

ODD ANGLES

THIRTY-THREE MATHEMATICAL ENTERTAINMENTS

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THALES MEASURES A PYRAMID

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You may have read, one place or another, about Euclid's encounter with an urchin on the steps of the library of Alexandria. The lad had all kinds of embarrassing questions to ask the mathematician about his book. But, it seems that Euclid was not the first Greek mathematician to run into this problem. Thales, who lived several centuries before Euclid, tangled with an uninhibited youngster on one of his trips to Egypt. Of course, all this was before the invention of Little League and Community Recreation Programs, and all the kids had to do of a summer day was sit around and ask embarrassing questions of the visiting mathematicians.

Anyway, it seems that friend Thales wandered down to Egypt one year to see the sights and, incidentally, try to learn a bit about the very practical work the Egyptians did in geometry. He became particularly intrigued with the pyramids and the problem of measuring the height of a pyramid. The direct approach was "out," since even if he climbed to the tip of the pyramid there was no way of measuring straight down. And, anyway, the Greeks were not much inclined toward direct approaches when they could work out a nice mathematical solution. So, Thales sat down to give the matter some thought.

After a number of weeks spent thinking and calculating,

he thought he had the problem solved, so he gathered up his drawing board, pencils, papyrus and a few instruments he had built, and went out to the pyramid.

Setting up shop there under his beach umbrella, Thales was working busily, when a small boy wandered up. "Whad-darya doin' with all that stuff out in the hot sun?" he asked.

"I'm calculating the height of yonder pyramid," replied Thales.

"Oh," said the boy. "Looks like the hard way."

Thales wasn't really listening to what the boy said, and continued his calculating, muttering to himself. "Hmmm . . . angle of 34 degrees 13 minutes, and 47 seconds . . . arc sine . . . hummm . . . tangent . . . confounded cheap pencils . . . now, where's the table . . . hummmmm . . . multiply by 1.414 . . . drat . . . someone should invent a ball-point pen . . . bah . . . made a mistake somewhere . . ."

About that time the boy interrupted this monologue. "I don't see why you need all these numbers and things."

Thales mumbled on. "Hmmmm, let's see . . . no . . . go away, lad . . . no, wait . . . I'll explain. You see all these numbers are related to the angles—this is a new thing—just invented it. Think I'll call it 'trigonometry.' You see, you get the angle on the top of the pyramid with this instrument here—just invented that too—and then you look up in the table . . . and you measure the distance . . . and . . . drat it, you've got me all confused. Anyway, you measure this distance . . . and then . . . I think . . . you multiply it by this number which is the cosine of the angle . . . No, . . . think I'll call this the 'tangent,' and then you'll have the height of the pyramid . . . drat it . . . something's wrong . . . hummm . . . confounded pencils . . ."

"I don't see it at all," the boy observed. "Still looks like the hard way to me."

"Look, kid," Thales broke in sharply. "This trigonometry is a complicated business. Why, I'm inventing a whole new branch of mathematics. This isn't for the likes of you. Now, go away and let me figure . . . hmmm . . . maybe sine of 34 degrees . . . bah . . . that couldn't be right . . ."

The lad was not so easily put off. "But look, Mr. Thales, why don't you just measure the shadow of the pyramid, and you'd be all set."

"What's that about the shadow?" Thales interrupted. "You've gotta have trigonometry for this. Now, go away."

"Okay, okay," said the boy. "Don't be so touchy. But if you measured the shadow, and then measured the shadow of one of your long sticks there . . . and you *can* measure the length of the stick . . . you could figure out the height of the pyramid by a simple proportion—shadow of the pyramid is to the height of the pyramid as the shadow of the stick is to the height of the stick—simple, huh?"

"Hmph," Thales snorted, ". . . a crude method . . . lessee . . . tangent of 34 degrees . . . what did you say, boy? Couldn't be that easy . . . now go away. I've work to do . . ."

So, the lad went off to draw a few diagrams in the sand. And, Thales returned to his calculations and mutterings. Later in the day, however, he was seen out beside the pyramid with a stick stuck in the ground, and his measuring rod on the ground.

Evidently his results impressed the folks back home, for Thales feat of measuring the pyramid is much acclaimed in the history books.

And, trigonometry had to wait a few hundred years or so to be invented.