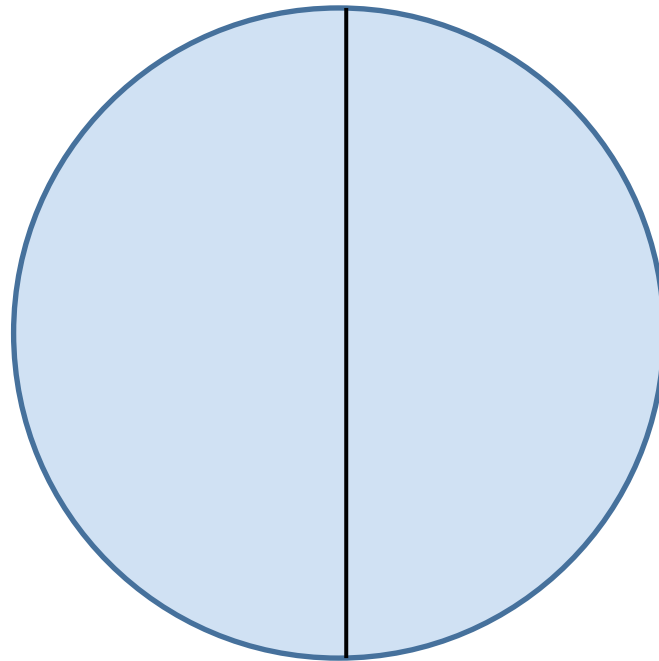

Turning Needle Cars

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A Vision of the Future



$$\text{Area swept out} = \pi\left(\frac{1}{2}\right)^2 = \pi/4$$

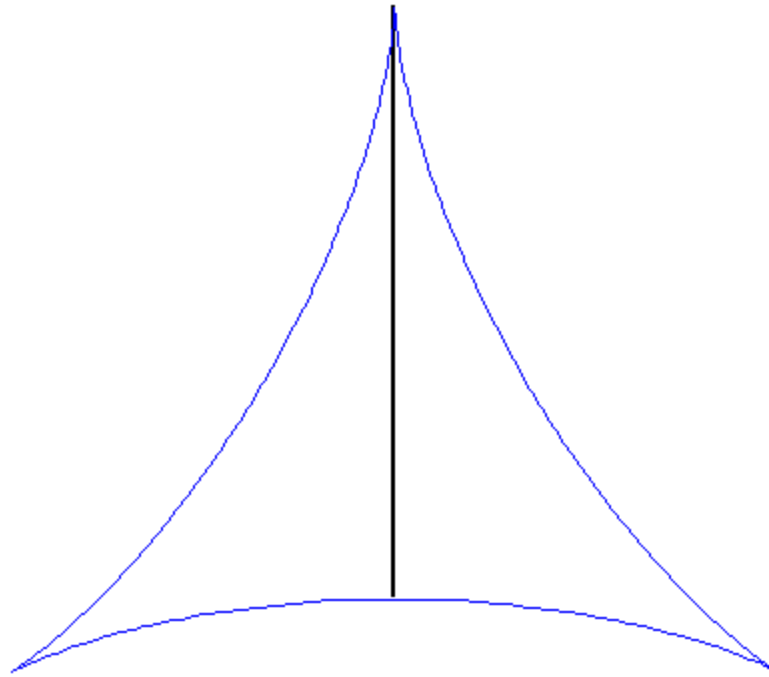
Turning round in $\pi/8$



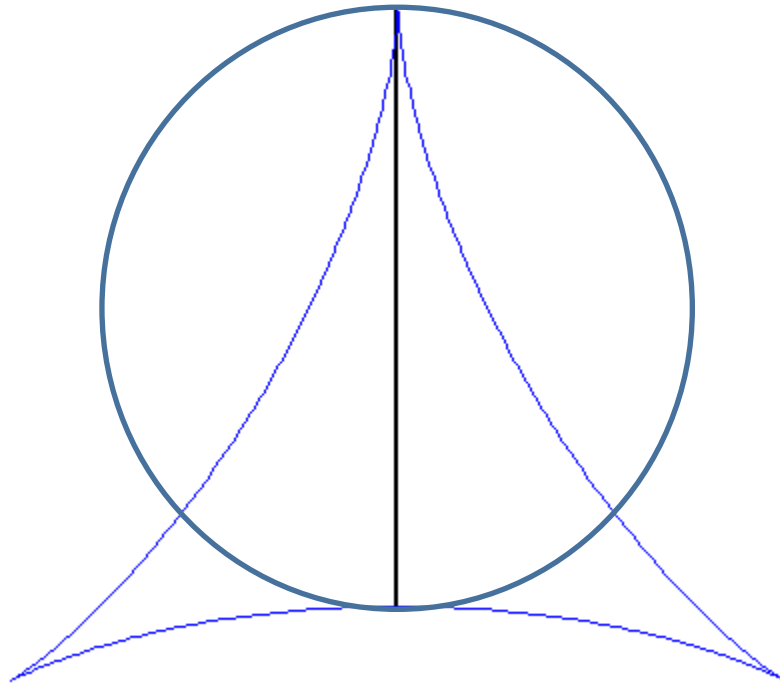
Turning round in $\pi/8$



Turning round in $\pi/8$



Turning round in $\pi/8$

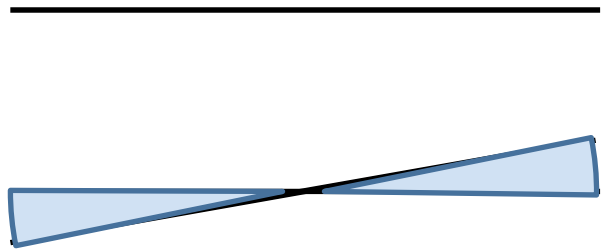


What is the least possible area?

