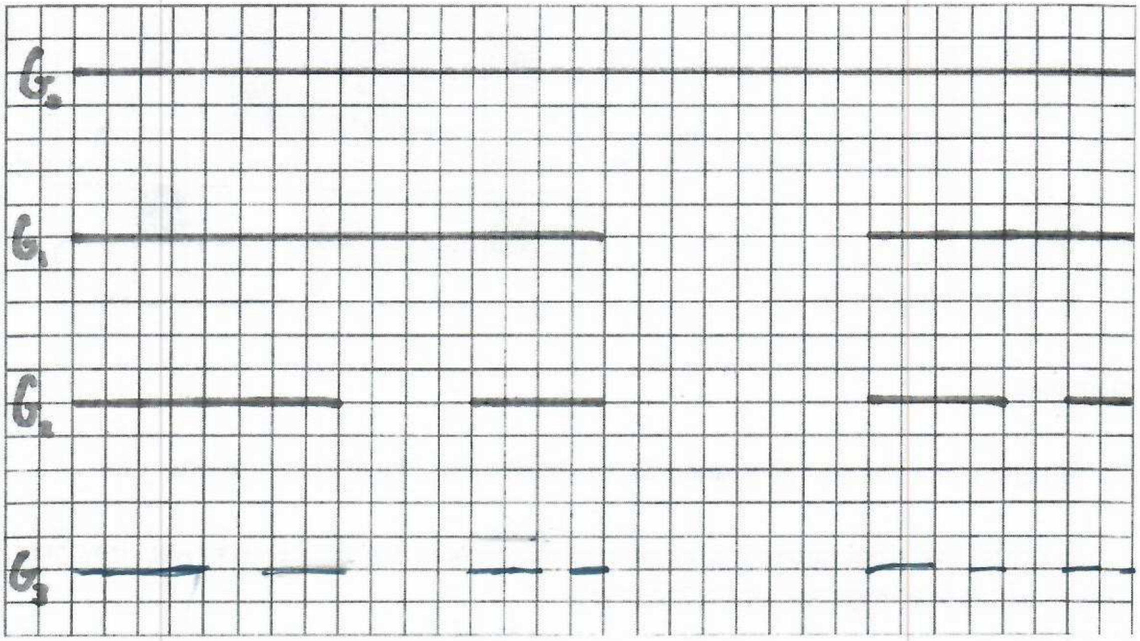
Quiz 09, MAT115, Spring 2024

Name:

Problem 1: In this case we have a stick fractal. The initiator is a stick; and we divide it into two sticks: one a quarter of the length of the original, and the other one half the length of the original stick.



Questions:

Nice work.

a. (2 pts) The initial stick we call generation 0, and the generator transforms it into generation 1. Do it again, and you reach generation 2. Draw generation 3.

b. (2 pts) A stick is divided into more sticks. How many sticks appear in generations 3, 4, and 5?

$G_0 = 1 = 2^0$ $\quad$ $G_3 = 8 = 2^3$

$G_1 = 2 = 2^1$ $\quad$ $G_4 = 16 = 2^4$

$G_2 = 4 = 2^2$ $\quad$ $G_5 = 32 = 2^5$

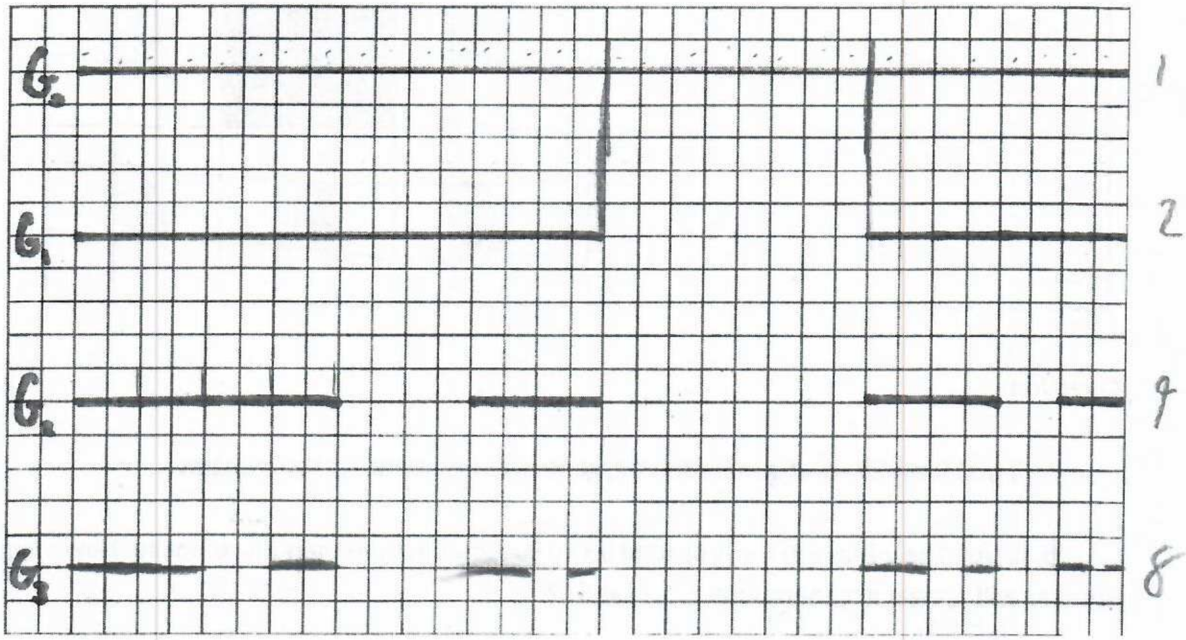
c. (1 pt) The initial stick has length equal to one unit. How much length is left in generation 1, after the first part is removed? How much length is left in generations 2, 3, 4, and 5?

