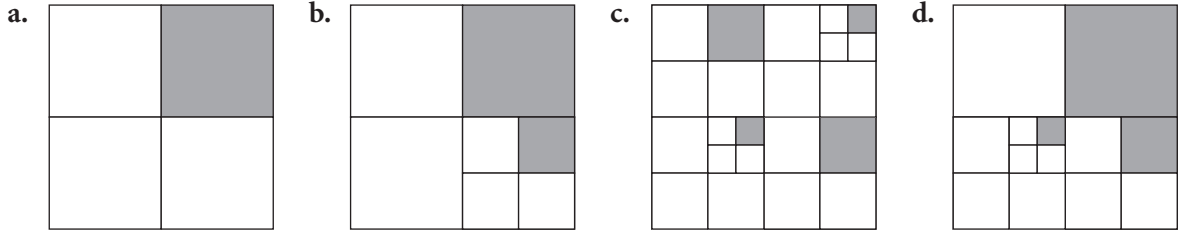


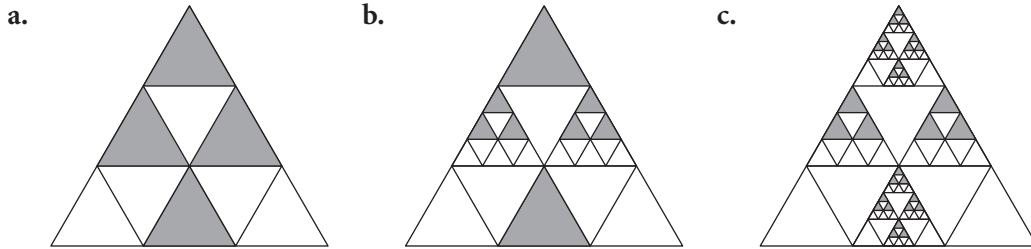
Lesson 0.1 • The Same yet Smaller

Name _____ Period _____ Date _____

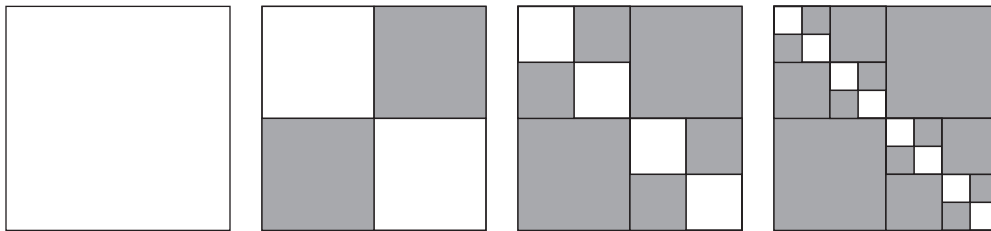
1. Write an expression and find the total shaded area in each square. In each case, assume that the area of the largest square is 1.



2. Write an expression and find the total shaded area in each triangle. In each case, assume that the area of the largest triangle is 81.



3. Use this fractal pattern to answer the questions. Assume that the area of the Stage 0 square is 1.



Stage 0

Stage 1

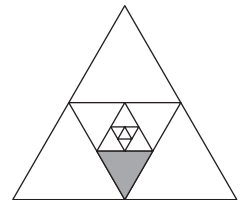
Stage 2

Stage 3

- Draw Stage 4 of the pattern.
- What is the area of the smallest square at Stage 4?
- What is the total area of the unshaded squares at Stage 2? At Stage 3?

4. Suppose the largest triangle in this figure has an area of 1.

- Write an expression for the shaded area.
- Write an expression for the unshaded area.
- Write an expression for the smallest triangle at the center.



