FUN WITH FUNDAMENTALS

Focal point

Problem 186 — The shadow knows only so much, as this month's problem by Everett H. Smith of Knob Noster, Mo., demonstrates.

"At last I found it!" exclaimed Dr. Schamm. "The famous 'Eye of Hahtseet' will be the archeological find of the decade! My life-long theory on the ancient Hahtseet form of instant mystical enlightenment will be proved at last!"

The object in question was a tall stone pillar with a small glass lens inserted into it. The pillar stood perpendicularly in the middle of a perfectly level plain. In ancient times, the high priests and those who had paid a premium to the temple would stand a certain distance away with their backs to the pillar and the sun. At a given point in the day, when the sun was at a certain angle, the god Hahtseet would favor the supplicant with instant enlightenment.

Dr. Schamm's theory was based on the tower being at least 250 ft tall. He had climbed a hill that was 125 ft above the plain and found that the pillar was taller than the hill. His notes told him the sun rose at 6:00 a.m., and was directly over the pillar at noon, such that the pillar cast no shadow. It set at 6:00 p.m. Some obscure notes Dr. Schamm had stumbled upon stated that the pillar cast a 70-ft shadow at a certain time in the day, and then, one hour later, cast a 140-ft shadow. Unfortunately the times at which the readings were taking were too blurry to read.

How tall is the pillar, and at what times were the shadow readings taken? Will Schamm be in the hot seat over his theory? Send your answer to:

Fun With Fundamentals
POWER TRANSMISSION DESIGN
1100 Superior Ave.
Cleveland, OH 44114-2543

Deadline is September 10. Good luck!

Technical consultant, Jack Couillard, Menasha, Wis.

Solution to last month's problem 185 — You aren't camera-shy if you answered: **Yes, Wurme miscalculated**. Here's what his ETD should have been:

Let t = the time it takes to walk along one side of the square park. Then, since distance = velocity × time, the distances from A, B, and C to the restaurant correlate to the 3, 4, and 5 min, since all velocities are the same. Draw two diagrams of the layout of park and restaurant. Rotate one a quarter turn clockwise and put it to the right of the other diagram. By similar angles, the angle between the two size-4 sides is 90 deg.

Extract the center shape and divide it into top and bottom triangles. Since the lower triangle is a right triangle, the length of this divider is:

$$\sqrt{4^2+4^2} = 4\sqrt{2}$$

Let ϕ be the angle between the size 5 and size $4\sqrt{2}$ sides. We can now use the Law of Cosines to solve for ϕ.

$$3^2 = 5^2 + \left(4\sqrt{2}\right)^2 - 2(5)\left(4\sqrt{2}\right)(\cos\phi)$$

$$\cos\phi = \frac{9-25-32}{-56.57} = 0.85$$

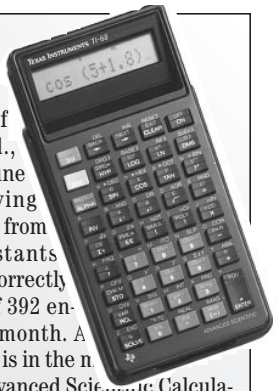
$$\phi = \cos^{-1}(0.85) = 31.95 \text{ deg}$$

Since the bottom is a right equilateral triangle, the two other angles are 45 deg. Thus, the angle between the size 4 and size 5 sides is $\phi + 45$. Draw another line connecting the top and bottom angles. The length of this line is t. We can use the Law of Cosines again:

$$t^2 = 5^2 + 4^2 - 2(5)(4)\cos(31.95+45)$$

$$t^2 = 5.65 \text{ min}$$

Wurme's timing needs work! To the nearest minute, he should have left at 12:00 − (5.65 + 3 min), or 11:51.



Contest winner — Congratulations to Mark Balthis of Evansville, Ind., who won our June contest by having his name drawn from the 338 contestants who answered correctly out of a total of 392 entrants for that month. A TI-68 calculator is in the n

The TI-68 Advanced Scientific Calculator by Texas Instruments can solve five simultaneous equations with real and complex coefficients and has 40 number functions that can be used in both the rectangular and polar coordinate systems. Other functions include formula programming, integration, and polynomial root finding. The calculator also features a last-equation replay function that lets you double-check your work.

To enter the contest, send your answer on a postcard or letter to POWER TRANSMISSION DESIGN, 1100 Superior Ave., Cleveland, OH 44114-2543.

You can also receive a TI-68 and credit in the magazine if you send in an *original* problem with solution, and we publish it.