Growth and Decay

b bigger than 1 grows, b between 0 and 1 decays, b = 1 is flat. Percent to factor: start from 100%. Factor to percent: measure from 100%.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Exponential growth	The output gets bigger by the same factor each step: b bigger than 1.	The curve rises faster and faster.
Exponential decay	The output gets smaller by the same factor each step: b between 0 and 1.	The curve falls and flattens.
Growth factor, decay factor	The number b you multiply by each step.	Read it off the equation, or build it from the percent.
Growth rate, decay rate	The percent change: how far b is from 1.	Factor above 1 minus 100%; or 100% minus a factor below 1.
Percent to factor	Start from 100%, add or take away the percent, write as a decimal.	Grows 10%: 1.10. Loses 25%: 0.75.
b = 1	Multiplying by 1 changes nothing: a flat line, not exponential.	The boundary between decay and growth.

Part A Growth or decay?

Write growth, decay, or flat, and why.

EQUATION OR STORY	GROWTH, DECAY, OR FLAT	WHY
$y = 30 \cdot 1.2^x$		
$y = 30 \cdot 0.9^x$		
$y = 4 \cdot (1/3)^x$		
$y = 40 \cdot 1^x$		
Bacteria triple every hour		
A car loses 15% of its value each year		

Part B Percent to factor

Start from 100%. Write the factor as a decimal.

CHANGE	100% PLUS OR MINUS	FACTOR B
grows 10% a year		

loses 25% a year

[illegible]% a year

Part C Factor to percent

B	GROWTH OR DECAY	RATE
loses 40% a month		
1.05		
doubles each day		
0.85		
2		
1/2		
1.5		

Part D Read the story

1. $50 \cdot 0.85^x$ milligrams remain after x hours. What do a and b mean? Growth or decay?

2. A town of 2,000 grows 5% a year. Write $y = a \cdot b^x$ and say what x counts.

3. A car worth $20,000 loses 25% a year. Write the equation.

Part E In your own words

1. Why does b bigger than 1 grow and b less than 1 decay?

2. What is the difference between the growth factor and the growth rate?

3. Why is b = 1 not really exponential, and why must b be positive?

Part F Exit ticket

1. Grows 7% a year: b = ? Loses 30% a year: b = ?

2. b = 1.25: growth or decay, rate? b = 0.6?

Answer key

Part A. Growth (1.2 more than 1). Decay (0.9). Decay (1/3). Flat (multiplying by 1). Growth (factor 3). Decay (0.85).

Part B. 110%, 1.10. 75%, 0.75. 104%, 1.04. 60%, 0.60. 200%, 2.

Part C. Growth 5%. Decay 15%. Growth 100%. Decay 50%. Growth 50%.

Part D. 1. a = 50 mg at the start; b = 0.85: 85% remains each hour, decay of 15%. 2. $y = 2000 \cdot 1.05^x$, x in years. 3. $y = 20000 \cdot 0.75^x$.

Part E. 1. Multiplying by more than 1 makes things bigger; by less than 1, smaller. 2. Factor is what you multiply by; rate is how far it is from 1, as a percent. 3. Multiplying by 1 changes nothing (flat); a negative b would flip signs every step.

Part F. 1. 1.07; 0.70. 2. Growth 25%; decay 40%.