

L'aiguille de Kakeya

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Vincent Borrelli
Jean-Luc Rullière

En cheminant avec Kekeya

Voyage au cœur
des mathématiques

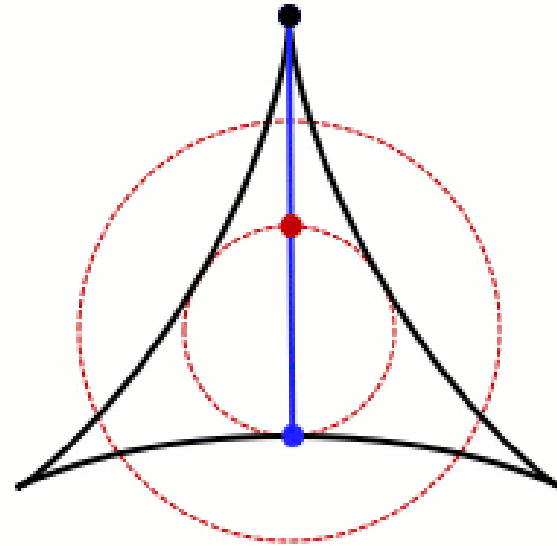
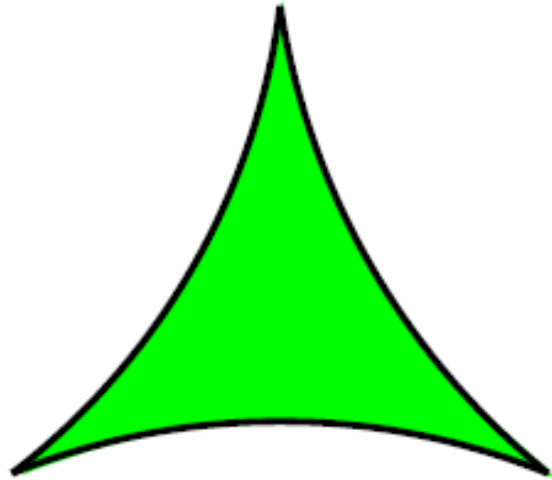


ENS ÉDITIONS

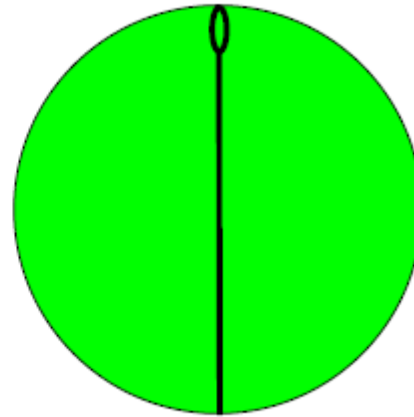
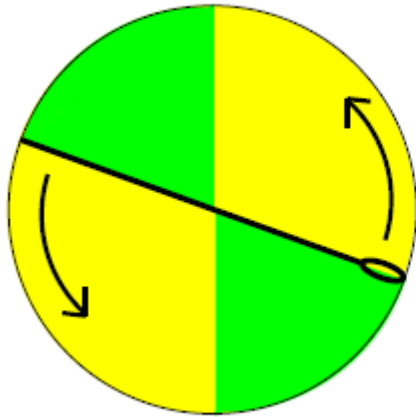
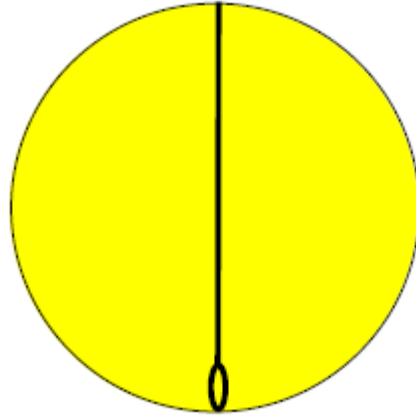


Quelle est la plus petite surface à l'intérieur de laquelle il est possible de déplacer une aiguille de manière à la retourner complètement ?

Candidat d'après Sôichi Takeya
qui posa le problème en 1917

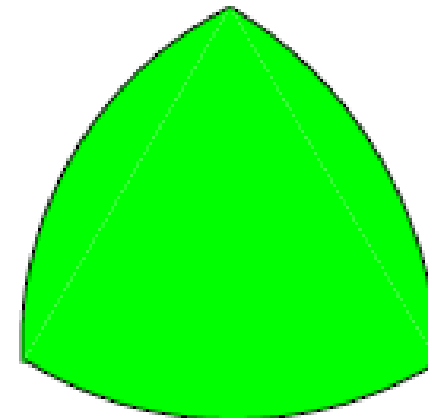
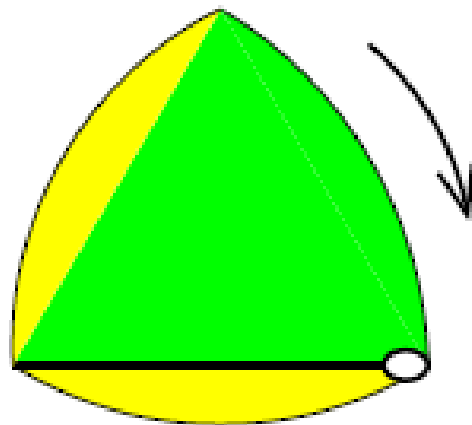
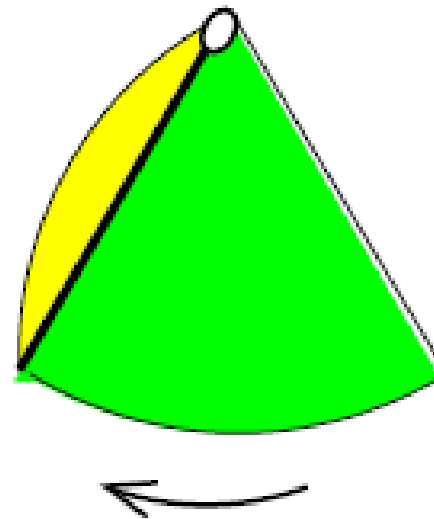
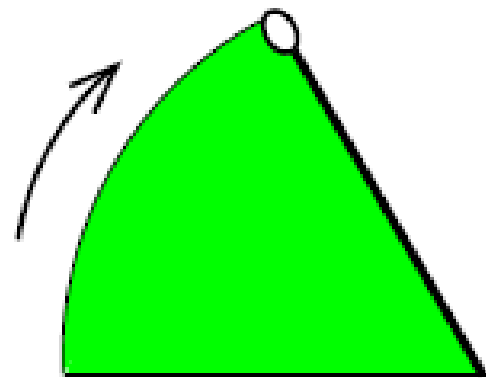


Aire = 0,78539...



