases by 8% each year.

EXPONENTIAL DECAY

For a positive starting amount, a factor between 0 and 1 gives exponential decay. Each equal time period multiplies the previous amount by that factor.

A model predicts that at the end of each hour, 90% of the mass present at the start of that hour remains.

1 SORT _____ 8 items

Part 1: Circle GROWTH or DECAY for each item; Part 2: choose two items and explain how the multiplier or percent change shows each classification.

1. A bacteria culture triples every 2 hours.

GROWTH

DECAY

2. $d(t)=900(0.76)^t$

GROWTH

DECAY

3. An account balance is multiplied by 1.05 each month.

GROWTH

DECAY

4. $h(x)=14(1.3)^x$

GROWTH

DECAY

5. At the end of each hour, 68% of the medicine amount present at the start of that hour remains.

GROWTH

DECAY

6. $r(n)=40(0.99)^n$

GROWTH

DECAY

7. The number of subscribers doubles each week.

GROWTH

DECAY

8. $v(x)=72(0.6)^x$

GROWTH

DECAY

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

Part 3: Write one new exponential growth example and one new exponential decay example. Include a function or enough information to identify the factor.

GROWTH

DECAY

CHALLENGE

A gym has 1,200 members, and membership falls by 7% each month. Write an exponential function for the number of members after t months, then classify it.

PART 1 • SORT

#	ITEM	CATEGORY	WHY
1	A bacteria culture triples every 2 hours.	GROWTH	Tripling uses a factor of 3, which is greater than 1.
2	$d(t)=900(0.76)^t$	DECAY	The factor 0.76 is between 0 and 1.
3	An account balance is multiplied by 1.05 each month.	GROWTH	The factor 1.05 is greater than 1.
4	$h(x)=14(1.3)^x$	GROWTH	The factor 1.3 is greater than 1.
5	At the end of each hour, 68% of the medicine amount present at the start of that hour remains.	DECAY	Retaining 68% means multiplying by 0.68, which is less than 1.
6	$r(n)=40(0.99)^n$	DECAY	The factor 0.99 is between 0 and 1.
7	The number of subscribers doubles each week.	GROWTH	Doubling uses a factor of 2, which is greater than 1.
8	$v(x)=72(0.6)^x$	DECAY	The factor 0.6 is between 0 and 1.

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)

- **GROWTH:** $N(t)=30(1.25)^t$, where t is measured in weeks.
- **DECAY:** A camera worth \$800 loses 20% of its value each year, so $V(t)=800(0.80)^t$.

Challenge: $M(t)=1200(0.93)^t$; this is DECAY because a 7% decrease means 93%, or 0.93, remains each month.

For Part 2, students should cite a factor greater than 1 for growth or a factor between 0 and 1 for decay. Accept equivalent functions and contexts in Part 3 when the classification and factor are correct.