

Department of Mechanical Engineering  
 University of California at Berkeley  
 ME 104 Engineering Mechanics II  
 Spring Semester 2017

Midterm Examination No. 1

Mar 1, 2017

The examination has a duration of 50 minutes.

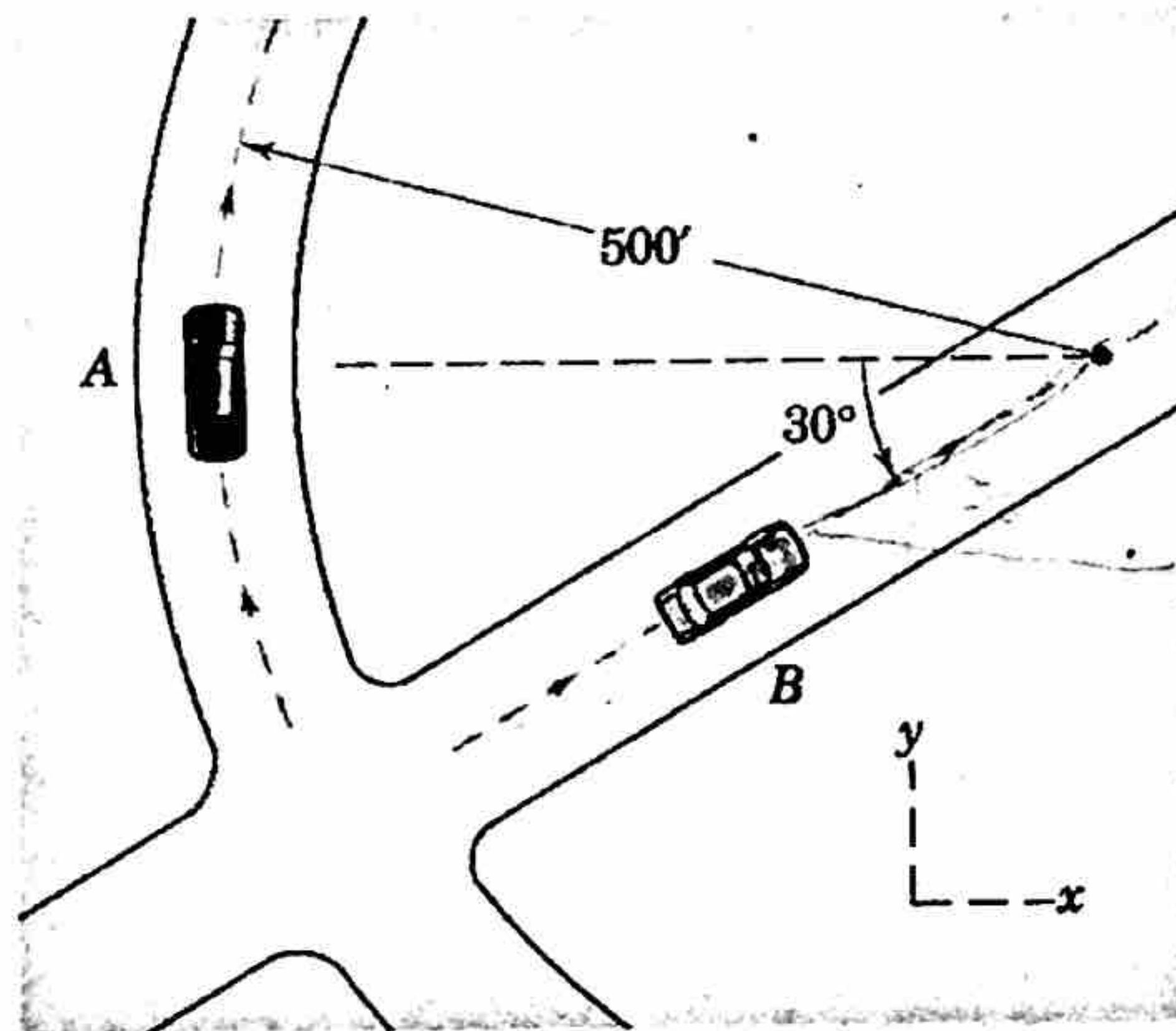
Answer all questions.

All questions carry the same weight.

