

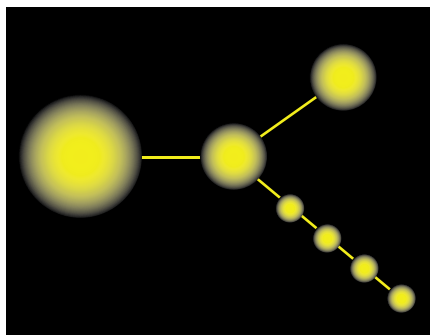
# Peculiar Star Position

## THIS ISSUE'S PUZZLE

In a newly found universe, called "SML," stars are of only three sizes — small, medium, and large. There is only one L star, which is  $4\sqrt{3}$  times as massive as each of the two M stars. Remarkably, centers of all of the stars lie on a single plane, and centers of all of the S stars lie on a straight line. The mass of an M star is  $24\pi^2$  times that of each of the infinite collection of S stars in the universe.

The only force acting between the stars is the force of gravity. The force between any two stars is proportionate to the product of the star masses and inversely proportionate to the square of the distance between them.

At time 1, an amateur astronomer, who can measure angles and distances (the latter are measured precisely only if they're equal to integral millions of kilometers), observed the following position of the stars (see the picture, not to scale). The number of S stars is infinite, and their distances to the M star in the middle are  $10^6$  km,  $3 \cdot 10^6$  km,  $5 \cdot 10^6$  km, etc. He could not precisely measure the distances from the other stars to the middle M star. Both obtuse angles between the imaginary lines connecting the stars as shown on the picture are 150 degrees. The middle star was still, if only for a moment, as the forces offset each other.



Several months later (time 2), the astronomer found that the stars have again positioned themselves in a peculiar pattern. The same angles were preserved, but both the large star and the outer M star moved closer to the M star in the middle so that the new distances to the middle star were

$\sqrt{3}/2$  of the original. (this information was obtained from an external source). The S stars formed a line again. The astronomer was astonished at two facts: He could measure *all* the distances accurately, and the middle planet was motionless again!

Please answer the following questions: (1) How far were the S stars from the middle star at time 2? (2) How far were the other stars from the middle star at time 2?

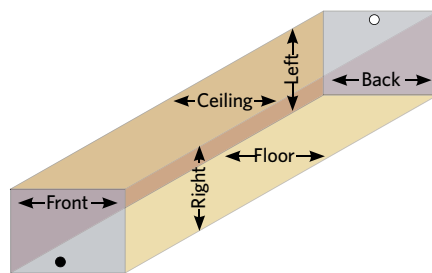
Note that the *solution* is required to make the solver list.

## SOLUTIONS FOR THE JAN/FEB PUZZLES

### Cable Company Mathematicians

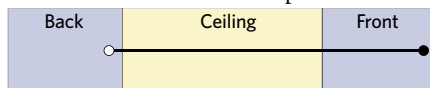
(1) 22 feet, (2) 31.9 feet (rounded), (3) 40 feet

**SOLUTION:** The picture below shows the room, where the black circle represents the jack in the TV set and the white circle is the cable outlet.

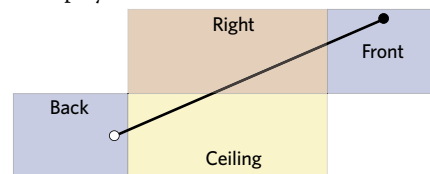


Because the cable can't hang anywhere and has to go along the walls, there are

many choices on how to connect the cable. It's clear that at least three out of six walls need to be used. So the simplest solution would be as shown on the picture below:

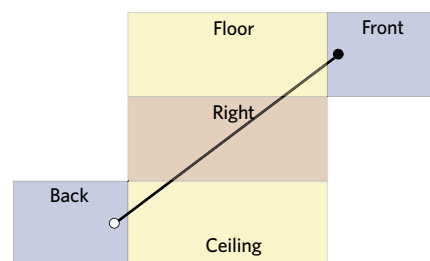


In this case, the required cable length would be equal to  $12 + b$ . Other possibilities exist for cable to be attached to exactly three walls, but they require at least as much cable. The most optimal way of cable connection using exactly four walls is displayed below:



Using the Pythagorean theorem, we find that cable length would be  $\sqrt{17^2 + (b + 7)^2}$

Finally, there is a way to connect the cable using five walls (clearly, use of all six walls is suboptimal) as shown below:



With this arrangement, the minimum required length is  $\sqrt{24^2 + (b + 2)^2}$

All we need to do now is to compare results for each room type. It can be shown that when  $b = 10$  feet, the three-wall case is the best, making the total length 22 feet. When  $b = 20$  feet, the four-wall case wins and the cable should be about 31.9 feet long. Finally, when  $b = 30$  feet, all five walls are needed for the most optimal solution, and the length is 40 feet.

## Chess Puzzle

Case A—(1) d4 Ne- (any move by the

**THIS ISSUE'S CHESS PUZZLE**

**White to Move and Mate in Three.**

8	♔							
7	♙							
6		♗						
5			♕					
4					♔			
3						♗	♙	♙
2						♗	♙	♙
1					♕		♔	
	A	B	C	D	E	F	G	H

Knight on e2); (2) Na4+ Kd1; (3) Nc3#.  
 Case B—(1) d4 Nf- (any move by the Knight on f5); (2) Nc4+ Kd1; (3) Ne3#.  
 Case C—(1) d4 g2; (2) Nd3+ Kd1; (3) Nf2#

John Dinius, Mark Evans, Mike Failor, Bill Feldman, Jerry Francis, Raja Malkani, Lee Michelson, Don Onnen, Stephen Peeples, Daniel Ropp, Noam Segal, Philip Silverman, Al Spooner

**SOLVER LISTS**

Due to an administrative deadline, names of only those people who submitted correct solutions by Jan. 31, 2006, are shown on the lists.

**Cable Puzzle:** Cliff Anderson, Robert Ballmer, Bob Bartholomew, Richard Bottelli, Bob Byrne, William Carroll, Mike Crooks, William Cross, Andrew Dean,

**Chess Puzzle:** Cliff Anderson, Steven Azar, Robert Burrell, William Carroll, Mike Crooks, Robert Ellerbruch, Mike Failor, Bob Gardner, Jeff Dvinoff, Leigh Halliwell, Krishna Kothoor, Brian Liebeskind, Mark Mercier, Lee Michelson, Don Onnen, Harry Ploss, Hugh Ramler, Boris Raskin, Edward Scher, Chris Townsend, Lee Zinzow

Solutions may be e-mailed to [cont\\_puzzles@yahoo.com](mailto:cont_puzzles@yahoo.com) or mailed to **Puzzles, 25 Sparrow Walk, Newtown, Pa. 18940.**

In order to make the solver lists (separately maintained for the regular and chess puzzles), please submit your answers and solutions by **March 31, 2006.** Depending on the response volume, solver lists may contain only the names of people who solved puzzles on the first attempt.

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