ANSWERS
Teacher Version

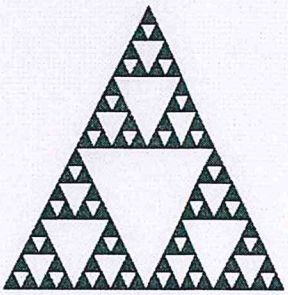
Understanding inverse relations

Student Activity Sheet 3; *Exploring* "The exponential function and its inverse"

1. Describe how the Sierpinski Triangle is an example of a ***fractal***. **[EX2, page 2]**

SKIP

The Sierpinski Triangle is a geometric shape that can be subdivided in parts, each of which is (at least approximately) a reduced-size copy of the whole.



2. The table shows the number of upward triangles for various iterations of the Sierpinski Triangle. What pattern do you notice in the number of upward triangles? **[EX2, page 3]**

Number of iterations	Visual description	Written description	Process	Upward triangles
0		1 upward triangle	$3^0 = 1$	1
1		3 upward triangles	$3^1 = 3$	3
2		9 upward triangles	$3^2 = 9$	9
3		27 upward triangles	$3^3 = 27$	27

The data exhibit a pattern of constant multiplication—the number of upward triangles produced in each new iteration is 3 times the number of upward triangles in the previous iteration.

3. What type of function could model the data in the table above? **[EX2, page 3]**

an exponential function

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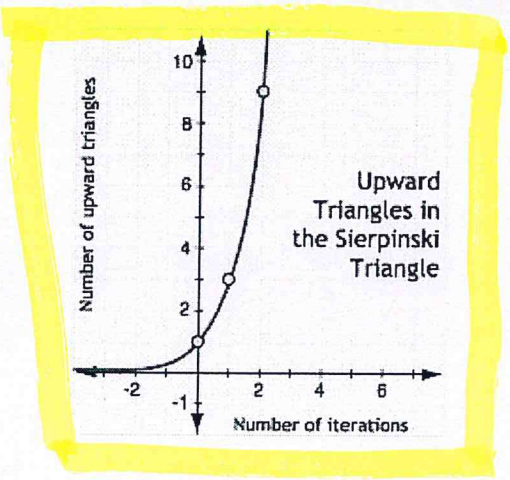
4. Complete the table to find a function rule that models the relationship between the number of upward triangles and the number of iterations. **[EX2, page 3]**

Number of iterations	Written description	Process	Upward triangles
4	81 upward triangles	$3^4 = 81$	81
5	243 upward triangles	$3^5 = 243$	243
n	3^n upward triangles	3^n	3^n

5. Graph the function rule that represents the upward triangles in the Sierpinski Triangle. **[EX2, page 4]**



6. How do the domain and range of the function rule compare to the domain and range of the problem situation? **[EX2, page 4]**

Function rule:

Domain: all real numbers

Range: $y > 0$ (The x-axis is a horizontal asymptote.)

Sierpinski Triangle situation:

Domain: non-negative whole numbers

Range: powers of 3 greater than or equal to 1 (If $x = 0$, then $3^0 = 1$.)

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7. How many upward triangles are in the 10th iteration of the Sierpinski Triangle? **[EX2, page 5]**

Let x = number of iterations and y = total number of upward triangles.
$y = 3^x = 3^{10} = 59{,}049$
There are 59,049 upward triangles in the 10th iteration.

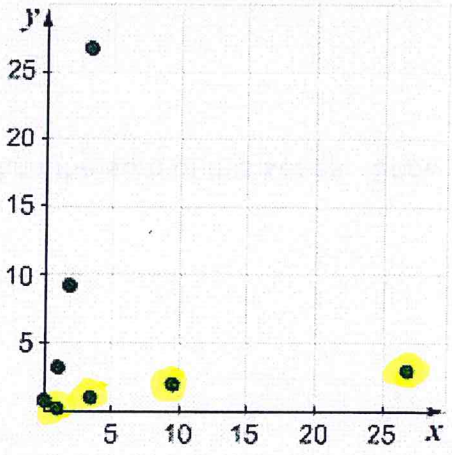
8. Which iteration of the Sierpinski Triangle has 531,441 upward triangles? **[EX2, page 5]**

Let x = number of iterations and y = total number of upward triangles.
Since $y = 3^x$, then $531{,}441 = 3^x$; however, the algebraic methods that you usually use to solve equations will not work here.
You could find this answer by extending the table and using repeated multiplication, or you could find the point on the graph for which $y = 531{,}441$.
The 12th iteration contains 531,441 upward triangles.

9. Complete the table to show the inverse of $y = 3^x$. **[EX2, page 7]**

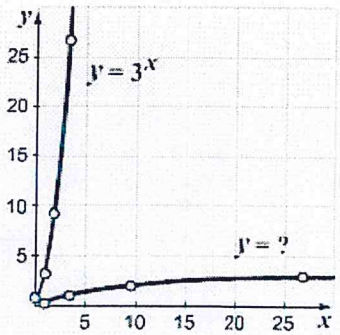
x	$y = 3^x$
0	1
1	3
2	9
3	27

$x = 3^y$	y
1	0
3	1
9	2
27	3



10. What type of function models this inverse? **[EX2, page 8]**

a logarithmic function



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