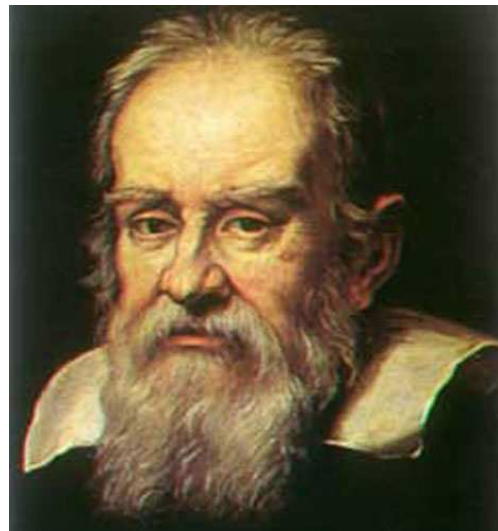
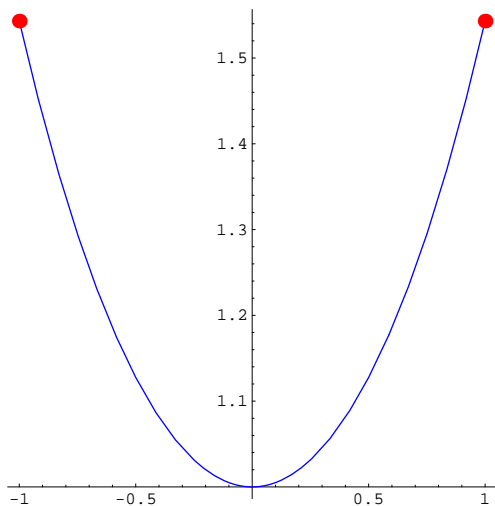


Find the arc length of the catenary  $\vec{r}(t) = \langle t, \cosh(t) \rangle$ , where  $\cosh(t) = (e^t + e^{-t})/2$  is the **hyperbolic cosine** and  $t \in [-1, 1]$ .

**Hint:** Use the identity  $\cosh^2(t) - \sinh^2(t) = 1$ , where  $\sinh(t) = (e^t - e^{-t})/2$  is the **hyperbolic sine**.



**HISTORY:** Galileo was the first to investigate the catenary. It is the curve, a freely hanging heavy rope describes, if the end points have the same height. Galileo mistook the curve for a parabola. It was Johannes Bernoulli in 1691, who obtained its true form after some competition involving Huygens, Leibniz and two Bernoullis. The name "catenarian" (=chain curve) was first used by Huygens in a letter to Leibniz in 1690.