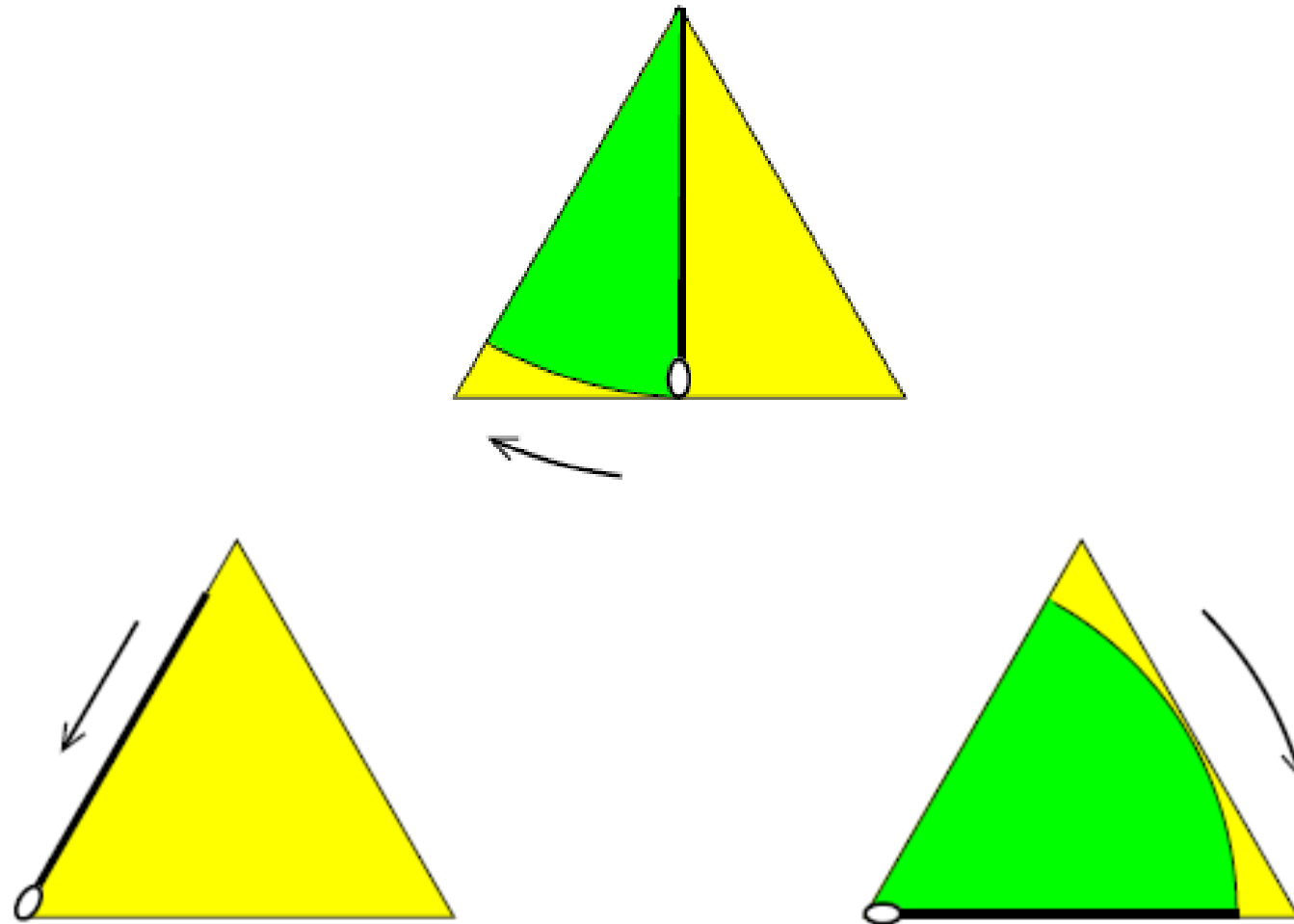
0,78539...

Aire = 0,70477...



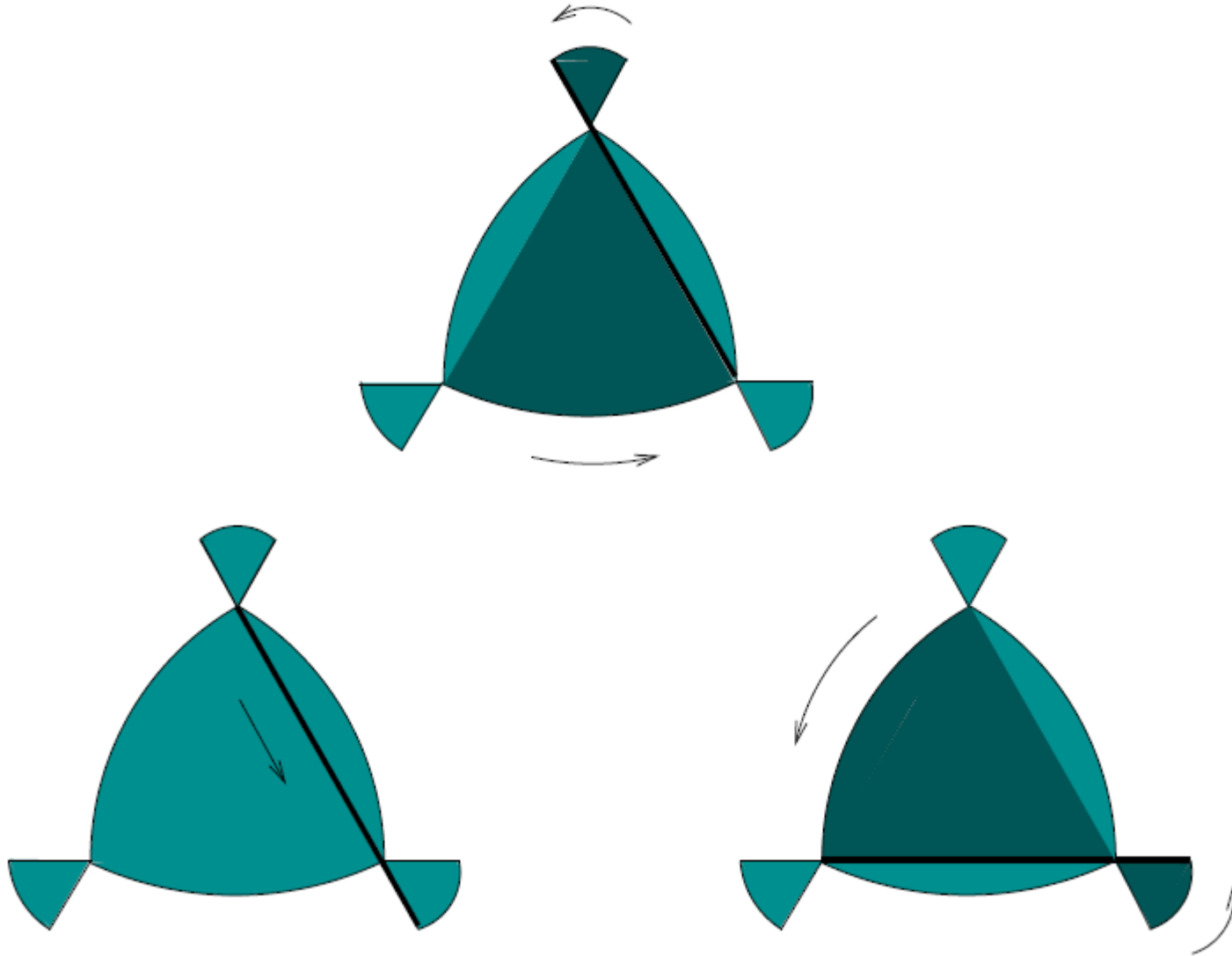
0,70477...

Aire = 0,57735...



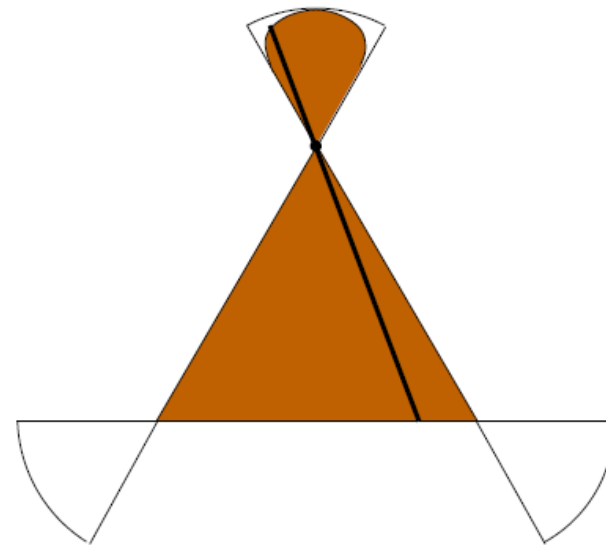
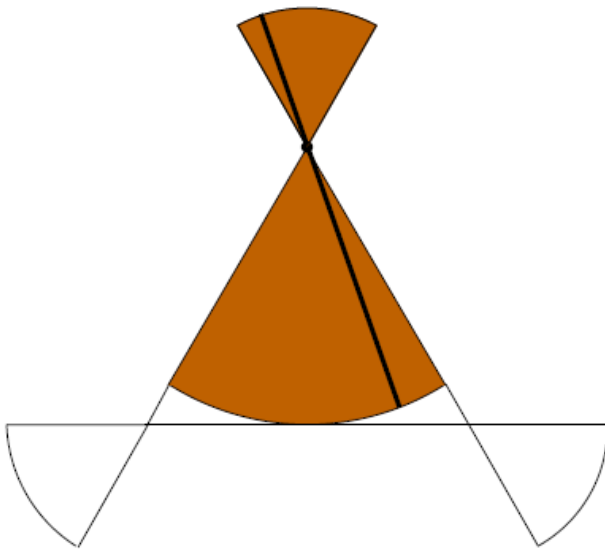
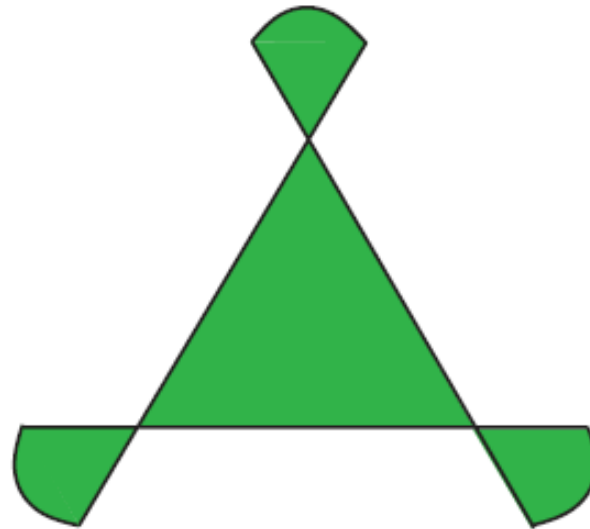
0,57735...

