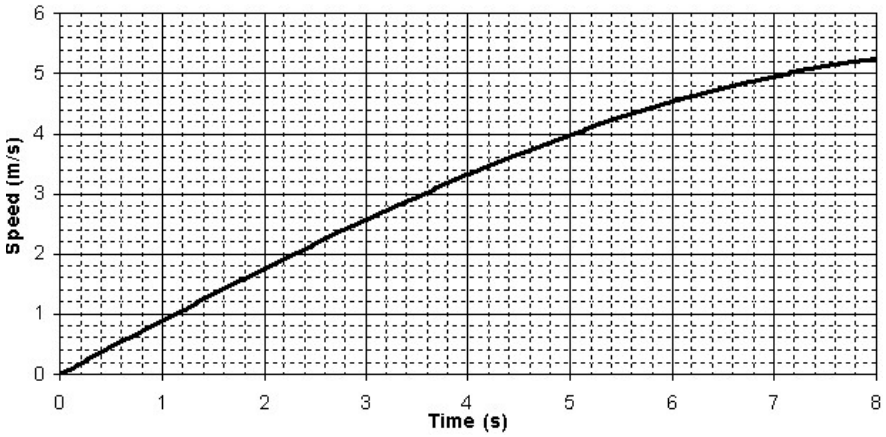
NAME _____ DATE _____

Scenario

An axle with a large amount of rotational inertia is lubricated so that it rotates with negligible friction. A light but thick rope is wrapped around the axle so that the rope is layered on top of itself several times as shown in the diagram. The free end of the string is connected to an object of mass $M = 2$ kg that is much heavier than the rope but much lighter than the axle. The mass is released at time $t = 0$ and is allowed to fall, causing the axle to accelerate rotationally. The downward speed of the mass is shown on the graph as a function of time.



Create an Equation

PART A: Write an equation that represents Newton's second law as applied to the mass. Then use the equation and the graph to estimate the tensions in the string T_0 (at time $t = 0$) and T_8 (at time $t = 8$ seconds).

The slope of the graph decreases slightly during the 8-second interval.

Analyze Data

PART B: Your answers in Part A should show that the tension increases slightly during the 8-second interval. Explain why this is the case.

Argumentation

PART C: Explain why the slope of the above graph decreases slightly. Cite specific physical principles and relationships.