$G_1 = 3/4$ $\quad$ $G_4 = 81/256$

$G_2 = 9/16$ $\quad$ $G_5 = 243/1024$

$G_3 = 27/64$

Problem 1: In this case we have a stick fractal. The initiator is a stick; and we divide it into two sticks: one a quarter of the length of the original, and the other one half the length of the original stick.



Questions:

a. (2 pts) The initial stick we call generation 0, and the generator transforms it into generation 1. Do it again, and you reach generation 2. Draw generation 3.

b. (2 pts) A stick is divided into more sticks. How many sticks appear in generations 3, 4, and 5?

G_3: 8 sticks
G_4: 16 Sticks
G_5: 32 Sticks

c. (1 pt) The initial stick has length equal to one unit. How much length is left in generation 1, after the first part is removed? How much length is left in generations 2, 3, 4, and 5?

$(3/4)^1$ G1: 0.75
$(3/4)^2$ G2: 0.5625
$(3/4)^3$ G3: 0.4219
$(3/4)^4$ G4: 0.3164
$(3/4)^5$ G5: 0.2373

Nice!

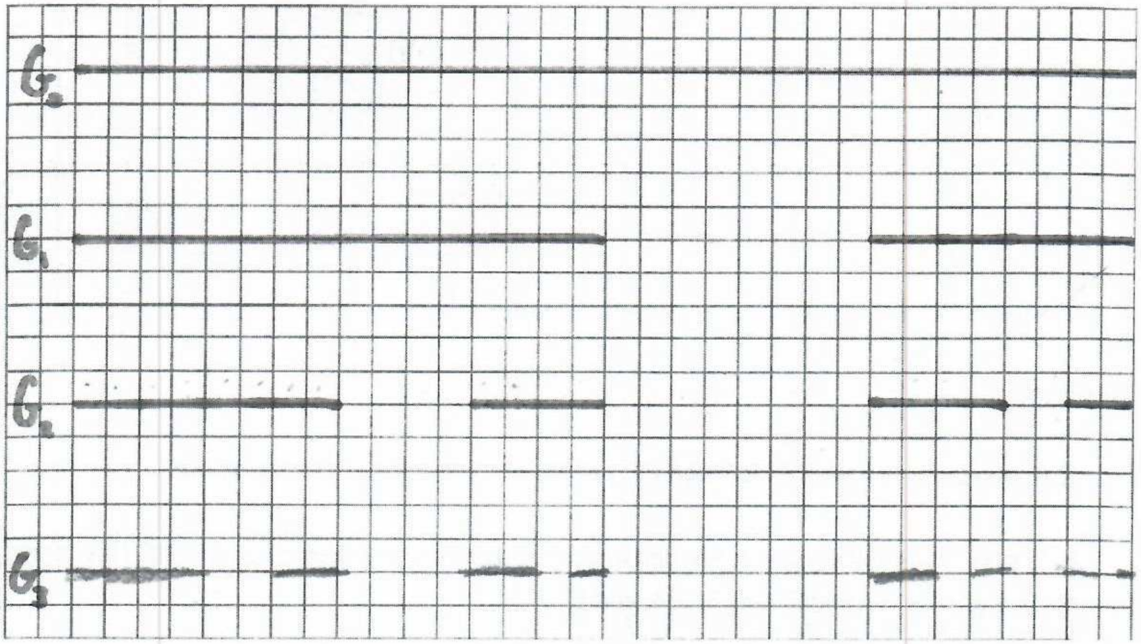
Problem 1: In this case we have a stick fractal. The initiator is a stick; and we divide it into two sticks: one a quarter of the length of the original, and the other one half the length of the original stick.