Lesson 0.1 • Adding and Multiplying Fractions

Name _____ Period _____ Date _____

1. Find each sum.

a. $\frac{1}{4} + \frac{1}{4}$

b. $\frac{3}{4} + \frac{1}{4}$

c. $\frac{3}{8} + \frac{2}{8}$

d. $\frac{1}{8} + \frac{1}{64}$

e. $\frac{1}{5} + \frac{3}{10}$

f. $\frac{1}{7} + \frac{2}{21}$

g. $\frac{2}{5} + \frac{2}{15}$

h. $\frac{1}{8} + \frac{3}{16} + \frac{5}{64}$

i. $\frac{1}{9} + \frac{1}{27} + \frac{1}{81}$

j. $\frac{3}{7} + \frac{8}{21}$

k. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$

l. $\frac{1}{3} + \frac{4}{9} + \frac{6}{27}$

2. Find each difference.

a. $1 - \frac{1}{4}$

b. $1 - \frac{3}{16}$

c. $1 - \frac{1}{4} - \frac{3}{8}$

d. $1 - \frac{1}{2} - \frac{1}{4} - \frac{1}{8}$

e. $1 - \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8}\right)$

f. $1 - \frac{3}{8} - \frac{7}{16}$

g. $1 - \frac{3}{4} - \frac{1}{8} - \frac{1}{16}$

h. $1 - \left(\frac{3}{4} + \frac{1}{8} + \frac{1}{16}\right)$

i. $1 - \frac{1}{4} - \frac{3}{8} - \frac{5}{16}$

3. Find each product.

a. $\frac{1}{4} \times \frac{1}{4}$

b. $\frac{1}{5} \times \frac{3}{5}$

c. $\frac{1}{3} \times \frac{1}{9}$

d. $\frac{2}{3} \times \frac{5}{8}$

e. $2 \times \frac{1}{5}$

f. $3 \times \frac{1}{6}$

g. $6 \times \frac{2}{9}$

h. $3 \times \frac{1}{4} \times \frac{7}{16}$

i. $9 \times \frac{1}{3} \times \frac{2}{27}$

4. Find each product.

a. $\frac{1}{2} \times 32$

b. $\frac{1}{4} \times 32$

c. $\frac{3}{4} \times 32$

d. $\frac{1}{2} \times \frac{3}{4} \times 32$

e. $\frac{1}{4} \times \frac{3}{4} \times 32$

f. $\frac{3}{4} \times \frac{3}{4} \times 32$

g. $\frac{1}{4} \times \frac{1}{8} \times 32$

h. $\frac{1}{8} \times \frac{1}{8} \times 32$

i. $\frac{3}{8} \times \frac{3}{4} \times 32$

Lesson 0.2 • More and More

Name _____ Period _____ Date _____

1. Write each multiplication expression in exponent form.

Example: $2 \cdot 2 \cdot 2 = 2^3$

a. $3 \cdot 3 \cdot 3 \cdot 3$

b. $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$

c. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

d. $10 \cdot 10 \cdot 10$

e. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$

f. $\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3}$

2. Rewrite each expression as a repeated multiplication and find the value.

a. 4^3

b. 2^6

c. 6^3

d. 10^6

e. $\left(\frac{1}{3}\right)^3$

f. $\left(\frac{2}{3}\right)^2$

3. Write each number in exponent form. Example: $25 = 5^2$

a. 32

b. 27

c. 64

d. 81

e. 289

f. 1331

4. Do each calculation. Check your results with a calculator.

a. $\frac{1}{4} + \frac{2}{3}$

b. $\frac{3}{8} \cdot 16$

c. $\frac{5}{6} - \frac{1}{4}$

d. $9 - \frac{3}{8}$

e. $\frac{1}{7} \cdot \frac{3}{5} \cdot 4$

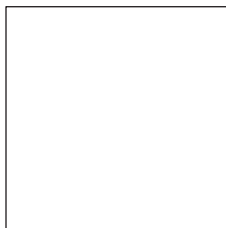
f. $\frac{7}{64} + \frac{5}{16} + \frac{3}{8}$

g. $\frac{15}{16} - \frac{7}{8} + \frac{3}{4}$

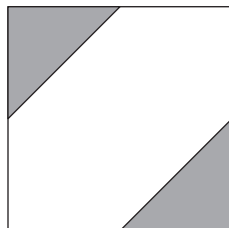
h. $\frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3}{4} \cdot 24$

i. $\frac{3}{4} + \frac{2}{3} - \frac{1}{2}$

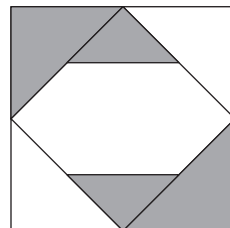
5. Four stages of a fractal spiral are shown. The area of Stage 0 is 12. Draw Stage 4 and copy and complete the table for Stages 0 to 4.



