

## 21-P-FA-AG-016

An adventurer, travelling by sea to his distant home, dozes off and begins to dream about the  $W$  kg Magnificent Treasure he *almost* stole from the Deep Dark Dungeon. The adventurer remembers tying a rope around the treasure chest containing the Magnificent Treasure and pulling on it so that the rope was constantly at  $\theta$  degrees. They pulled with a force of  $F = At^2$  Newtons. If the coefficient of static friction was  $\mu$ , at what time did the adventurer manage to make the treasure move?

*Do not consider if it tips first.*

ANSWER:

To find the answer, we create a force balance equation in the x-direction. Then, we solve for time.

$$\sum F_x = 0 = At^2 \cdot \cos(\theta) - (W \cdot g - At^2 \cdot \sin(\theta)) \cdot \mu$$

$$At^2(\cos(\theta) + \sin(\theta) \cdot \mu) - W \cdot g \cdot \mu = 0$$

$$t = \sqrt{\frac{W \cdot g \cdot \mu}{A \cdot (\cos(\theta) + \sin(\theta) \cdot \mu)}}$$