$(2)^0$ $\quad (\frac{3}{4})^0 = 1$

$(2)^1$

$(2)^2$

$(2)^3$



$(2)^4$

$(2)^5$

Questions:

a. (2 pts) The initial stick we call generation 0, and the generator transforms it into generation 1. Do it again, and you reach generation 2. Draw generation 3.

b. (2 pts) A stick is divided into more sticks. How many sticks appear in generations 3, 4, and 5?

$3: (2)^3 = 8$

$4: (2)^4 = 16$

$5: (2)^5 = 32$

c. (1 pt) The initial stick has length equal to one unit. How much length is left in generation 1, after the first part is removed? How much length is left in generations 2, 3, 4, and 5?

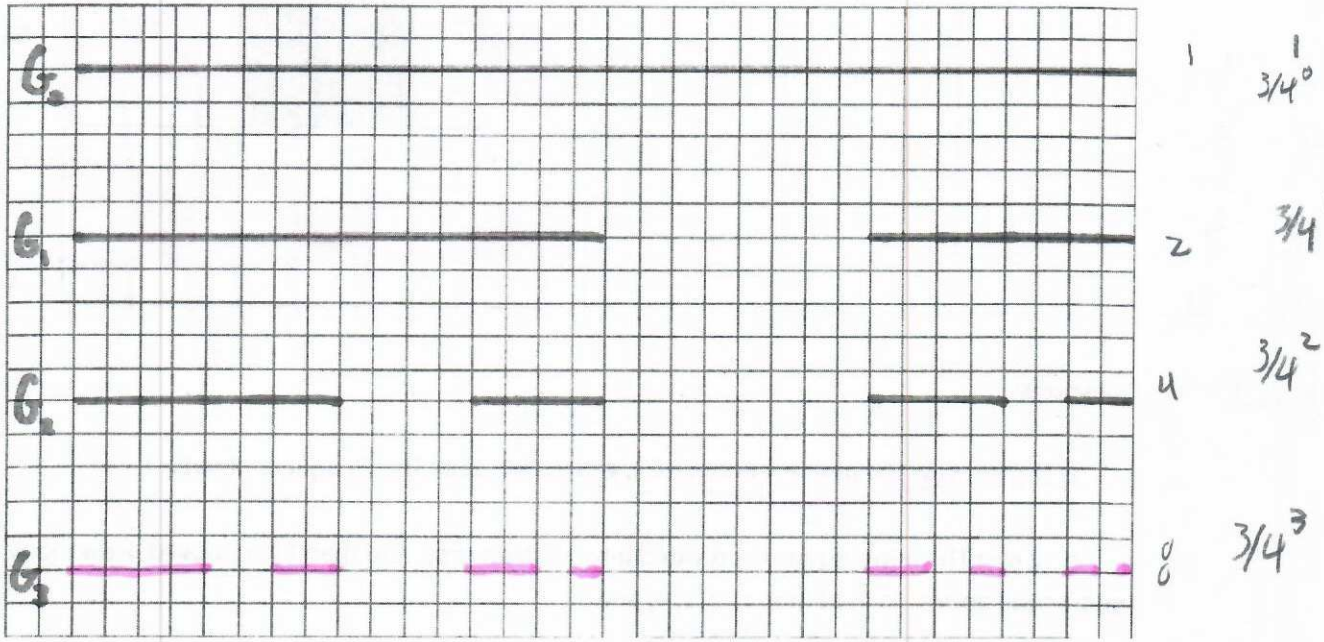
$L_{G0} = (\frac{3}{4})^0 = 1$ $\qquad L_{G3} = (\frac{3}{4})^3 = \frac{27}{64}$

$L_{G1} = (\frac{3}{4})^1 = \frac{3}{4}$ $\qquad L_{G4} = (\frac{3}{4})^4 = \frac{81}{256}$

$L_{G2} = (\frac{3}{4})^2 = \frac{9}{16}$ $\qquad L_{G5} = (\frac{3}{4})^5 = \frac{243}{1024}$

Nice work!