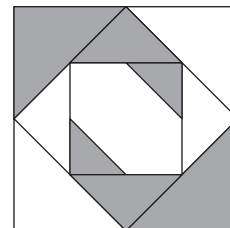
Stage 0



Stage 1



Stage 2



Stage 3

Stage	Total shaded area in multiplication and addition form	Total shaded area in fraction form	Total shaded area in decimal form
0	0	0	0
1	$\left(2 \cdot \frac{1}{8}\right) \cdot 12$	3	3
2	$\left[\left(2 \cdot \frac{1}{8}\right) + \left(2 \cdot \frac{1}{8} \cdot \frac{1}{2}\right)\right] \cdot 12$		
3			

Lesson 0.3 • Shorter yet Longer

Name _____ Period _____ Date _____

1. Evaluate each expression. Write your answer as a fraction and as a decimal rounded to the nearest hundredth.

a. $\left(\frac{3}{4}\right)^3$

b. $\frac{3^3}{4^3}$

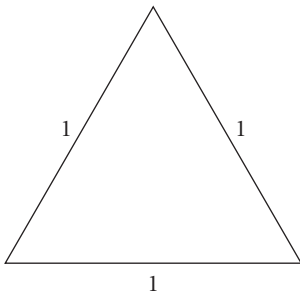
c. $\frac{6^2}{5^2}$

d. $\left(\frac{5}{7}\right)^2$

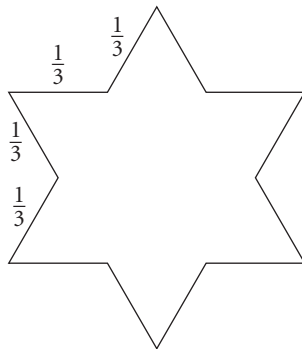
e. $\left(\frac{8}{10}\right)^4$

f. $\frac{12^2}{5^3}$

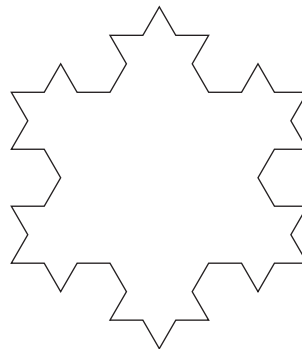
2. This fractal is a relative of the Koch curve called the snowflake curve.



Stage 0



Stage 1



Stage 2

- a. Complete the table by calculating the length of the figure at Stages 2 and 3. Round decimal answers to the nearest hundredth.

- b. How much longer is the figure at Stage 4 than at Stage 3? Express your answer as a fraction and as a decimal rounded to the nearest hundredth.

Stage number	Total length		
	Multiplication form	Exponent form	Decimal form
0	$3 \cdot 1 = 3$	$3 \cdot \left(\frac{4}{3}\right)^0$	3.00
1	$3 \cdot 4 \cdot \frac{1}{3} = 4$	$3 \cdot \left(\frac{4}{3}\right)^1$	4.00
2	$3 \cdot 4 \cdot 4 \cdot \frac{1}{3} \cdot \frac{1}{3} = \frac{16}{3}$		
3			

3. At what stage does the figure in Exercise 2 first exceed a length of 15? How many segments are there at that stage?

4. Evaluate each expression, and check your results with a calculator.

a. $\frac{5}{8} + \frac{5}{3}$

b. $3^2 + 2^3$

c. $5^3 - \frac{7}{12}$

d. $\left(\frac{5}{6}\right)^2 \cdot \left(\frac{2}{3}\right)^2$

e. $\frac{1^2}{2^2} - \left(\frac{1}{2}\right)^3$

f. $4^3 + \left(\frac{3}{4}\right)^2$

g. $2^4 - \left(\frac{3}{2}\right)^2 + \frac{1}{2}$

h. $\left(\frac{3}{4}\right)^2 + \left(\frac{3}{2}\right)^3 - 3$

i. $\left(\frac{7}{2}\right)^2 - \frac{7}{3} + \frac{5^2}{6}$

Lesson 0.4 • Going Somewhere?

