

2019

Question 1: Cost to Carpool; Question 2: Waiting in TSA Lines

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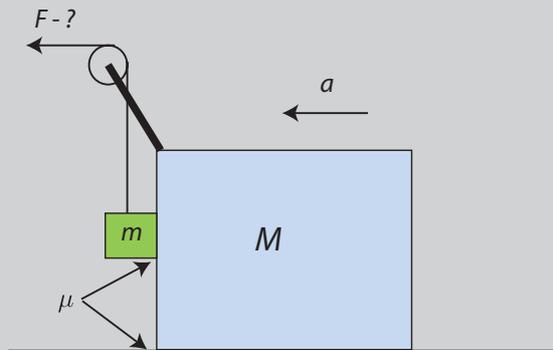


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Physics Challenge for Teachers and Students

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► Up and away ...



A block of mass M is placed on a horizontal floor. A frictionless pulley is attached to the top edge of the block, and a light string passes over the pulley as shown. A cube of mass m is suspended from the string so that the bottom part of the string is vertical, and the cube touches the block. The coefficient of kinetic friction between the block and the cube as well as between the block and the floor is μ .

The string is pulled horizontally by a force of unknown magnitude F . As a result, the cube slides upward, and the block is moving with acceleration a . Find F .

Guidelines for contributors

- We ask that all solutions, preferably in Word format, be submitted to the dedicated email address challenges@aapt.org. Each message will receive an automatic acknowledgment.
 - If your name is—for instance—Makoto Kobayashi, please name the file “**Kobayashi19Oct**” (do not include your first initial) when submitting the October 2019 solution.
 - The subject line of each message should be the same as the name of the solution file.
 - The deadline for submitting the solutions is the last day of the corresponding month.
 - Each month, a representative selection of the successful solvers’ names will be published in print and on the web.
 - If you have a message for the Column Editor, you may contact him at korsunbo@post.harvard.edu; however, please do not send your solutions to this address. Many thanks to all contributors and we hope to hear from many more of you in the future!
- Note:** as always, we would very much appreciate reader-contributed original *Challenges*.

Boris Korsunsky, Column Editor

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Fermi Questions

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► Question 1: Cost to carpool

How much extra gasoline does it cost to carpool, i.e., to carry another passenger?

► Question 2: Waiting in TSA lines

How much time is spent each year in the U.S. waiting in security lines at airports?

Look for the answers online at tpt.aapt.org under “Browse,” at the very end of the current issue.

Question suggestions are always welcome!

For more Fermi questions and answers, see *Guesstimation 2.0: Solving Today's Problems on the Back of a Napkin*, by Lawrence Weinstein (Princeton University Press, 2012).

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