Problem 1: In this case we have a stick fractal. The initiator is a stick; and we divide it into two sticks: one a quarter of the length of the original, and the other one half the length of the original stick.



Questions:

Nice work

a. (2 pts) The initial stick we call generation 0, and the generator transforms it into generation 1. Do it again, and you reach generation 2. Draw generation 3.

b. (2 pts) A stick is divided into more sticks. How many sticks appear in generations 3, 4, and 5?

G_3 has 8 sticks, G_4 would have 16 sticks, and G_5 would have 32 sticks.

✓

c. (1 pt) The initial stick has length equal to one unit. How much length is left in generation 1, after the first part is removed? How much length is left in generations 2, 3, 4, and 5?

In G1 there is 3/4 of the length left. (0.75)

In G2, there is $3/4^2$ length left. (0.5625)

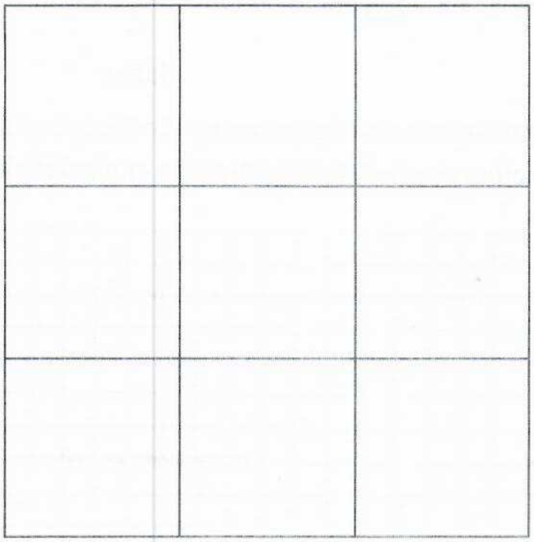
In G3, there's $3/4^3$ left. (0.421875)

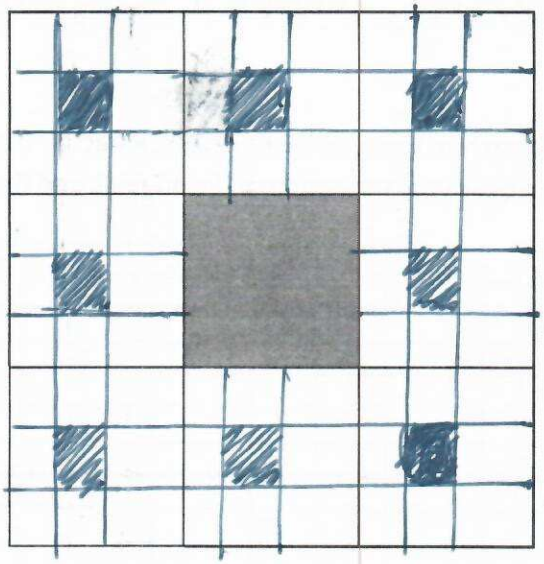
In G4, there's $3/4^4$ left. (0.31640625)

In G5, there's $3/4^5$ left. (0.2373046875)

✓

Problem 2: In this case we have an area fractal. The initiator is a square; and we divide it into 9 squares, and remove the middle square, as shown in these images. Now we can "do it again!"





G1

Questions:

a. (2 pts) Draw the next generation G2, generation 2, on the G1 square above.

b. (2 pts) The initial square is divided into 9 subsquares, and then 1 is removed. How many squares will appear in generations 2, 3, 4, and 5?

$G_0 = 1$
$G_1 = 8$
$G_2 = 64$

$G_3 = 512$
$G_4 = 4096$
$G_5 = 32{,}768$

b. (1 pt) The initial square has area equal to one unit. How much area is left in generation 1, after the first square is removed? How much area is left in generations 2, 3, 4, and 5?

