Chain sliding off the edge of table without friction

A uniform chain of total length $A$ has a portion $B$ ($0 < B < A$) hanging over the edge of a table with a smooth (frictionless) surface. Show that the time it takes the chain to slide off the table if it starts from rest is

$$T = \sqrt{\frac{A}{g}} \ln \left( \frac{A}{B} + \sqrt{\frac{A^2}{B^2} - 1} \right).$$

Solution: