When Money Shrinks, and Using the Models

Every factor is 1 plus or minus the rate. Start from 1, which is keeping all of it. Decay: A = P(1 - r)^t. For how-long questions, build a table.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Depreciation	Losing value over time.	Same form as compound interest, with a factor below 1.
Decay factor	1 minus r: the number you multiply by each time.	Losing 13% gives 0.87.
Decay rate	r, the percent lost each time. How far the factor is below 1.	A factor of 0.85 is a rate of 15%, not 85%.
Doubling time	How long it takes an amount to double.	Find it with a table. 72 divided by the rate is a quick estimate.
Principal, balance	The starting amount and the amount now. On a loan, what you borrowed and what you owe.	Interest on a debt grows the same way savings do.
Growth factor	1 plus r, from Lesson 2.	Above 1 grows, below 1 shrinks, exactly 1 does nothing.

Part A Factors and rates, both ways

FACTOR	GROWTH OR DECAY	RATE	CHANGE	FACTOR
1.06			grows 9%	
0.85			loses 9%	
1.125			loses 25%	
0.6			grows 2.5%	

Part B The car

A car's value is $35{,}000(0.87)^t$.

1. What did it cost new? What percent does it lose each year? Show how you read the factor.

YEAR	0	1	2	3
value	$35,000.00			

Part C Write and use a model

1. A $1,200 laptop loses 25% of its value each year. Write its value after t years. Find the value after 2 years.

2. A $1,000 credit card balance grows 20% a year with nothing paid. How much is owed after 3 years?

Part D What if?

A city of 8,000 grows 4% a year: $8{,}000(1.04)^t$.

1. Write the model if the city starts at 12,000. How do the values compare?

2. Write the model if it grows 6% instead. How do the two curves compare over time?

Part E How long? Build the table

$500 at 8% compounded annually. Multiply by 1.08 each year.

YEAR	0	1	2	3	4	5	6	7	8	9	10
balance	$500.00										

1. About how many years until it doubles? Check with 72 divided by the rate.

Part F Exit ticket

1. Factor 0.92: growth or decay, and what rate?

2. A $20,000 car loses 15% a year. Write the model and find the value after 2 years.

Answer key

Part A. Growth 6%; decay 15%; growth 12.5%; decay 40%. Factors: 1.09, 0.91, 0.75, 1.025.

Part B. 1. $35,000; 0.87 = 1 – 0.13, so 13% a year. Values: $30,450.00, $26,491.50, $23,047.61.

Part C. 1. $1200(0.75)^t$; $675.00. 2. $1000(1.20)^3 = \$1{,}728.00$.

Part D. 1. $12{,}000(1.04)^t$: every value is 1.5 times bigger. 2. $8{,}000(1.06)^t$: same start, and the gap widens every year.

Part E. $540.00, $583.20, $629.86, $680.24, $734.66, $793.44, $856.91, $925.47, $999.50, $1,079.46. About 9 years (it passes $1,000 in year 10); 72 ÷ 8 = 9.

Part F. 1. Decay, 8%. 2. $20{,}000(0.85)^t$; $14,450.00.