Aire = 0,48649...



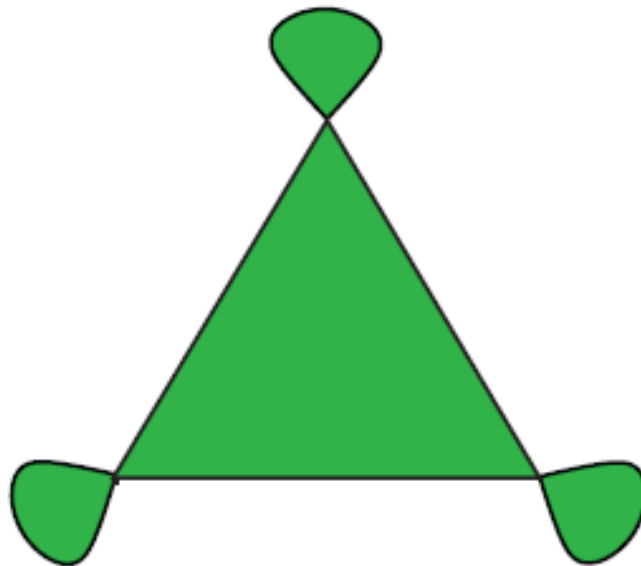
0,48649...

Aire = 0,41296...



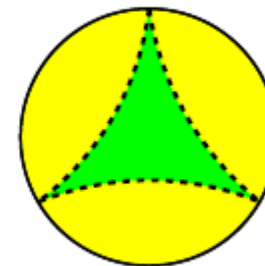
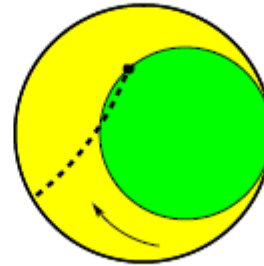
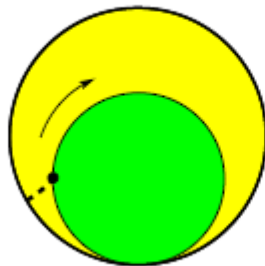
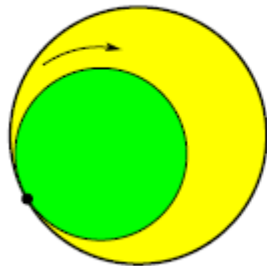
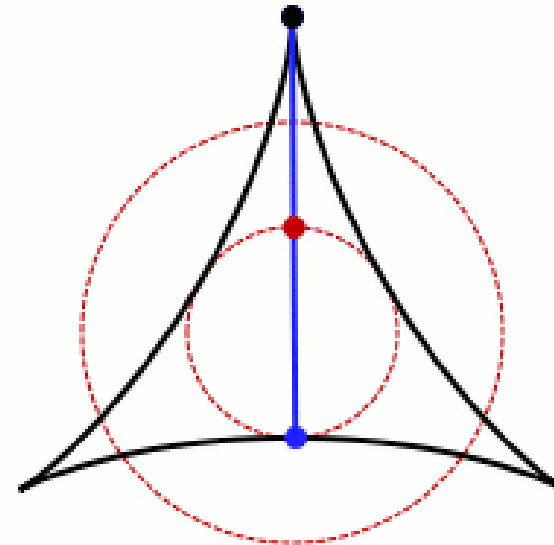
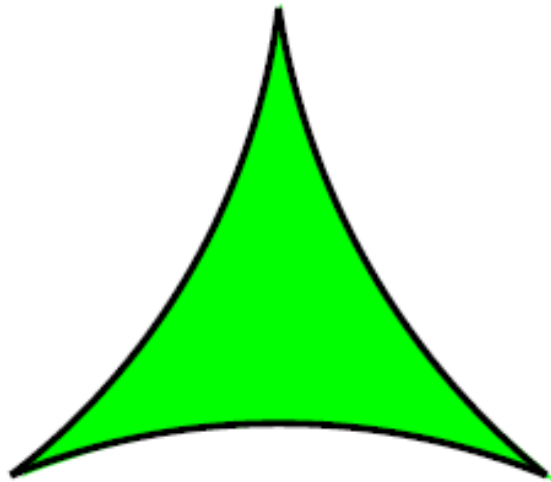
0,41296...

Aire = 0,40475...

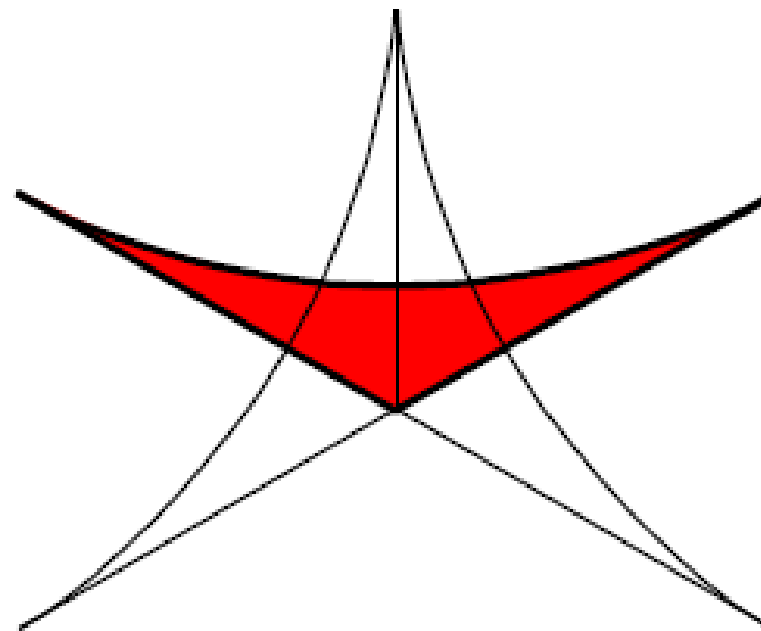
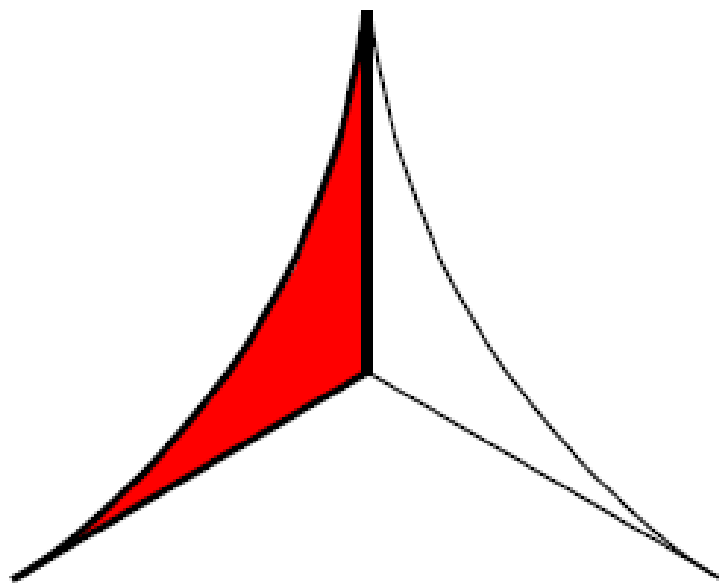
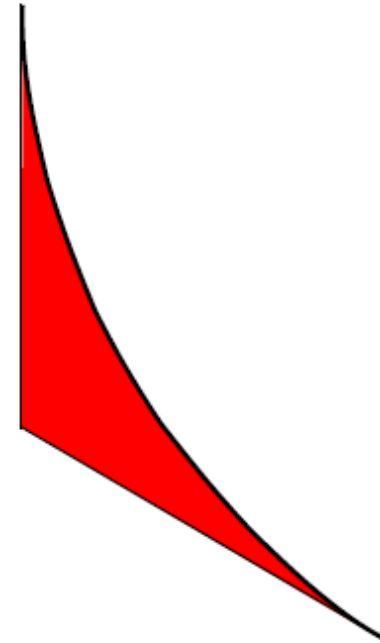
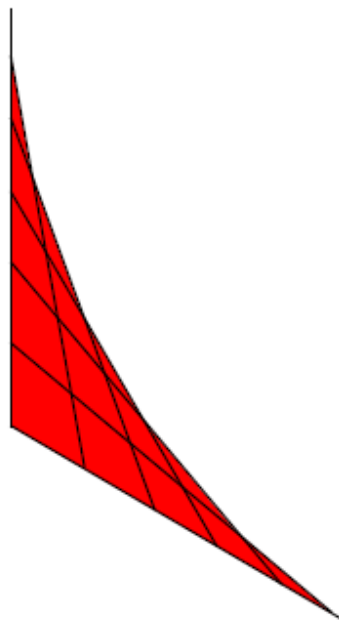
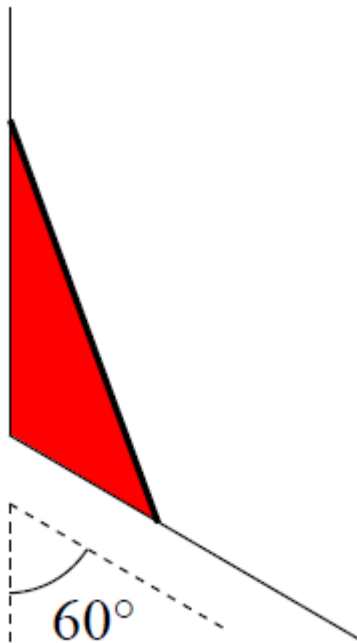