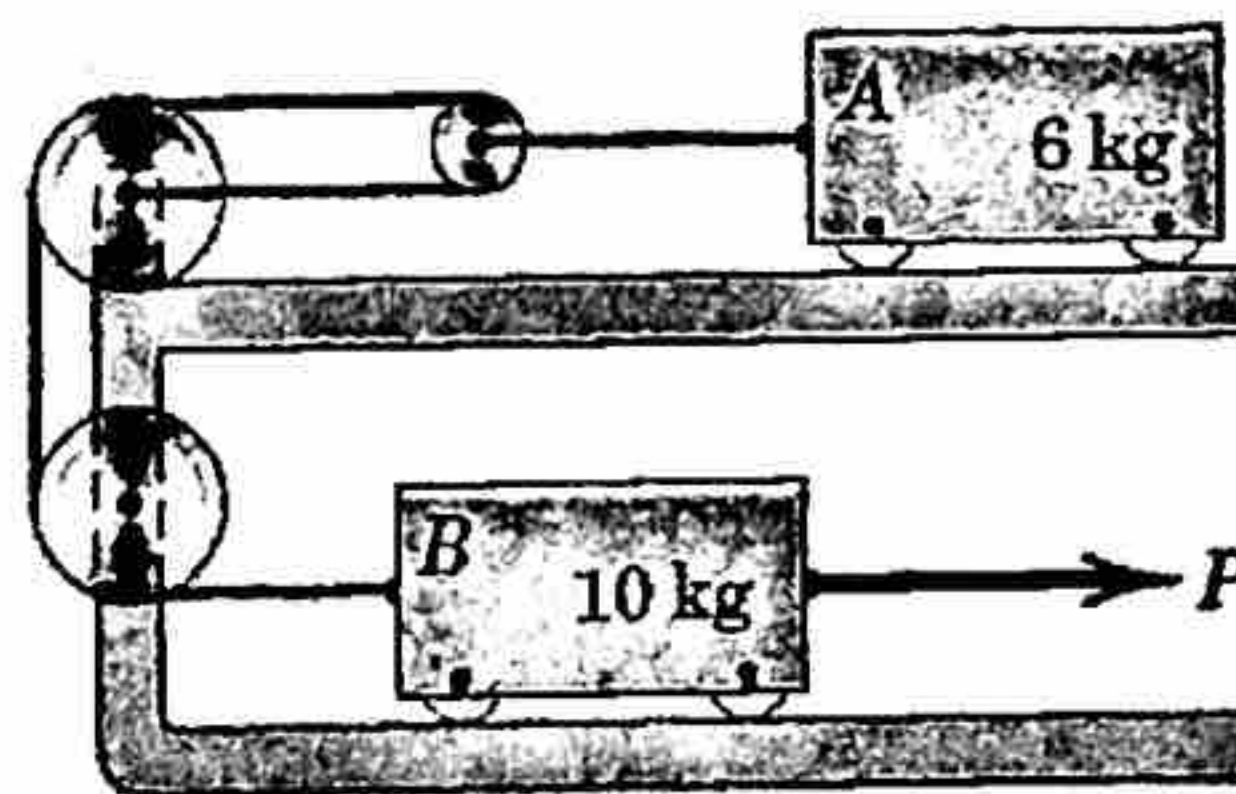
1. For the instant represented, car *A* is rounding the circular curve at a constant speed of 30 mi/hr, while car *B* is slowing down at the rate of 5 mi/hr per second. (a) Determine the magnitude of the acceleration that car *A* appears to have to an observer in car *B*. (b) Is the acceleration of car *A* as observed from car *B* equal and opposite the acceleration found earlier? Explain.

