EDSTAR ANALYTICS | Deep Dive 5
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Building Sequences from the Real World

Decide the type, write the rule, answer the question. Ask what n counts and whether the counting starts at 0 or at 1.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Arithmetic sequence	A list that adds the same amount each time. The line family as a list.	Equal differences. Rule: start + d(n – 1).
Geometric sequence	A list that multiplies by the same number each time. The exponential family as a list.	Equal ratios. Rule: start · r^{n-1}.
Common difference, common ratio	d, the amount added; r, the number multiplied.	Subtract to find d; divide to find r.
Explicit rule, recursive rule	Any term from n; the next term from the one before.	Explicit for a far term; recursive to see how the list moves.
Model	A rule that stands in for a real situation.	Say what n counts and where the counting starts.
Zeroth term	The value one step before the first term.	Sometimes it has a real meaning: a plain pizza.

Part A Decide the type

SITUATION	FIRST VALUES	DIFFERENCES OR RATIOS	ARITHMETIC OR GEOMETRIC; D OR R
Pizza: $12.00, $13.50, $15.00			
Nursery: 2, 8, 32, 128 trees			
Cups: 7.5, 9, 10.5 inches			
Bacteria: 1, 2, 4, 8			
Simple interest: 1000, 1050, 1100			
Compound interest: 1000, 1050, 1102.50			

Part B Pizza

1. Write C(n), the cost with n toppings. Simplify it.

2. What does the 10.50 mean?

Part C The orchard

3. What does a pizza with 8 toppings cost?

4 trees to start (year 0), 178 trees in year 29, the same number planted each year.

1. How many trees are planted each year? Show the work.

2. Cross out the rules that cannot be right, and say why for each.

RULE	KEEP OR CROSS OUT	WHY
$t(n) = 4n + 6$		
$t(n) = 6n + 4$		
$t(n) = 4 \cdot 6^n$		
$t(n) = 29n + 4$		

Part D Cups and bacteria

1. A 7.5 inch cup has a 1.5 inch lip. Write the height of a stack of n cups, simplify, and find the height of 20 cups.

2. One bacterium splits in two every minute. How many after n minutes? After 5? Why n and not n – 1?

Part E Reach the target

1. Week 1: $50. Each week after, $20 more. In which week is the total $410?

2. The bacteria number 2^n. After how many minutes are there first more than 1,000? Use a table.

Part F Exit ticket

1. A gym costs $40 the first month and $25 each month after. Type, and the total for n months.

2. A video has 3, 6, 12, 24 views in hours 1 to 4. Rule, and hour 8.

Answer key

Part A. Differences 1.50: arithmetic, d = 1.50. Ratios 4: geometric, r = 4. Differences 1.5: arithmetic, d = 1.5. Ratios 2: geometric, r = 2. Differences 50: arithmetic, d = 50. Ratios 1.05: geometric, r = 1.05.

Part B. 1. $C(n) = 12 + 1.50(n - 1) = 10.50 + 1.50n$. 2. The price of a plain pizza (the zeroth term). 3. $22.50.

Part C. 1. $(178 - 4) \div 29 = 6$. 2. $4n + 6$: cross out, starts at 6. $6n + 4$: keep. $4 \cdot 6^n$: cross out, multiplies but the story adds. $29n + 4$: cross out, gives 845 in year 29.

Part D. 1. $7.5 + 1.5(n - 1) = 6 + 1.5n$; 36 inches. 2. 2^n; 32; the counting starts at minute 0, so n minutes is n doublings.

Part E. 1. $50 + 20(n - 1) = 410$; n = 19. 2. 256, 512, 1,024: 10 minutes.

Part F. 1. Arithmetic, d = 25; $40 + 25(n - 1) = 15 + 25n$. 2. $a_n = 3 \cdot 2^{n-1}$; 384.