Name _____ Period _____ Date _____

1. Do each calculation. Check your results on your calculator. Use a number line to illustrate your answer for 1d–f.

a. $12 - 5$

b. $5 - 12$

c. $15 + -6$

d. $15 - (-6)$

e. $-3 + -7$

f. $-3 - (-7)$

2. Do the indicated multiplication or division. Check your results on your calculator.

a. $4 \cdot -2$

b. $-2 \cdot 4$

c. $-4 \cdot -7$

d. $-24 \div 3$

e. $32 \div -16$

f. $-64 \div -16$

g. $100 \div -4 \cdot 3$

h. $-3 \cdot 16 \div -8$

i. $12 \div -3 \div -2$

3. Do the following calculations. Remember, if there are no parentheses, you must do multiplication or division before addition or subtraction. Check your results by entering the expression exactly as it is shown on your calculator.

a. $9 - 4 \cdot 2 + 3$

b. $9 - 4 + 12 \cdot 3$

c. $-3 \cdot 6 + 4 \cdot -5$

d. $-18 + -6 \cdot -2 + 5$

e. $2 \cdot (9 - 18) - (-10)$

f. $-(5 - 9) \cdot -3 + -6 \cdot -2$

4. Do the following calculations. Check your results on your calculator.

a. $3 + -7 \cdot 2 - 5$

b. $(3 + -7) \cdot 2 - 5$

c. $(3 + -7) \cdot (2 - 5)$

d. $3 + -7 \cdot (2 - 5)$

e. $3 + (-7 \cdot 2 - 5)$

f. $(3 + -7 \cdot 2) - 5$

5. Start with this expression:

$$0.5 \cdot (\square - 1)$$

a. Recursively evaluate the expression three times, starting with 2. Round your answers to the nearest thousandth.

b. Do three more recursions starting with the last value you found in 5a.

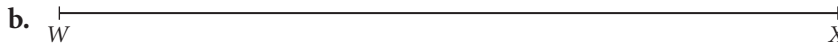
c. Now do five recursions, starting with -2 .

d. Do you think this expression has an attractor value? Explain your reasoning.

Lesson 0.5 • Out of Chaos

Name _____ Period _____ Date _____

1. Estimate the length of each segment in centimeters. Then measure and record the length to the nearest tenth of a centimeter.



2. Draw a segment to fit each description.

- one-fourth of a segment 16.4 cm long
- two-thirds of a segment 12 cm long
- three-fifths of a segment 15.5 cm long
- five-eighths of a segment 16 cm long

3. Draw a line segment and label the endpoints A and B .

- Mark and label point C midway between A and B .
- Mark and label point D two-thirds of the distance from B to A .
- Mark and label point E three-fourths of the distance from A to B .
- Which two points are closest together? If the segment is 12 cm long, how far apart are they?

4. Do each calculation. Check your results with a calculator.

a. $\frac{1}{4} \cdot (12)^2$

b. $\frac{2}{3} - \left(\frac{3}{2}\right)^2$

c. $3^2 - (-4^3) - \frac{3}{8}$

d. $46 - \frac{3^2}{7}$

e. $-3 - \frac{3}{4} + \left(\frac{7}{2}\right)^2$

f. $-(2^4) \cdot \frac{5}{6} - 17$

g. $16 + (-2^4)$

h. $\frac{6^2}{7} + 21 + (-2)^4$

i. $-\left(\frac{5}{7}\right) + (8^2) - 36$

j. $-3\frac{1}{4} + 2\frac{2}{3}$

k. $4\frac{3}{4} - 2\frac{1}{2} + 1\frac{3}{10}$

l. $-1\frac{3}{4} + -1\frac{1}{2}$