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The KOCH snowflake

Table 1

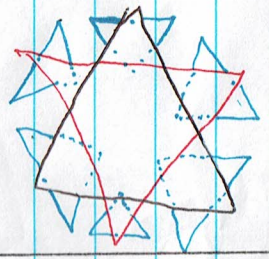
Iteration		No. of sides	No. of new △ added	Notes
1		3		each S/DE — is replaced by 
2		3×4	$3\times1 \leftarrow 3\times4^{0}\times1$ (2-2)	becomes 4 new sides add 1 new △
3		$3\times4\times4$ $=3\times4^{2}$ (3-1)	$3\times4\times1$ (3-2) $3\times4\times1$	
4		$3\times4\times4\times4$ $=3\times4^{3}$	$3\times4\times4\times1$ (4-2) $=3\times4^{2}\times1$	
n		$3\times4^{n-1}$	$3\times4^{n-2}$	

Table 2 About sizes: Length and area, Refer to notes

Iteration	No. of sides	Length of side	Perimeter (No. of sides × Length of side)	Area of triangle	No. of triangle Added	Area of each new triangle △	Area added to the Koch Snowflake	Total Koch snowflake area
1	3	L	$3L$	A	0	0		
2	3×4	$\frac{1}{3}L$	$3\times4\times\frac{1}{3}L$		3×1	$\frac{1}{9}A$	$3\times1\times\frac{1}{9}A$	$A+3\times1\times\frac{1}{9}A$
3	3×4^2	$\frac{1}{3}\times\frac{1}{3}\times L$ $(\frac{1}{3})^2\times L$	$3\times4^2\times(\frac{1}{3})^2\times L$		$3\times4^1\times1$	$\frac{1}{9}\times\frac{1}{9}A$ $(\frac{1}{9})^2A$	$3\times4\times1\times(\frac{1}{9})^2A$	$A+3\times1\times\frac{1}{9}A+3\times4^1\times1\times(\frac{1}{9})^2A$
4	3×4^3	$(\frac{1}{3})^3\times L$	$3\times4^3\times(\frac{1}{3})^3\times L$		$3\times4^2\times1$	$(\frac{1}{9})^3A$	$3\times4^2\times1\times(\frac{1}{9})^3A$	$A+3\times1\times\frac{1}{9}A+3\times4^1\times1\times(\frac{1}{9})^2A+3\times4^2\times1\times(\frac{1}{9})^3A$
n	$3\times4^{n-1}$	$(\frac{1}{3})^{n-1}\times L$	$3\times4^{n-1}\times(\frac{1}{3})^{n-1}\times L$		$3\times4^{n-2}\times1$	$(\frac{1}{9})^{n-1}A$	$3\times4^{n-2}\times1\times(\frac{1}{9})^{n-1}A$	$A+3\times1\times\frac{1}{9}A+3\times4^1\times1\times(\frac{1}{9})^2A+3\times4^2\times1\times(\frac{1}{9})^3A+\ldots+3\times4^{n-2}\times1\times(\frac{1}{9})^{n-1}A$

Conclusions:

1. Perimeter of Koch Snowflake at the n^{th} iteration is $3\times4^{n-1}\times(\frac{1}{3})^{n-1}\times L$
2. Area of Koch Snowflake at n^{th} iteration is:

$$A+3\times4^0\times1\times(\tfrac{1}{9})^1A+3\times4^1\times1\times(\tfrac{1}{9})^2A+3\times4^2\times1\times(\tfrac{1}{9})^3A+\ldots\ldots+3\times4^{n-2}\times1\times(\tfrac{1}{9})^{n-1}A$$

$$=\left(1+3\times4^0\times1\times(\tfrac{1}{9})^1+3\times4^1\times1\times(\tfrac{1}{9})^2+3\times4^2\times1\times(\tfrac{1}{9})^3+\ldots\ldots+3\times4^{n-2}\times1\times(\tfrac{1}{9})^{n-1}\right)\times A$$

I used excel to calculate the equation above. Multiplying factor

NOTES

△ABC = △DEF are the same

The small △ is $\frac{1}{9}$ of the big △

The side of the small △ is $\frac{1}{3}$ of original △