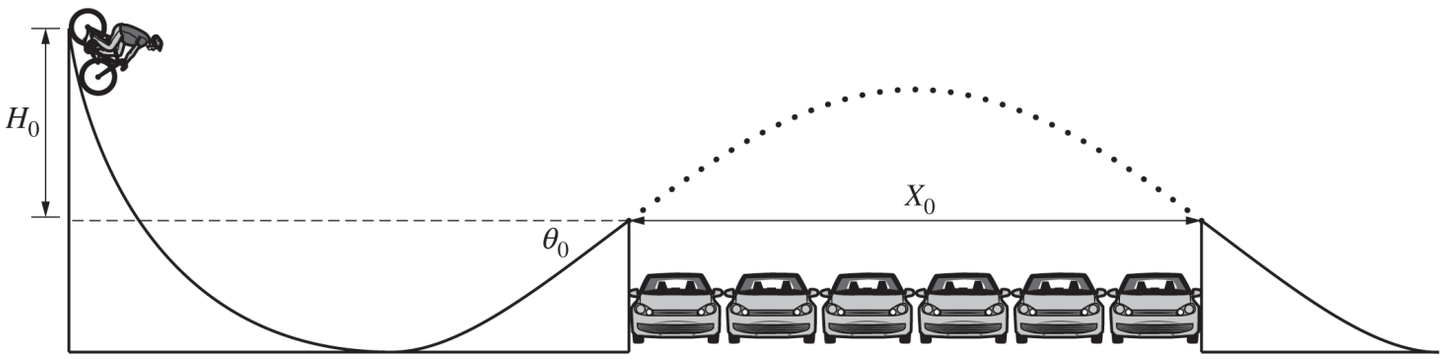
PHYSICS 1

SECTION II

Time—1 hour and 30 minutes

5 Questions

Directions: Questions 1, 4, and 5 are short free-response questions that require about 13 minutes each to answer and are worth 7 points each. Questions 2 and 3 are long free-response questions that require about 25 minutes each to answer and are worth 12 points each. Show your work for each part in the space provided after that part.



Note: Figure not drawn to scale.

1. (7 points, suggested time 13 minutes)

A stunt cyclist builds a ramp that will allow the cyclist to coast down the ramp and jump over several parked cars, as shown above. To test the ramp, the cyclist starts from rest at the top of the ramp, then leaves the ramp, jumps over six cars, and lands on a second ramp.

H_0 is the vertical distance between the top of the first ramp and the launch point.
θ_0 is the angle of the ramp at the launch point from the horizontal.
X_0 is the horizontal distance traveled while the cyclist and bicycle are in the air.
m_0 is the combined mass of the stunt cyclist and bicycle.

(a) Derive an expression for the distance X_0 in terms of H_0, θ_0, m_0, and physical constants, as appropriate.

GO ON TO THE NEXT PAGE.

Use a pencil or pen with black or dark blue ink only. Do NOT write your name. Do NOT write outside the box.

(b) If the vertical distance between the top of the first ramp and the launch point were $2H_0$ instead of H_0, with no other changes to the first ramp, what is the maximum number of cars that the stunt cyclist could jump over? Justify your answer, using the expression you derived in part (a).