0,40475...

Aire = 0,39269...

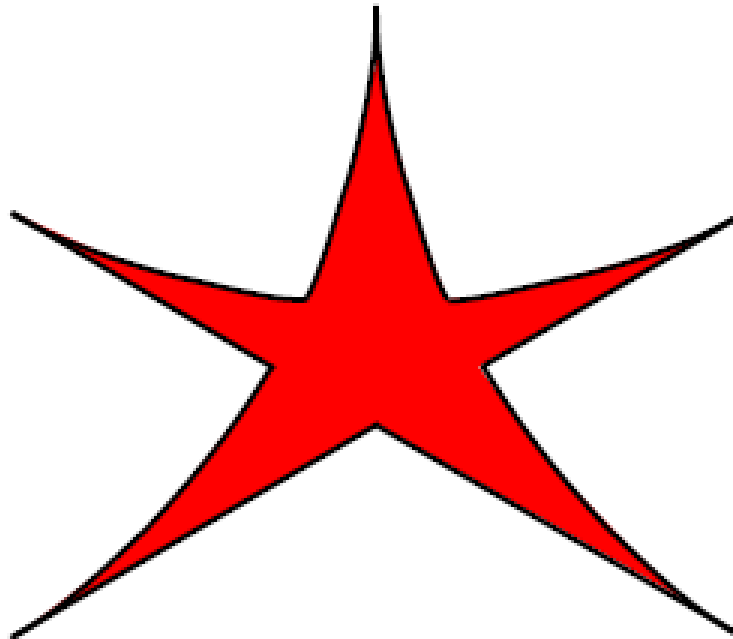


0,39269...



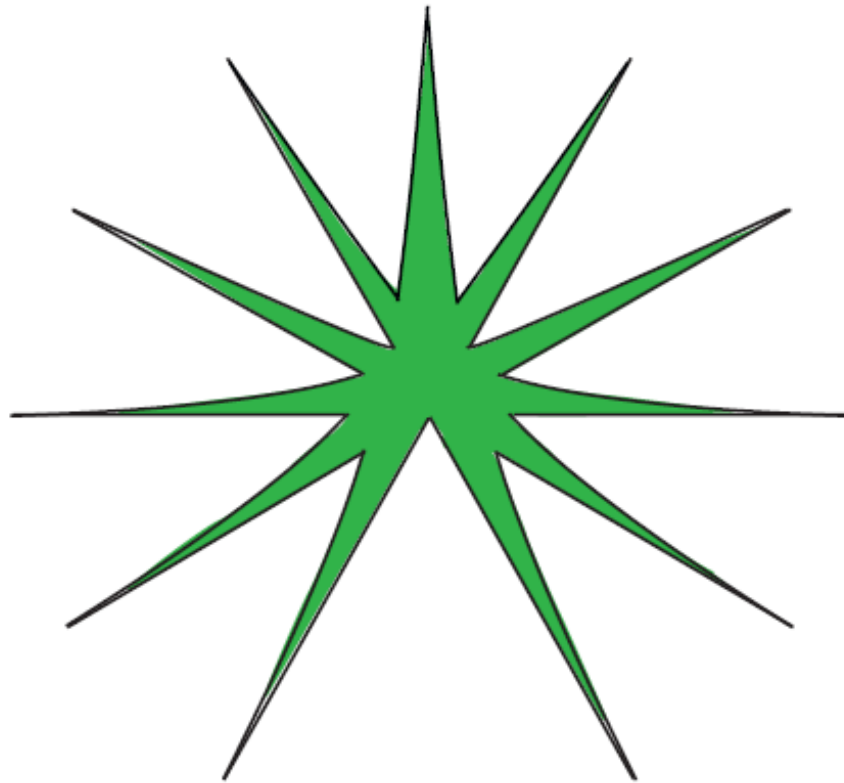
0,39269...

Aire = 0,44843...

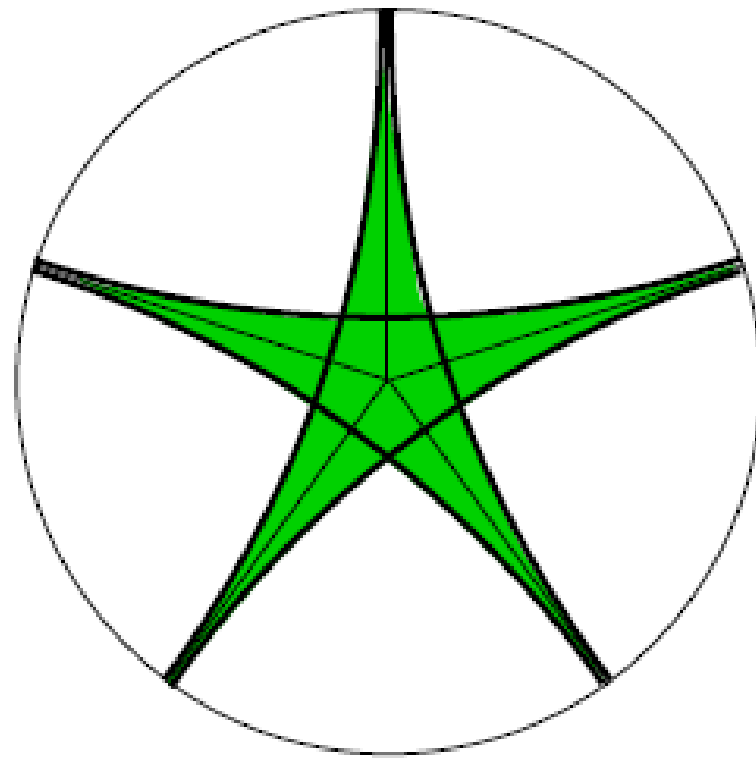
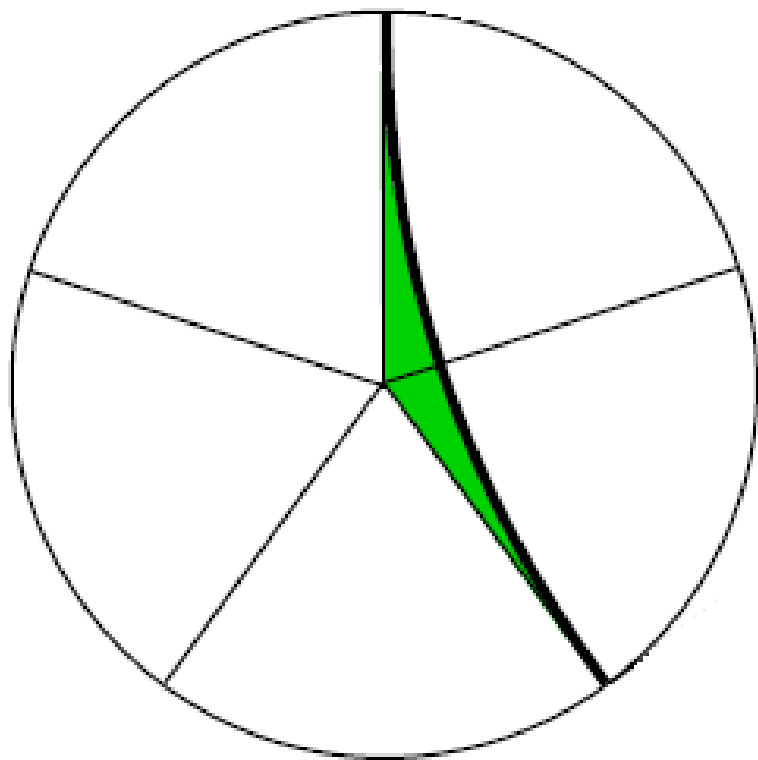


0,39269...

