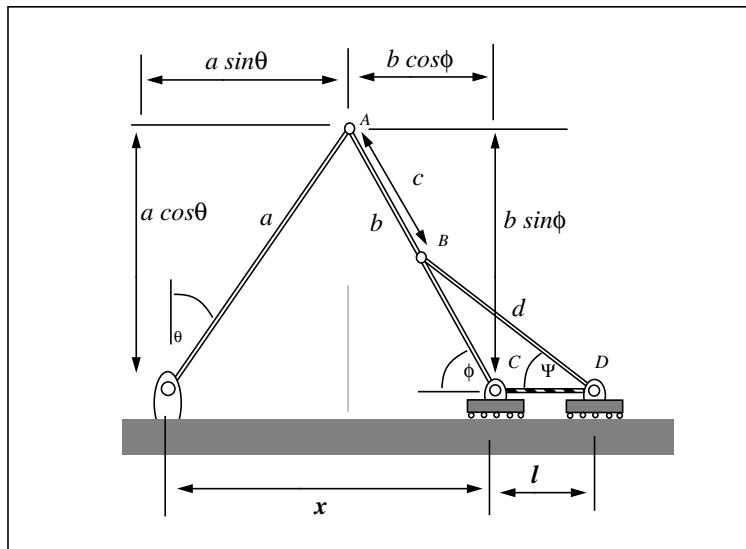


Displacement/Deformation(spring) analysis of opening the umbrella. Again, we show one of the eight, rotationally symmetrically distributed, ribs in a displaced state.



We seek now how the angles Ψ and ϕ , and the lengths x and l , change with θ . This is a matter of geometry of displacement and rotations. Consider θ , a , b , c , and d as given. From the geometry, construct two relationships from which you can compute Ψ and ϕ in terms of these given quantities.

Deduce, again from the geometry, an expression which will allow you to compute the length l given Ψ and ϕ and the given lengths.