19.3: The Intrinsic Equation to the Cycloid

An element ds of arc length, in terms of dx and dy, is given by the theorem of Pythagoras: $ds = ((dx)^2 + (dy)^2))^{1/2}$ or, since x and y are given by the parametric Equations 19.1.1 and 19.1.2, by And of course we have just shown that the intrinsic coordinate ψ (i.e. the angle that the tangent to the cycloid makes with the horizontal) is equal to θ.

Exercise 19.3.1

Integrate ds (with initial condition s = 0, θ = 0) to show that the intrinsic equation to the cycloid is

$$s = 4a \sin \psi \tag{19.3.1}$$

Also, eliminate ψ (or θ) from Equations 19.3.1 and 19.1.2 to show that the following relation holds between arc length and height on the cycloid:

$$s^2 = 4ay. \tag{19.3.2}$$