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Shortest Paths on the Cone

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Like the cylinder, the cone can be rolled out flat so, again, the shortest route will become a straight line. And again we can use the rubber band to show the shortest route between two points.

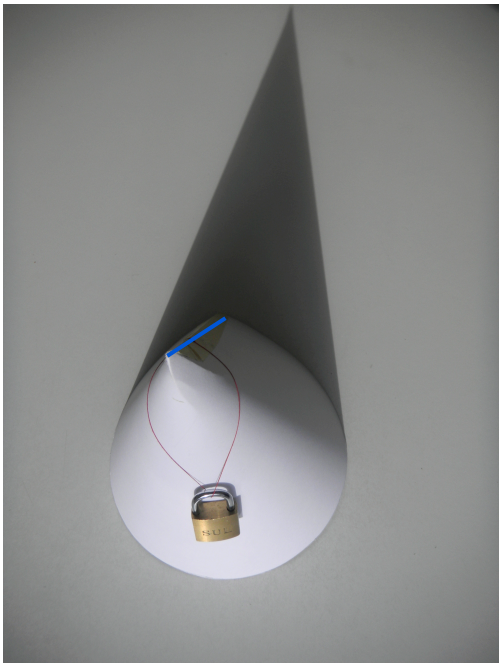
If we ask a different question: Starting at X, what is the shortest circuit which brings us back to our starting point, we could in principle use the rubber band loop but the friction is too great to make this a reliable method. Changing the physical analogue, we could hang a pendant at X and progressively shorten the necklace. But again, difficult in practice.

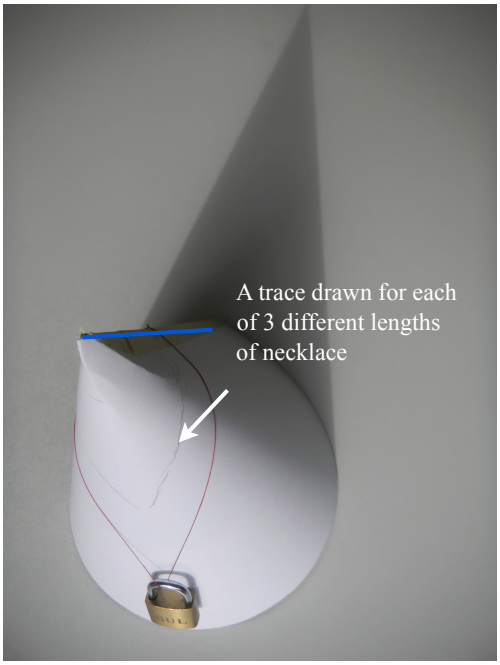
If we don't mind where X is, the following experiment with the pendant gives a clearer result.

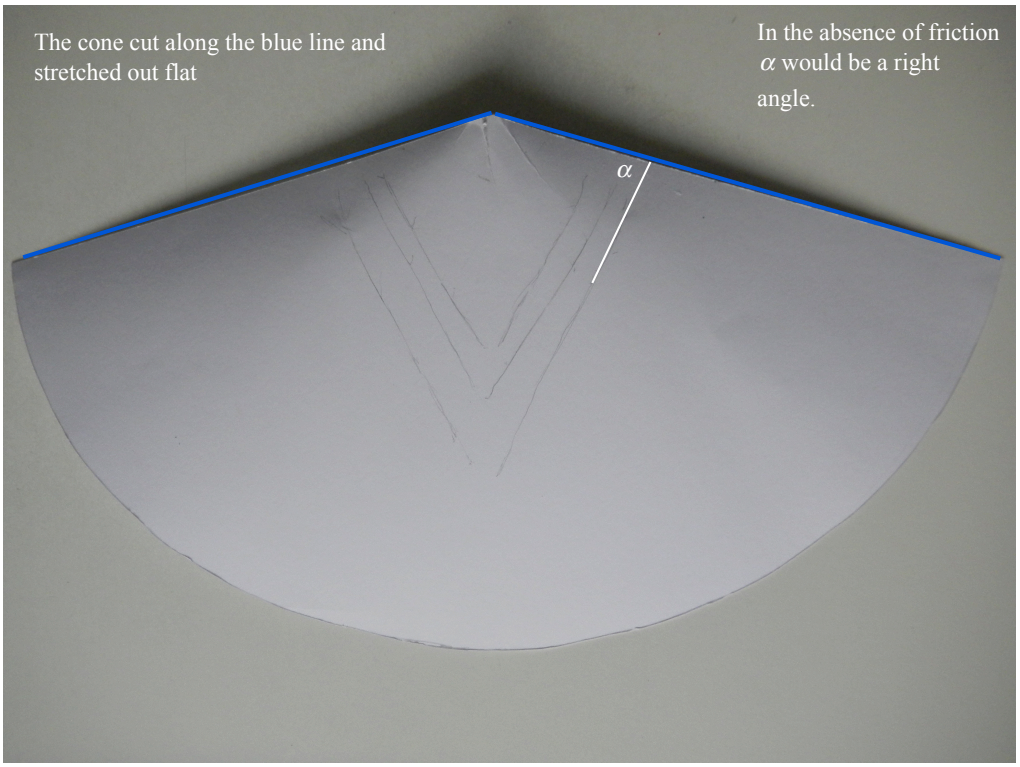
Hold the back of the necklace near the apex of the cone and bring it slowly down. At first the pendant will also fall. But there comes a point where it stops and begins to rise. At this point the necklace traces the shortest route.

Look at the flattened cone, on which we've traced the path. It stays perpendicular to the cone generator at the top.

Paraboloid
Parabola
Hyperbola
Line
Hyperboloid
Ellipse
Hyperbolic paraboloid
Sphere
Line pair
Cone
Sine curve
Cylinder
Tractrix
Circle
Exponential curve
Line family
Catenary
Catenoid
Loxodrome
Helix
Equiangular spiral
Helicoid
Archimedean spiral
Plane




A trace drawn for each
of 3 different lengths
of necklace


The cone cut along the blue line and
stretched out flat
In the absence of friction
α would be a right
angle.
α