Aire = 0,39140...

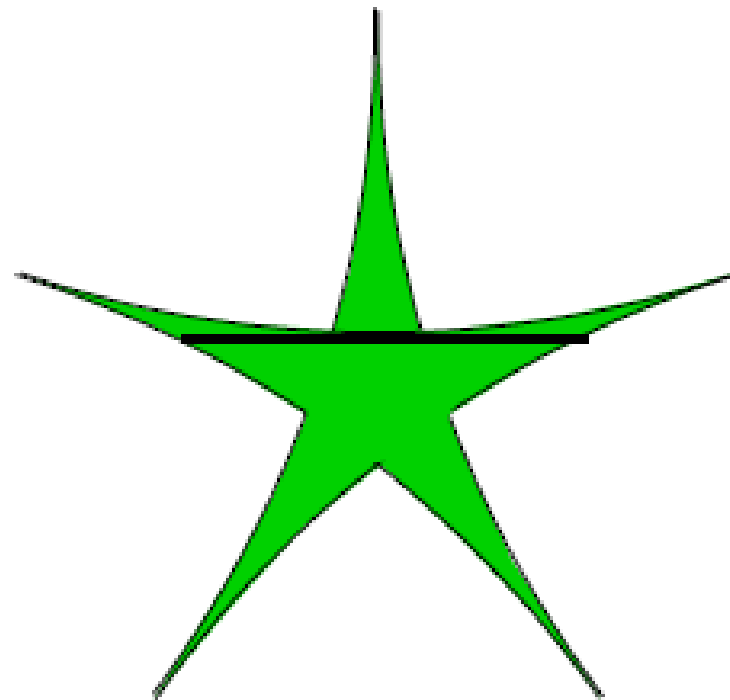
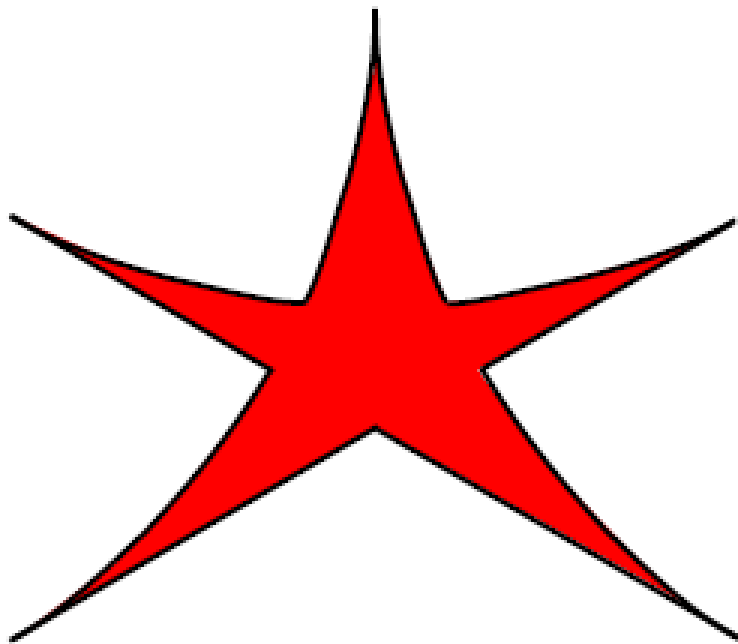


0,39140...



0,39140...

Aire = 0,29044...



0,29044...

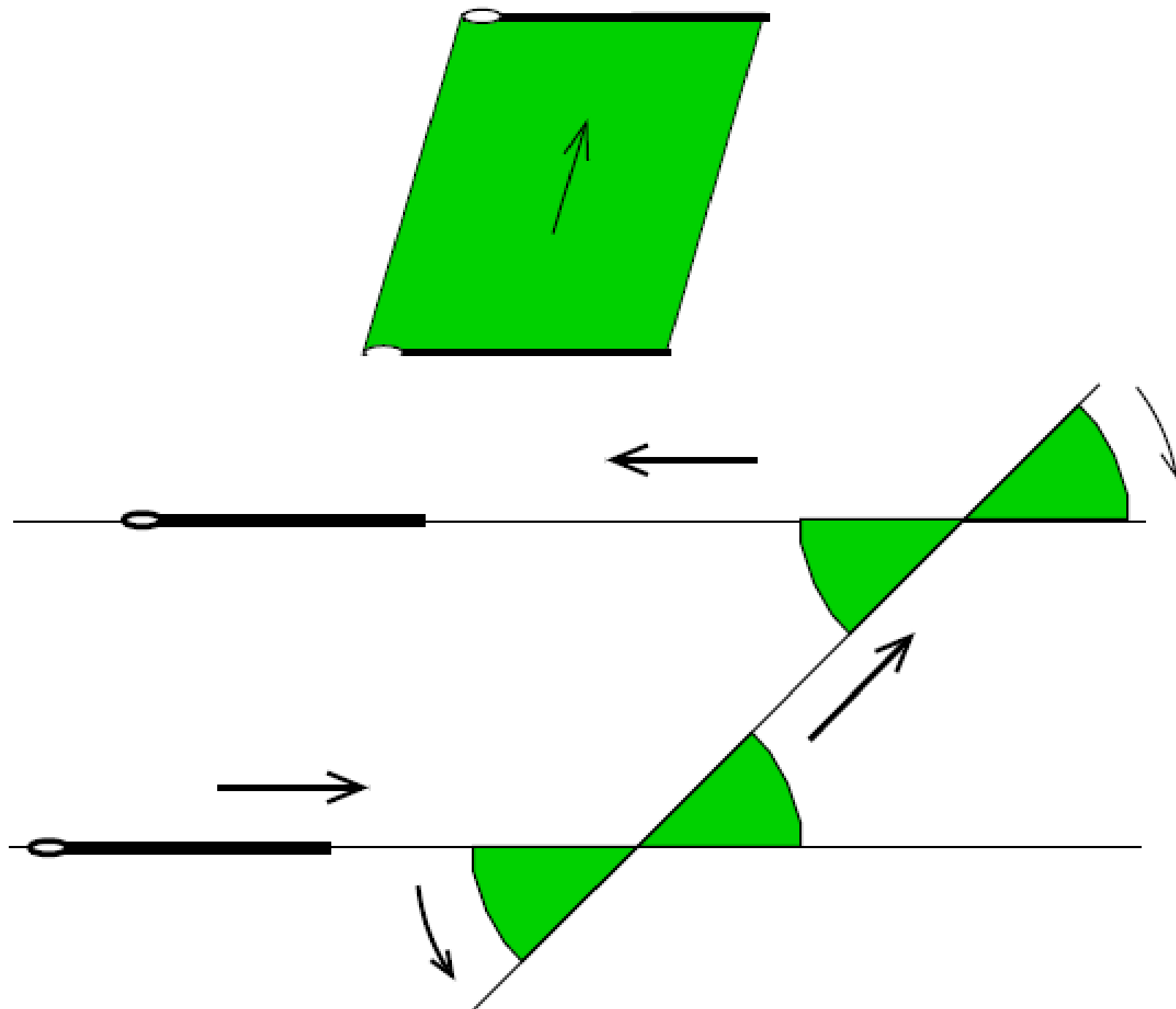
Nombre de branches	11	101	1001	10001
Aire de l'étoile	0,29044377...	0,2843301...	0,2842589...	0,2842582...