Turning round in ε

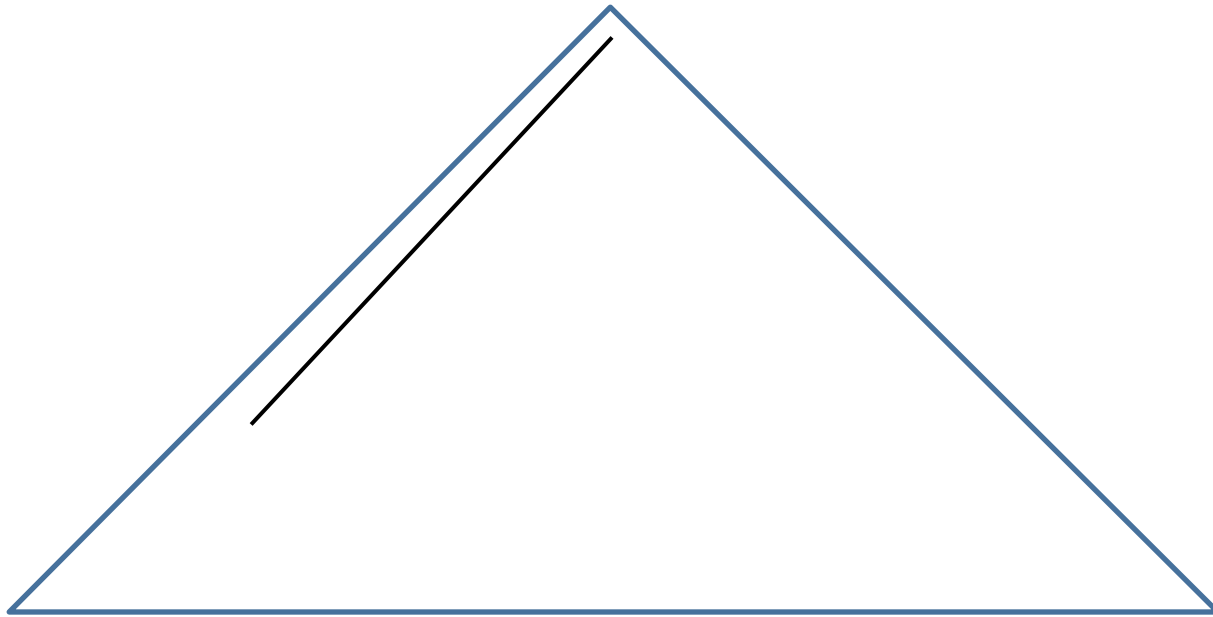
Idea 1

- The area swept out in parallel parking can be made arbitrarily small



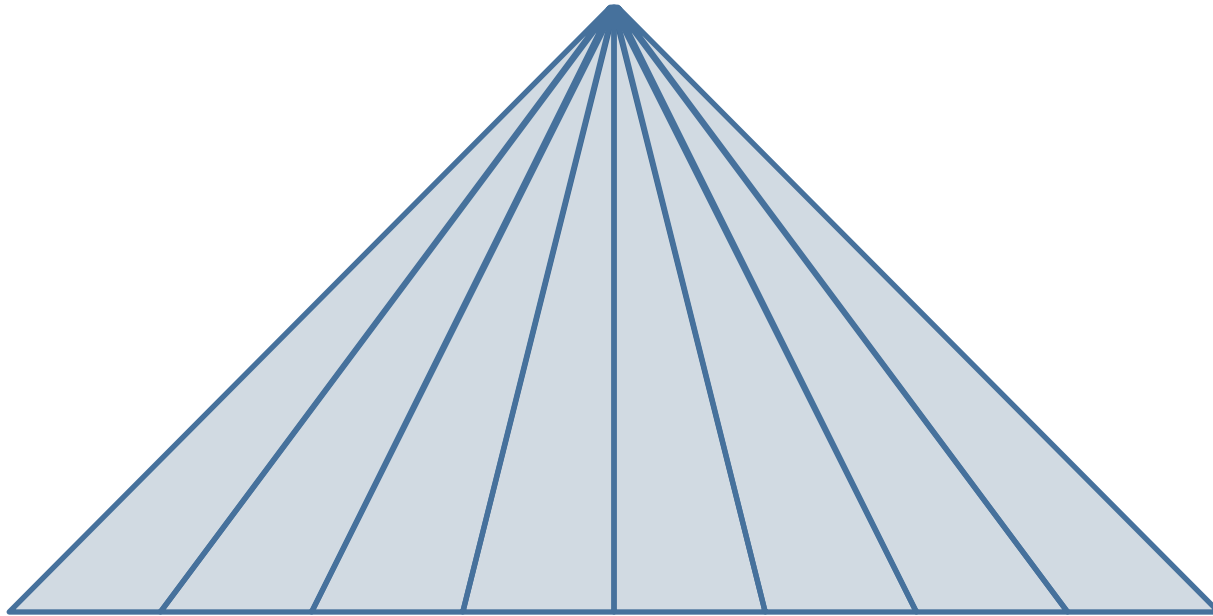