$G_0 = 1$
$G_1 = 8/9$
$G_2 = 64/81$

$G_3 = 512/729$
$G_4 = 4096/6561$
$G_5 = 32{,}768/59{,}049$

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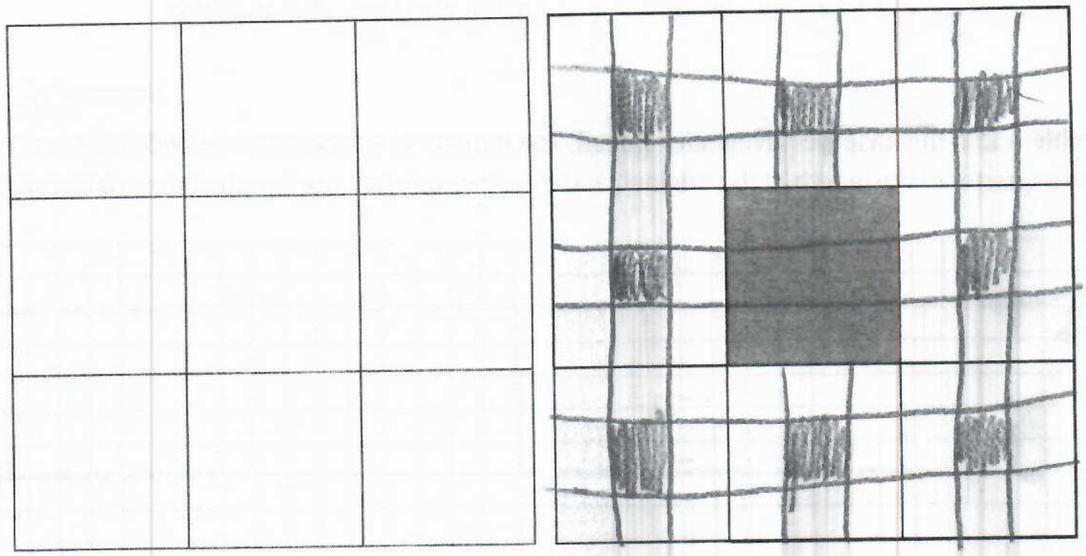


G1

Questions:

a. (2 pts) Draw the next generation G2, generation 2, on the G1 square above.

b. (2 pts) The initial square is divided into 9 subsquares, and then 1 is removed. How many squares will appear in generations 2, 3, 4, and 5?

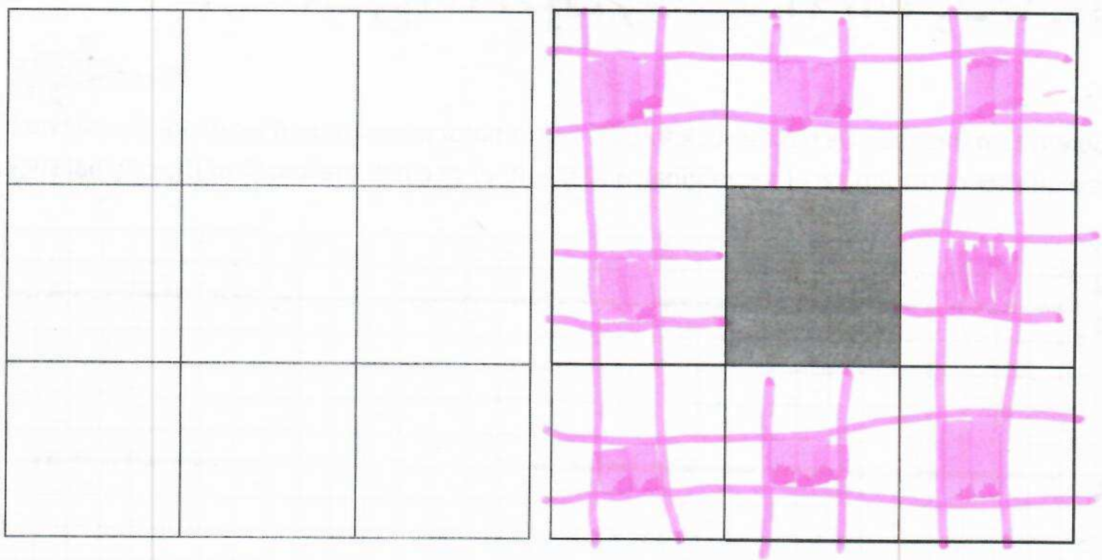
$G^1 = 8$
$G^2 = 64$
$G^3 = 512$
$G^4 = 4,096$
$G^5 = 32,768$

b. (1 pt) The initial square has area equal to one unit. How much area is left in generation 1, after the first square is removed? How much area is left in generations 2, 3, 4, and 5?

$(8/9)^1 = 0.\overline{8}$
$(8/9)^2 = 0.7901$
$(8/9)^3 = 0.7023$
$(8/9)^4 = 0.6243$
$(8/9)^5 = 0.5549$

Problem 2: In this case we have an area fractal. The initiator is a square; and we divide it into 9 squares, and remove the middle square, as shown in these images. Now we can “do it again!”