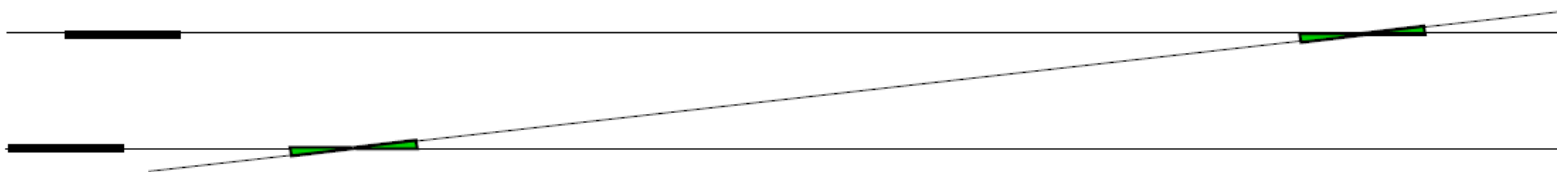
Tend vers 0,284258224...

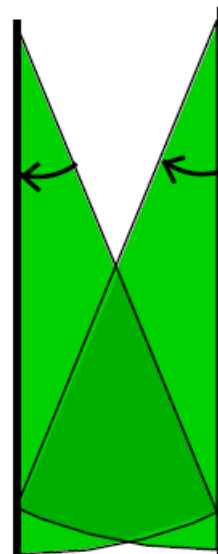
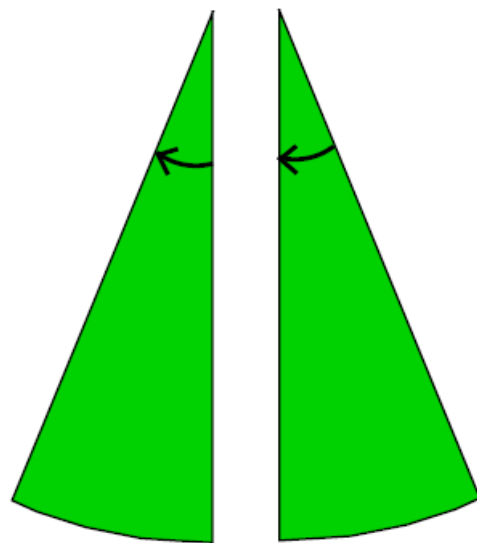
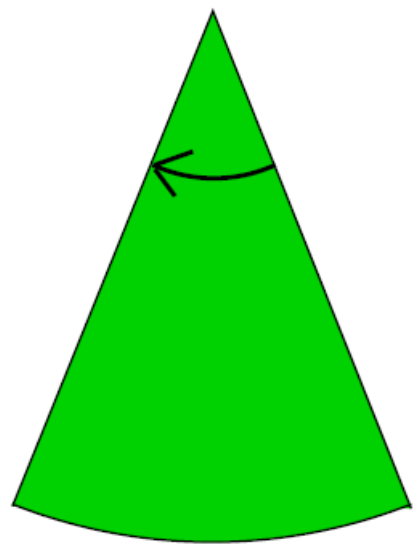
Théorème de Besicovitch (1928)

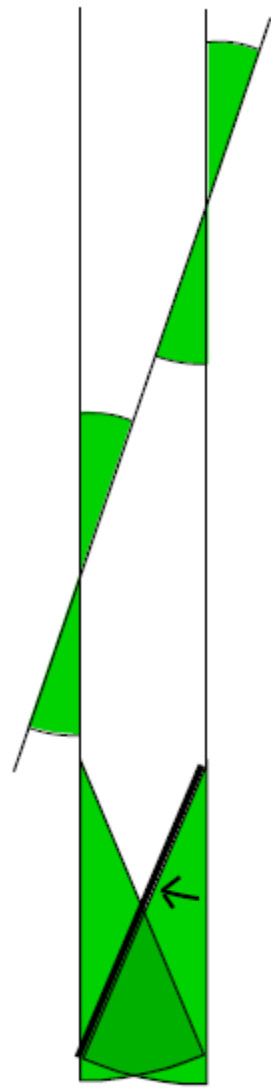
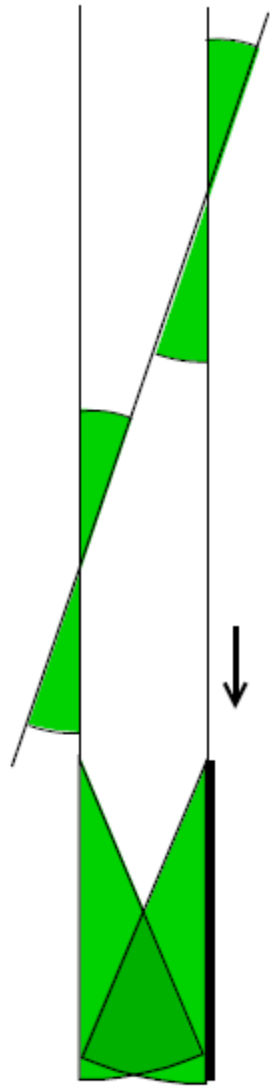
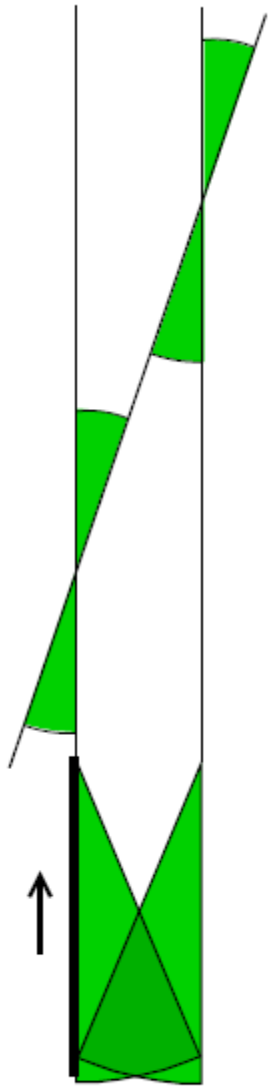
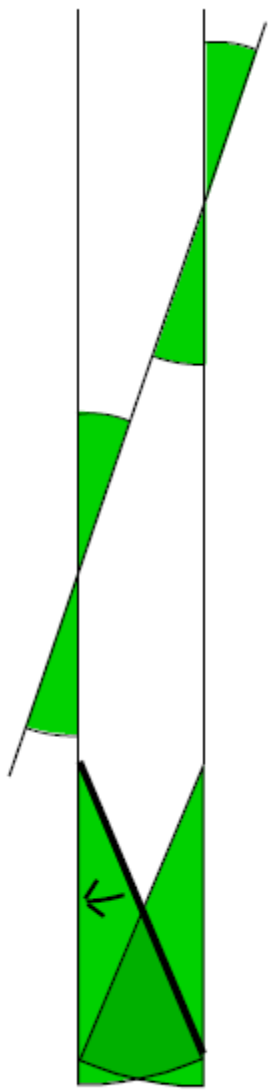
Il est possible de retourner une aiguille dans une aire aussi petite que l'on veut.

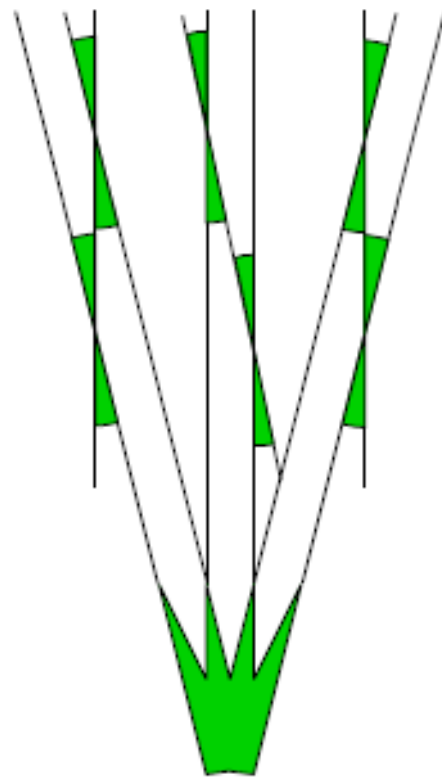
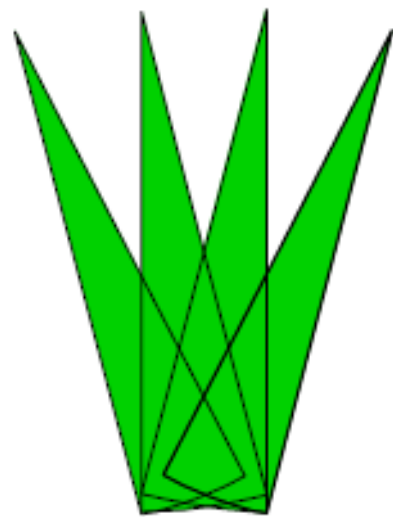
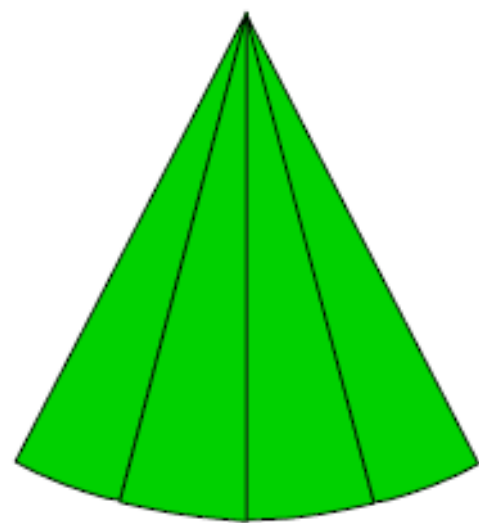