Turning round in ε

Idea 2



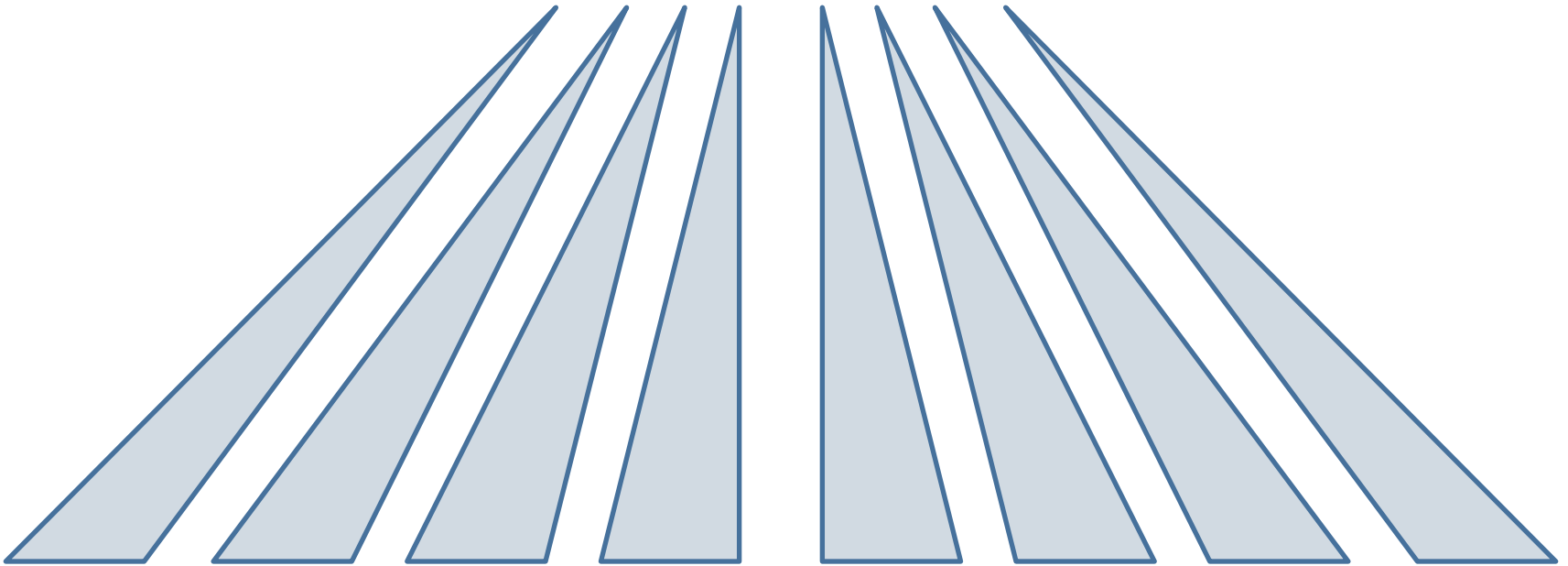
Turning round in ε

Divide base into 2^m equal segments (here $m = 3$)