1 8/9



G1

$G_0 = 1$
$G_1 = 8/9$
$G_2 = 8/9^2$
$G_3 = 8/9^3$
$G_4 = 8/9^4$
$G_5 = 8/9^5$

9 0
8 1
64 2
512 3
4096 4
32768 5

Questions:

a. (2 pts) Draw the next generation G2, generation 2, on the G1 square above.

b. (2 pts) The initial square is divided into 9 subsquares, and then 1 is removed. How many squares will appear in generations 2, 3, 4, and 5?

G_2 will be 64 squares
G_3 will be 512 squares
G_4 will be 4096 squares
G_5 will be 32768 squares

b. (1 pt) The initial square has area equal to one unit. How much area is left in generation 1, after the first square is removed? How much area is left in generations 2, 3, 4, and 5?

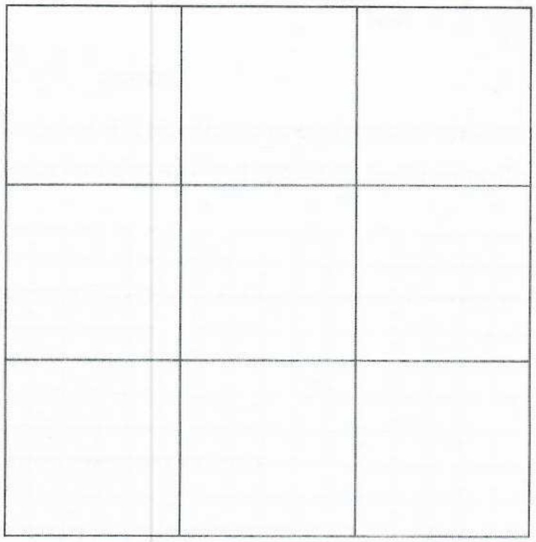
In G_1 there is 8/9 area left.
In G_2 there is $8/9^2$ left. (64/81)
In G_3 there's $8/9^3$ left.
In G_4 there's $8/9^4$ left.
In G_5 there's $8/9^5$ left

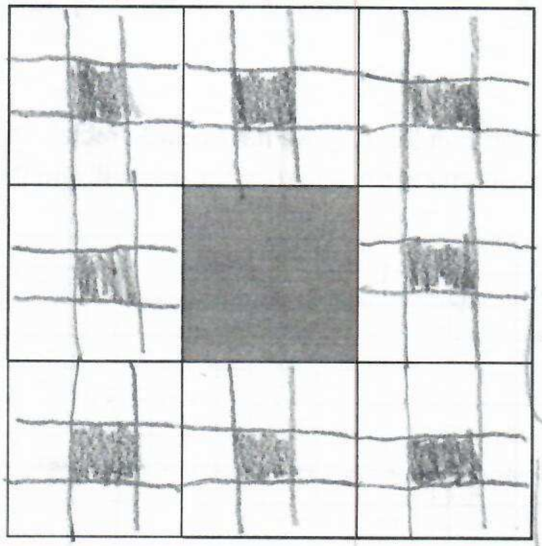
Problem 2: In this case we have an area fractal. The initiator is a square; and we divide it into 9 squares, and remove the middle square, as shown in these images. Now we can "do it again!"

G0

$\left(\frac{8}{9}\right)^0 = 1$

$(8)^0 = 1$





G1

$\left(\frac{8}{9}\right)^1 = \frac{8}{9}$

$(8)^1 = 8$

Questions:

a. (2 pts) Draw the next generation G2, generation 2, on the G1 square above.

b. (2 pts) The initial square is divided into 9 subsquares, and then 1 is removed. How many squares will appear in generations 2, 3, 4, and 5?

$2 = 8^2 = 64$ $\quad 5 = 8^5 = 32{,}768$

$3 = 8^3 = 512$

$4 = 8^4 = 4{,}096$

b. (1 pt) The initial square has area equal to one unit. How much area is left in generation 1, after the first square is removed? How much area is left in generations 2, 3, 4, and 5?

$G0 = \left(\frac{8}{9}\right)^0 = 1$ $\qquad G3 = \left(\frac{8}{9}\right)^3 = \frac{512}{729}$

$G1 = \left(\frac{8}{9}\right)^1 = \frac{8}{9}$ $\qquad G4 = \left(\frac{8}{9}\right)^4 = \frac{4096}{6561}$

$G2 = \left(\frac{8}{9}\right)^2 = \frac{64}{81}$ $\qquad G5 = \left(\frac{8}{9}\right)^5 = \frac{32{,}768}{59{,}049}$

good!