Building and Using Exponential Models

Build: a is the start, b is the factor (from 100%). Forward: evaluate, power first. Backward: table, or target line and the crossing. Say what a and b mean. Discrete or continuous. Ask what changes.

1 THE VOCABULARY
Words we use

Model an equation standing in for a real situation.
Forward given x, find y: evaluate.
Backward given y, find x: table or graph.
Target line y = the given value; the answer is the crossing.
Discrete, continuous whole steps only, or any x.

- Watch out for these.
- Using the percent as b: losing 20% is 0.80.
- Multiplying a and b before the power.
- Leaving a and b as bare numbers. Say what they mean.
- Answering a discrete question with a decimal year. Say the whole year.

2 THE METHOD
Build, then use

1. a the start: the x = 0 value, or the amount at the beginning of the story.
2. b the factor: the ratio down the table, or 100% plus or minus the percent.
3. WRITE AND INTERPRET $y = a \cdot b^x$, and say what a, b, x, and y mean.
4. FORWARD put x in, power first, then times a.
5. BACKWARD build a table until you pass the target, or draw the target line and read the crossing.

WHY THE CROSSING ANSWERS A BACKWARD QUESTION
The curve says what the model gives at every x; the horizontal line says y equals the target. Where they meet, both are true at once: the model equals the target. That is the same crossing idea that solved a system in Unit 6, Lesson 1.

3 THE PHONE
$800, losing 20% a year

a = 800, b = 0.80	the price new; keeps 80% each year
$y = 800 \cdot 0.80^x$	x in years, y in dollars
after 3 years: 800 · 0.512 = $409.60	forward, power first
table: 800, 640, 512, 410, 328, 262, 210, 168	backward by table
under $200 during year 7	or read the crossing with y = 200 on the graph
discrete: whole years	answer with a year

WHAT CHANGES
Losing 15% instead: b = 0.85, falls more slowly, crosses $200 later (year 9). Costing $1,000: a = 1000, same shape, starts higher.

SAY IT OUT LOUD
a starts it, b multiplies it. Forward: evaluate. Backward: find the crossing. Say what the numbers mean.