

Cal Poly Department of Mathematics

Puzzle of the Week

Feb 27 - Mar 5, 2009

You are given two fuses which each take one hour to burn, but they burn irregularly (e.g. not necessarily at constant rates). Can you use them to measure 45 minutes? How about 50 minutes?

Solutions should be submitted to Morgan Sherman:

Dept. of Mathematics, Cal Poly

Email: sherman1 -AT- calpoly.edu

Office: bldg 25 room 310

before next Friday. Those with correct and complete solutions will have their names listed in next week's email announcement. Anybody is welcome to make a submission.

Solution: For 45 minutes: light *both* ends of one fuse and one end of the other. The fuse with two flames will burn twice as fast so will finish in 30 minutes. At that time light the other end of the remaining fuse – together with the already lit end it will burn for another 15 minutes.

For 50 minutes: Many people didn't believe 50 minutes could be done, but it can if you follow this (admittedly impractical) algorithm. With one fuse we can get 30 minutes by lighting both ends simultaneously, so it suffices to measure 20 minutes with the other fuse. Since 20 minutes = $1/3$ of an hour the aim is to keep *three* flames on the fuse going at all times. We start by lighting one end as well as at some point in the middle. When one flame goes out we immediately light an unlit end. When two flames hit each other and go out we light at some new untorched middle point. Assuming we can keep this up, moving infinitely fast if necessary, we will eventually burn the entire fuse three times as fast as with just one flame going!