B

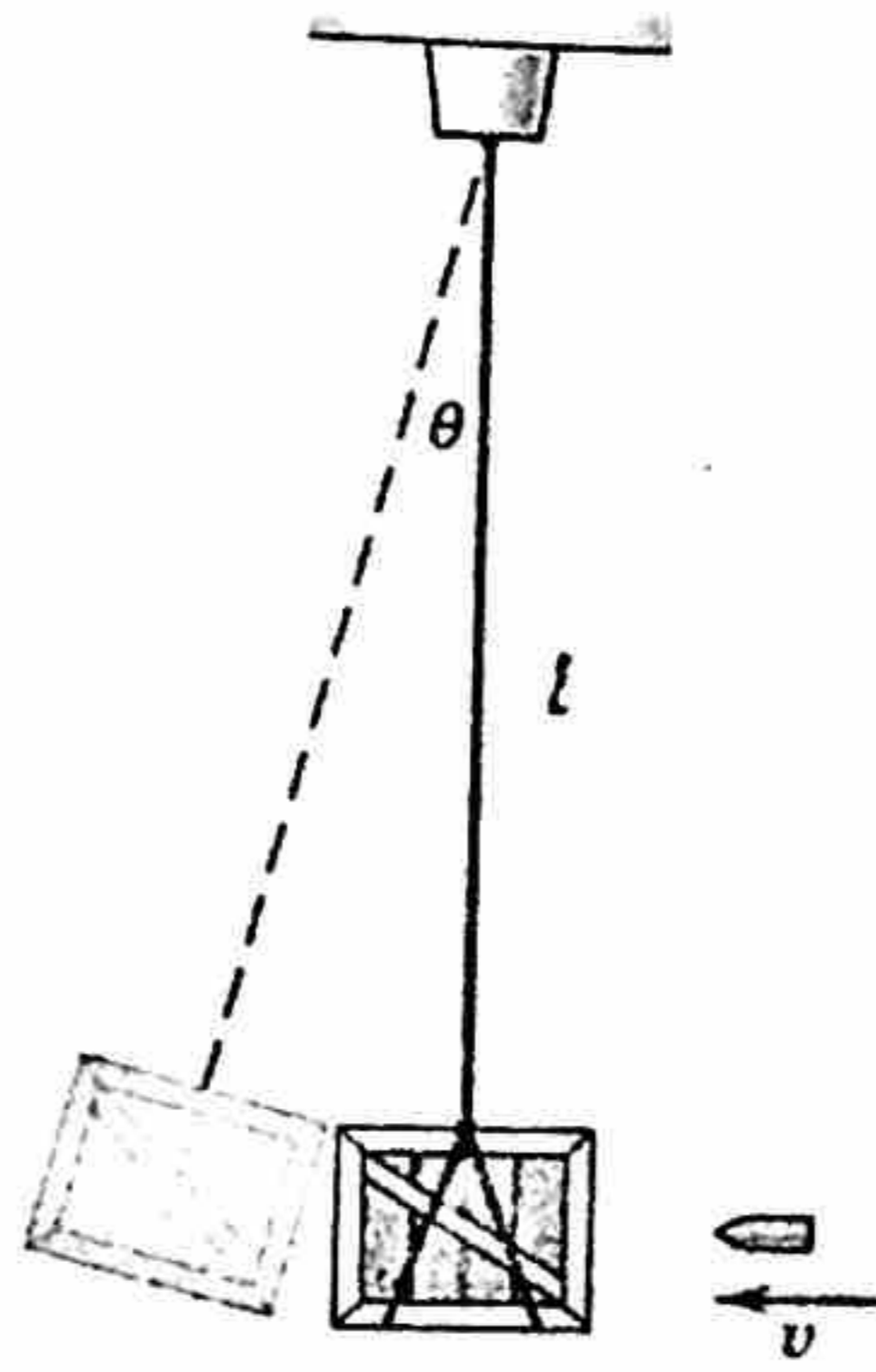
A



2. The force  $P = 40$  N is applied to the system, which is initially at rest. Determine the speeds of *A* and *B* after *A* has moved 0.4 m.



3. The ballistic pendulum is a simple device to measure projectile velocity  $v$  by observing the maximum angle  $\theta$  to which the box of sand with embedded projectile swings. Let  $m$  and  $v$  be the mass of the bullet and its speed before impact. Let  $M$  be the mass of the box, and let  $l$  be the length of the inextensible string. For calculations, use  $m = 0.05$  kg,  $M = 25$  kg,  $v = 800$  m/s, and  $l = 2$  m.



- a) Calculate the velocity at the end of impact (projectile becomes embedded).
- b) Calculate the jump in the tension  $N$  of the string due to impact.
- c) Calculate the maximum angle  $\theta$  attained by the box and projectile.