Recognizing Exponential Relationships Practice

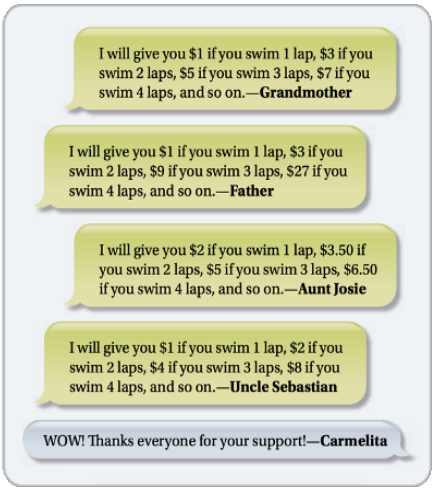
(These are ACE questions. The number from the book is included so you can check your answers.)

15. Carmelita is planning to swim in a charity swim-a-thon. Several relatives said they would sponsor her.

a. Decide whether each donation pattern is an exponential function, linear function, or neither. Filling in more of the table will help you recognize the pattern.

b. For each relative, write an equation.

c. For each plan, tell how much money Carmelita will raise if she swims 20 laps.



# of Laps	Grandmother	Father	Aunt Josie	Uncle Sebastian
1	1	1	2	1
2	3 (+2)	3 (×3)	3.50 (+1.5)	2 (×2)
3	5 (+2)	9 (×3)	5 (+1.5)	4 (×2)
4	7 (+2)	27 (×3)	6.5 (+1.5)	8 (×2)
5	9 (+2)	81 (×3)	8 (+1.5)	16 (×2)
6	11 (+2)	243 (×3)	9.5 (+1.5)	32 (×2)
7	13	729	11	64
a. Type of relationship (Circle one)	**Linear** / Exponential / Neither	Linear / **Exponential** / Neither	**Linear** / Exponential / Neither	Linear / **Exponential** / Neither
b. Equation (if there is one)	$y = 2x - 1$	$y = \frac{3^x}{3}$	$y = 1.5x + 0.5$	$y = \frac{2^x}{2}$
c. How much will she make for 20 laps?	$y = 2(20) - 1$ **\$39**	$y = \frac{3^{20}}{3}$ **\$1,162,261,467**	$y = 1.5(20) + 0.5$ **\$30.50**	$y = \frac{2^{20}}{2}$ **\$524,288**

For Exercises 17-21, study the pattern in each table.

a. Tell whether the relationship between *x* and *y* is linear, exponential, or neither.

b. If the relationship is linear or exponential, write its equation. ***Make sure to test your equation with one or more values from your table.***

17.

x	0	1	2	3	4	5
y	10	12.5	15	17.5	20	22.5

+1 +1 +1 +1 +1

+2.5 +2.5 +2.5 +2.5 +2.5

Linear - constant slope

$\frac{\Delta y}{\Delta x} = 2.5$

$y = 2.5x + 10$

18.

x	0	1	2	3	4
y	1	6	36	216	1,296

+1 +1 +1 +1

×6 ×6 ×6 ×6

Exponential - constant growth factor = 6

$y = 6^x$

19.

x	0	1	2	3	4	5	6	7	8
y	1	5	3	7	5	8	6	10	8

+1 +1 +1 +1 +1 +1 +1 +1

+4 −2 +4 −2 +4 −2 +4 −2

Neither

No constant slope or growth factor

20.

x	0	1	2	3	4	5	6	7	8
y	2	4	8	16	32	64	128	256	512

+1 +1 +1 +1 +1 +1 +1 +1

×2 ×2 ×2 ×2 ×2 ×2 ×2 ×2

Exponential - constant growth factor = 2

$y = 2(2^x)$

21.

x	0	1	2	3	4	5
y	0	1	4	9	16	25

+1 +1 +1 +1 +1

+1 +3 +5 +7 +9

Neither

No constant slope or growth factor

$\frac{\Delta y}{\Delta x} = \frac{1}{1} \neq \frac{1}{3} \neq \frac{1}{5} \neq \frac{1}{7} \neq \frac{1}{9}$

51. The king tried to figure out the **total** number of rubas the peasant would receive under Plan 1.

> Remember, for Problem 1 we were just calculating how many rubas went on **each square**, not the total number that were on the chess board!

a. Fill the table up to square 10.

Square Number	Number of Rubas on the square	Total Number of Rubas on the board
1	1	1
2	2	3
3	4	7
4	8	15
5	16	31
6	32	63
7	64	127
8	128	255
9	256	511
10	512	1023

×3, ×7/3, ×15/7

It is clear that there is no constant growth factor, so this cannot be exponential.

b. We know that the relationship between the square number and the number of rubas on the square is exponential.
Is the relationship between the square number and the **total number of rubas** on the board exponential? Explain.

the relationship between square number and total number of rubas is NOT exponential. See above, there is no constant growth factor.

c. We know the equation for the Number of Rubas on a square (look back at Problem 1.2). Use that equation to come up with a new one that will calculate the **total** number of rubas on the board.

Did you notice?

5	16	31
6	32	63
7	64	127
8	128	255
9	256	511

$y = \frac{2^x}{2}$

Try with $x=7$

$y = \frac{2^x}{2} - 1$

$y = \frac{2^7}{2} - 1$

$= 63$ ← We are expecting $y = 127$

$y = 2^x - 1$

Play around with it a bit, and you will get

e. Suppose the king gave the peasant the reward she requested. How many Rubas would she receive? (A chessboard has 64 squares!)

$y = 2^{64} - 1 \sim 1.8 \times 10^{19}$ Rubas