

# Physics Challenges for Teachers and Students

This month we present more problems on mechanics:

## ► Cats and Dogs

A dog is chasing a cat. The velocity of the cat,  $u$ , is constant. The dog's velocity is directed toward the cat at all times; the dog maintains constant speed  $v$ . At the instant when velocities  $u$  and  $v$  are perpendicular, the distance between the dog and the cat is  $x$ . What is the dog's acceleration  $a$  at that moment?

## ► The Cable News

A student has a large quantity of a flexible cable. If she cuts a piece of that cable and hangs it vertically, the longest piece that does not break under its own weight is  $l$ . The student then cuts another piece and places it on a horizontal smooth table. A small part of that cable hangs over the edge so that the cable begins to slide down after being released. How long ( $L$ ) can this piece be so that it does not break during the slide?

## ► A Slippery Slope

An object is given a quick push up an inclined plane. It slides up and then comes back down. It is known that the ratio of the ascent time ( $t_{\text{up}}$ ) to the descent time ( $t_{\text{down}}$ ) is equal to the coefficient of kinetic friction ( $\mu$ ). Find the angle  $\theta$  that the inclined plane makes with the horizontal. Is the situation described possible for any value of  $\mu$ ? Assume that the coefficients of static and kinetic friction are equal.

**Please send correspondence to**

*Boris Korsunsky,*  
Weston High School,  
444 Wellesley St., Weston,  
MA 02493-2631;  
korsunbo@gse.harvard.edu

*Please note that the solutions will now be published on our website (<http://www.aapt.org/tpt/>). This practice will allow our readers more time to submit their solutions for each issue, while making them available with less delay. Also, we hope to be able to post more names of the contributors and, on occasion, publish alternative solutions.*