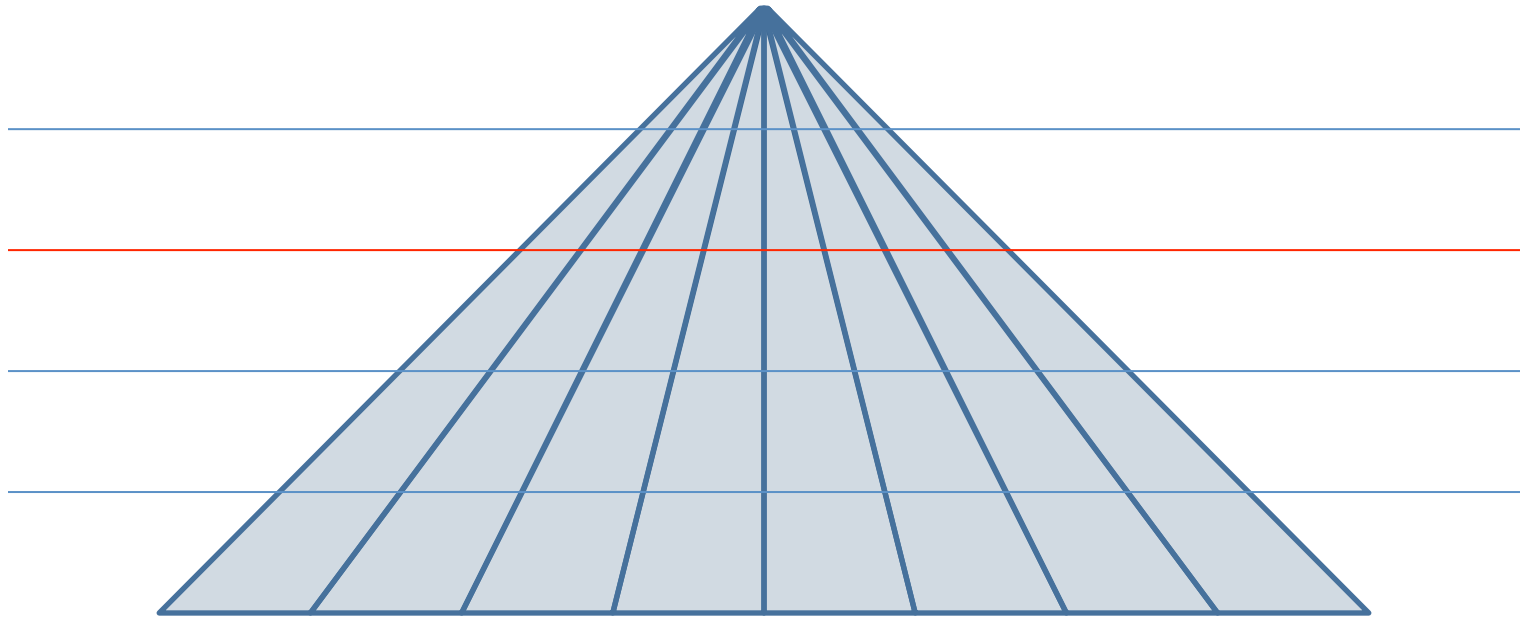
Turning round in ε

Divide base into 2^m equal segments (here $m = 3$)