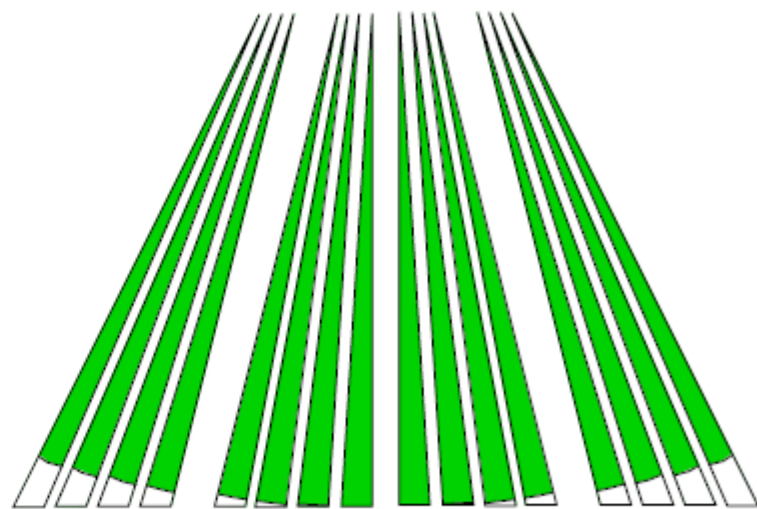
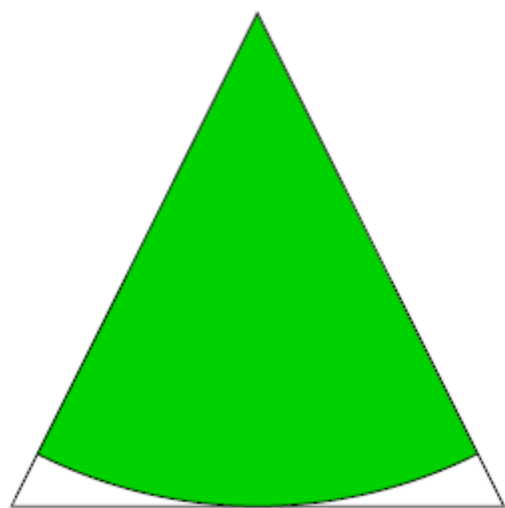


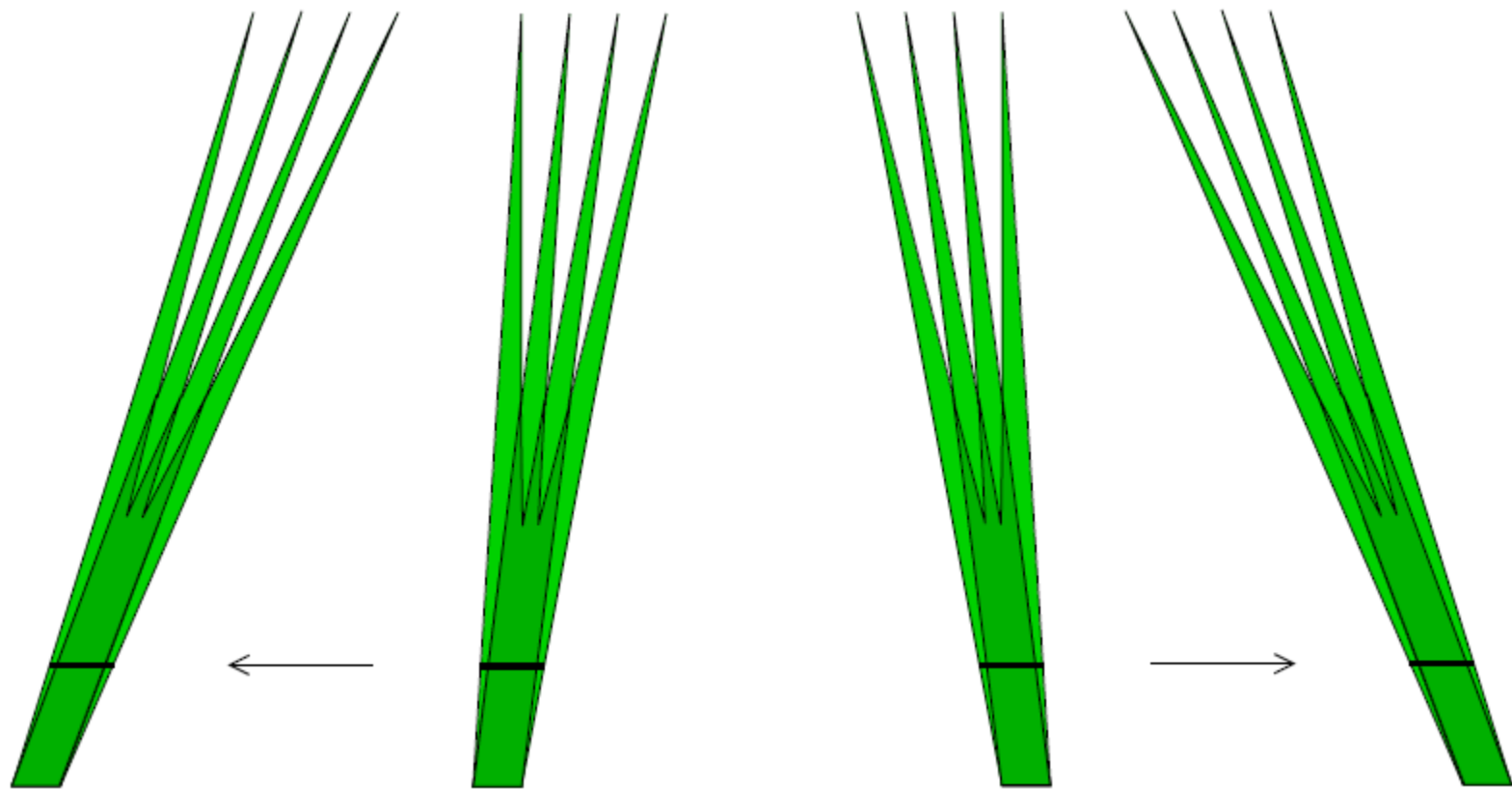


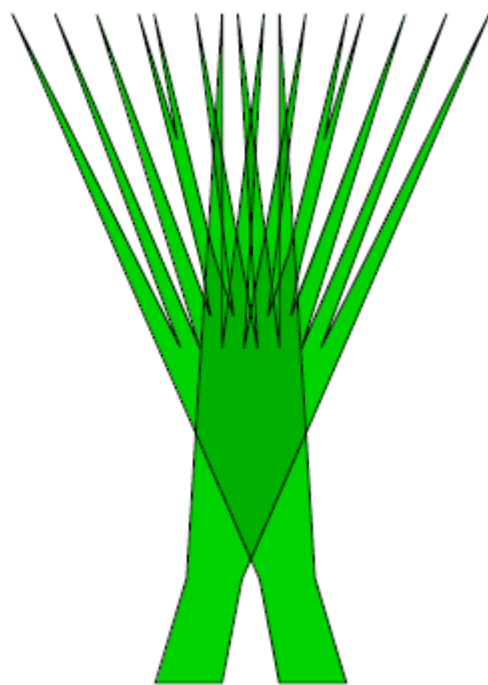
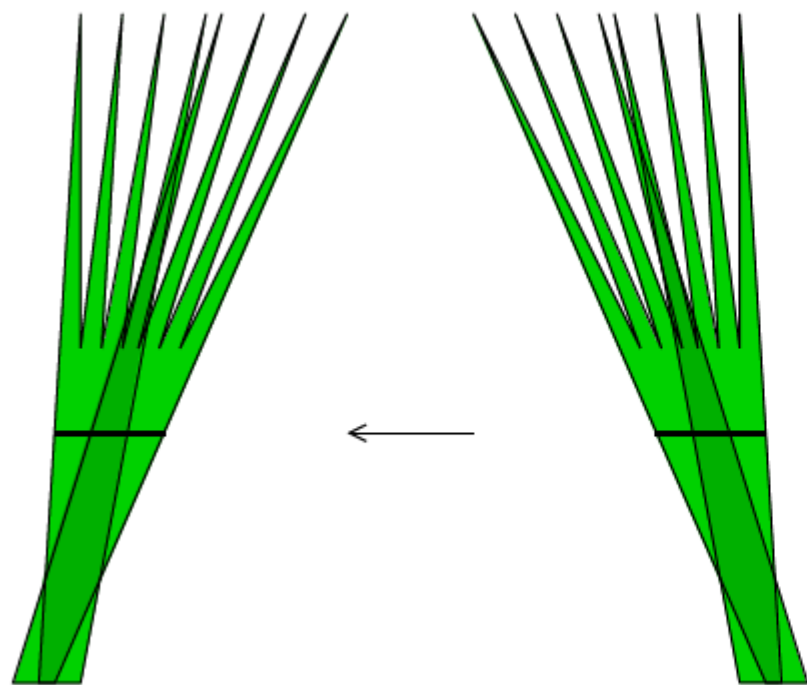


