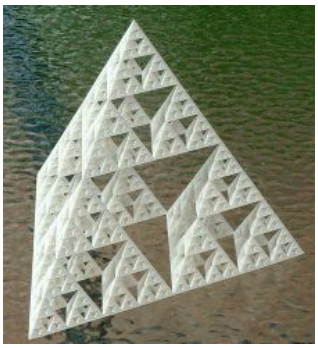
FANTASTIC FRACTALS Sierpinski Tetrahedron Calculations

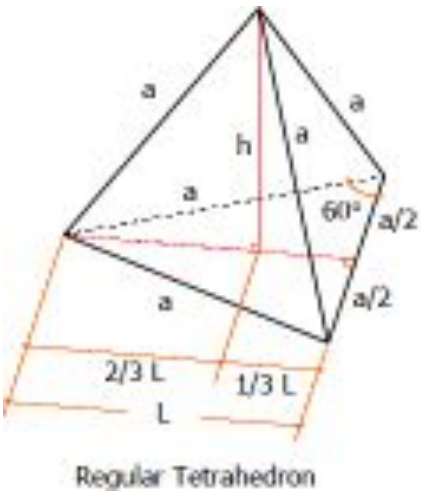
Here are some answers to help teachers to use this as a starting point for mathematical activities and investigations. There is scope at all levels from developing language for young learners just describing what they see, to work at upper secondary
level on calculations involving trigonometry and geometric series.



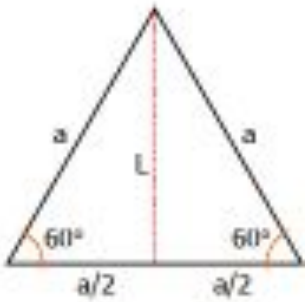
The number of small tetrahedra in the Guinness Record Breaking Balloon Model will be: $4096 = 2^{12} = 4^6$

This picture shows a Sierpinski Tetrahedron built from 1024 of the smallest tetrahedra. So the Balloon Model will consist of 4 of these constructions with 4096 tiny tetrahedra.

If the smallest tetrahedron in the picture has edge length 0.25 m then the edge length of the tetrahedron illustrated is 8m and the Guinness Record Breaking Balloon Model will have edge length 16 metres.



Regular Tetrahedron



One Face of Regular Tetrahedron

STAGE	0	1	2	3	4	5	6
NUMBER OF TETRAHEDRA	1	4	4^2=16	4^3=64	4^4=256	4^5=1024	4^6=4096
							
EDGE LENGTH a metres	0.25	0.5	1	2	4	8	16
ALTITUDE OF TRIANGULAR FACE L = a√3/2 metres	0.217	0.433	0.866	1.732	3.464	6.928	13.856
VERTICAL HEIGHT h = a√(2/3) metres	0.204	0.408	0.816	1.633	3.266	6.532	13.064
VERTICAL HEIGHT IN FEET	0.663	1.327	2.654	5.307	10.614	21.229	42.458

all calculations rounded to 3 places of decimals

MORE QUESTIONS

(1) If the tetrahedra were solid (rather than skeletal) how many times greater would be the volume of the record breaking tetrahedron compared to the volume of the original small tetrahedron? Answer: the volume scale factor is $(2^6)^3$=262144

(2) There is a big hollow space inside each Sierpinski Tetrahedron. What is the shape of that space? It is certainly not another tetrahedron. Have a look and see for yourself.