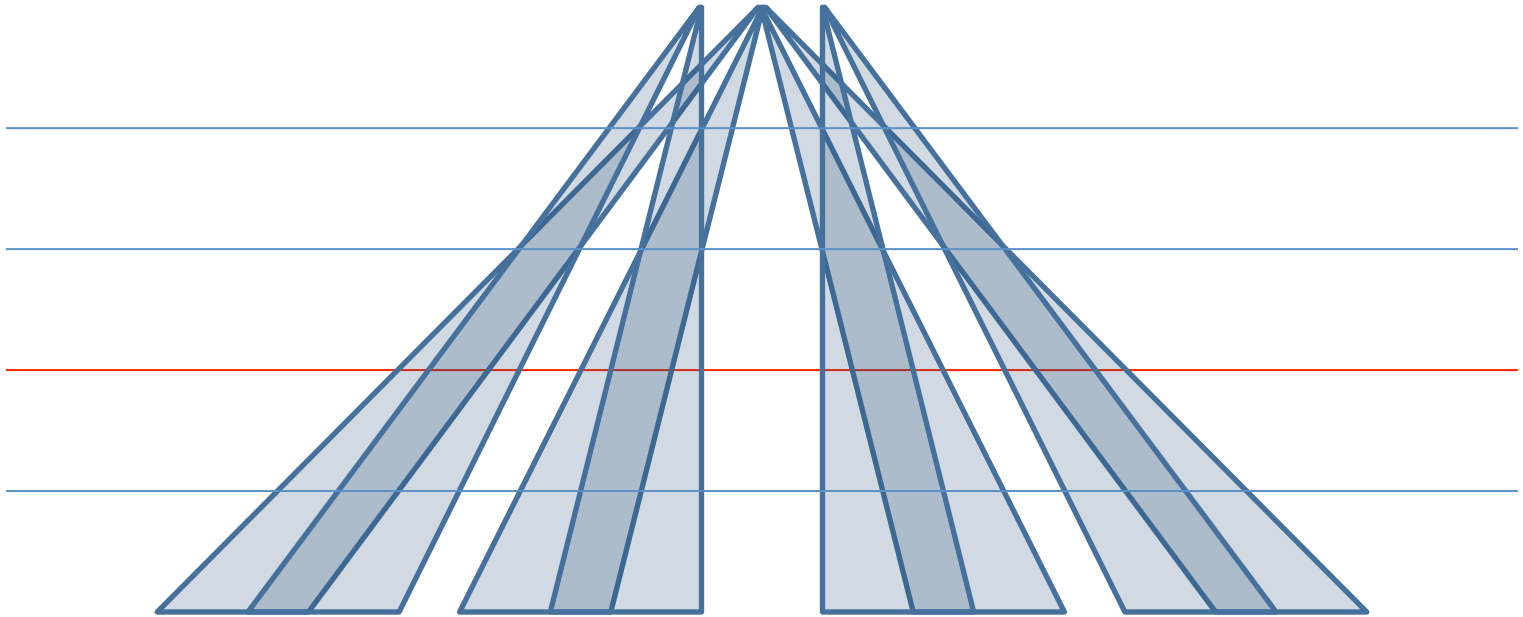


Turning round in ε

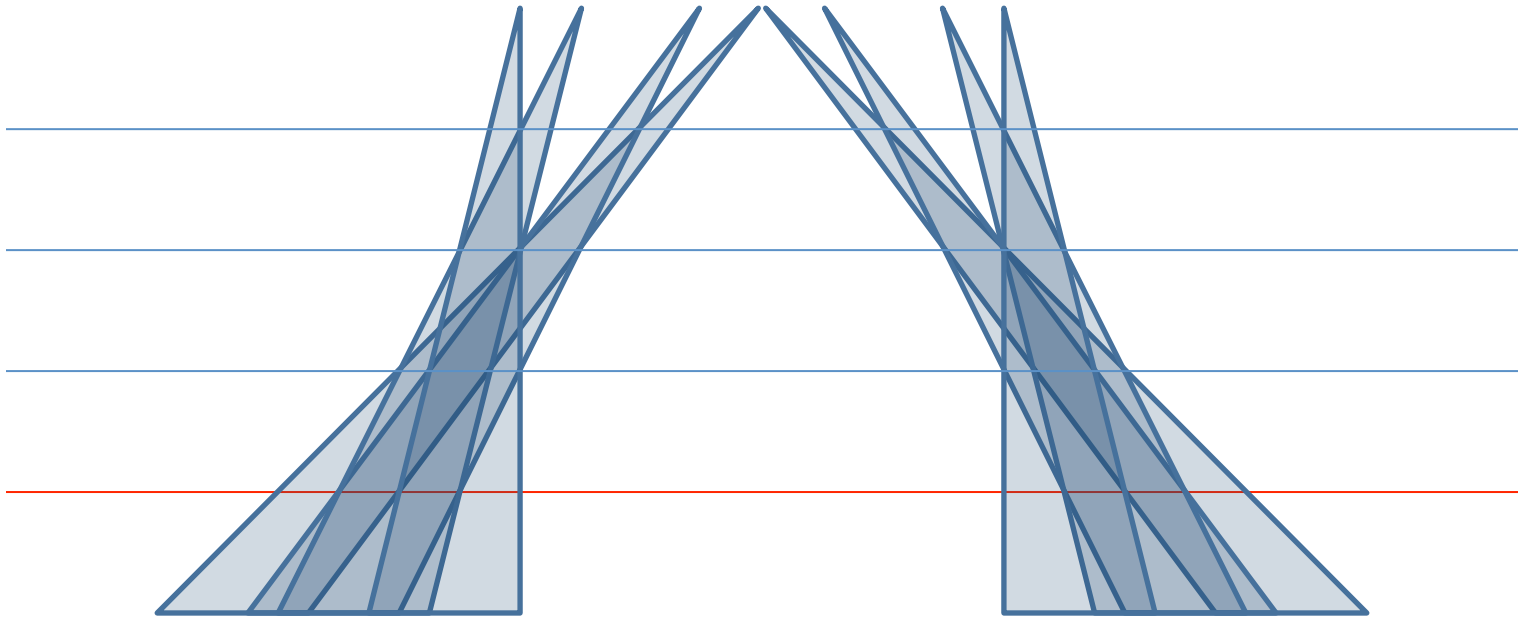
Divide height into $m + 2$ equal bands



Turning round in ε

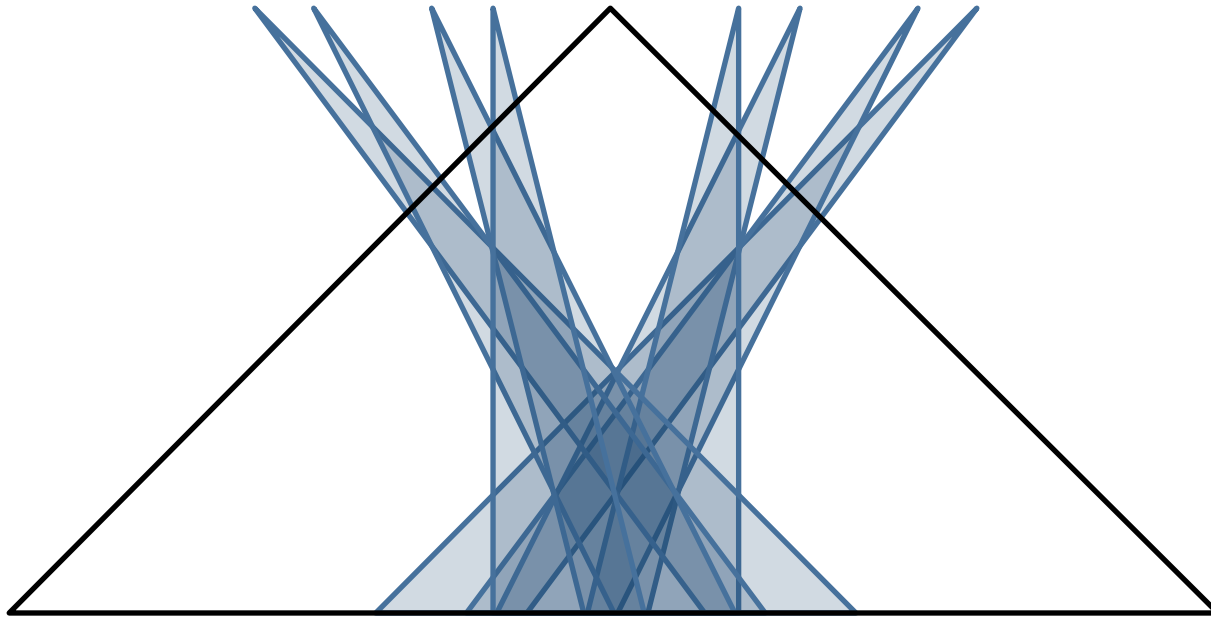


Turning round in ε



Turning round in ε

area of shape has been reduced by a factor of $2/(m+2)$



By choosing m large enough
we can make this arbitrarily small

Conclusion

- the area of the spikagon can be made arbitrarily small (by choosing m large enough)
- the area of the 2^m parallel parks can be made arbitrarily small (by driving far enough)
- the total area needed to turn our needle car round can therefore be made arbitrarily small