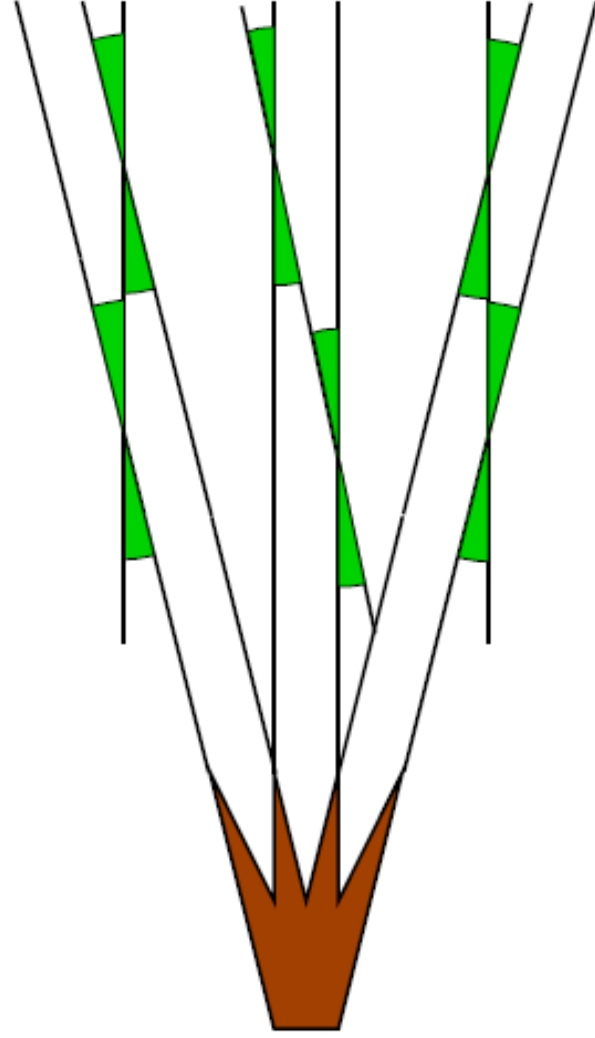


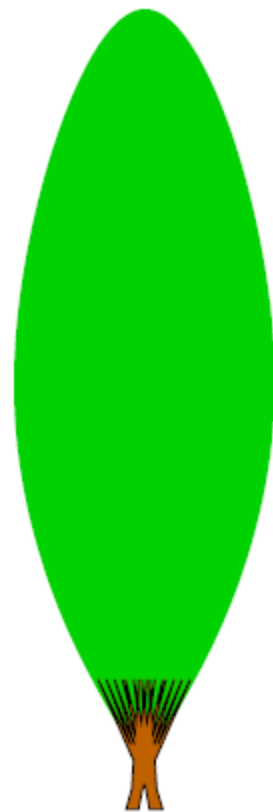
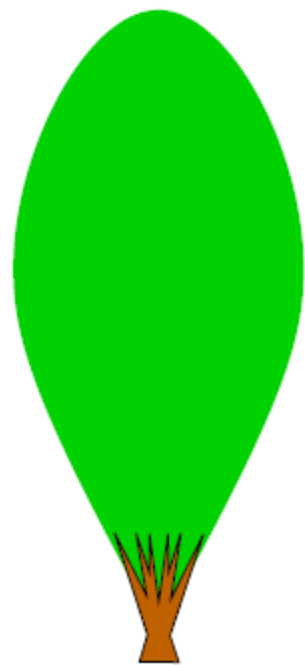
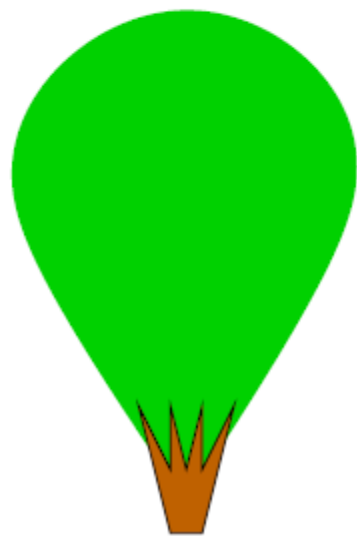








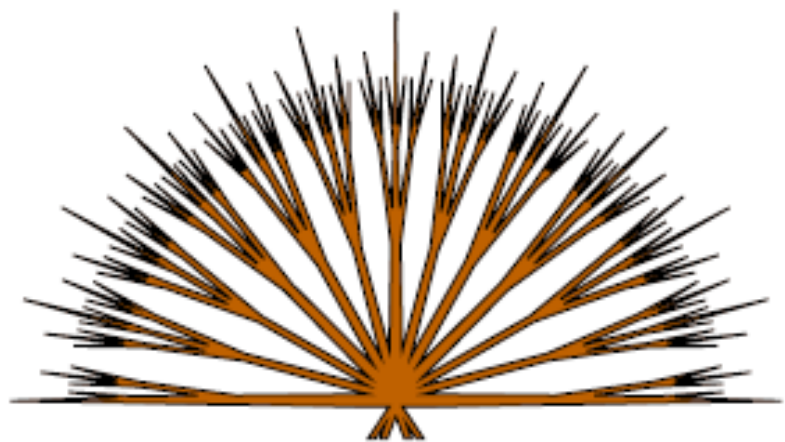
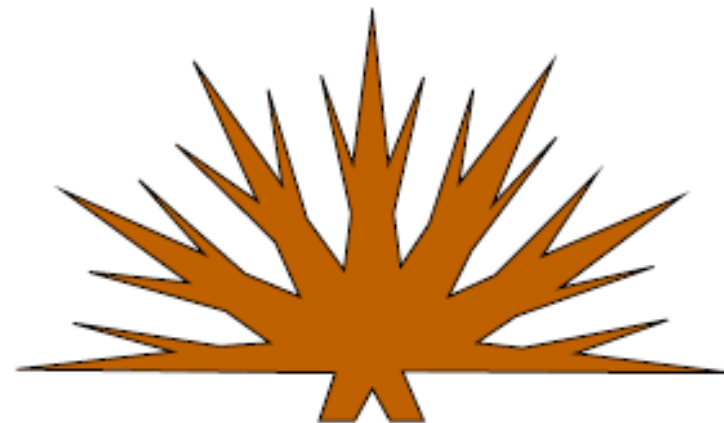
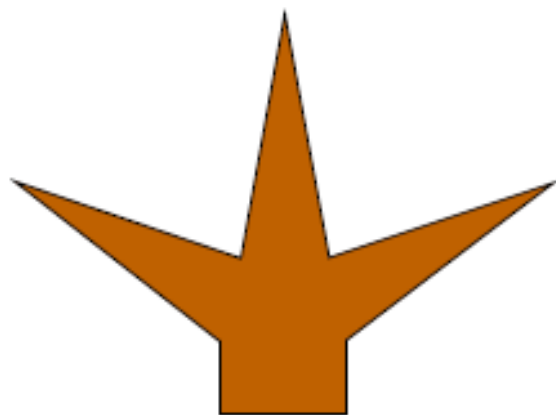




Nouveau théorème de Besicovitch

Il existe une figure d'aire nulle qui contient
l'aiguille dans toutes ses directions

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