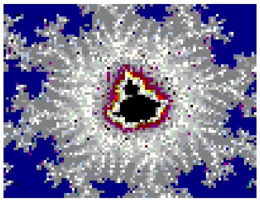

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HOW DOES YOUR PERSONALITY TYPE AFFECT THE WAY YOU TEACH?

At the Math Department Retreat held in August at Bergamo Center the participants were given some possible answers to this question. Each person deter-mined his/her personality type based on the Myers-Briggs Personality Inventory after Tom Wilson gave some background on the inventory and an explanation of the four scales: Extrovert/Introvert (E/I); Sensing /Intuition (S/N); Thinking/Feeling (T/F); and Judging/Perceiving (J/P). An individual normally has a preference for one of the two options on each scale which leads to a four-letter type—for example, INFJ. Each of the 16 types has definite characteristics that determine how a person takes in information from the world, makes decisions, interacts with others, and structures his or her life.

As teachers, we often identify more easily with students who share some or all of the preferences we have. For example, if I, as an instructor, like to be organized and planned in what I do, then I will naturally value and identify with students who are also organized and planned. My challenge is to appreciate those students who may be more spontaneous and unstructured. If my preference is to normally think through something before I offer an opinion, then I may not easily understand students who think "as they talk"—the ones who often blurt out answers to questions before others have a chance to respond. These kinds of students—who would be typed "extraverts" usually prefer to work in groups and bounce ideas off of others when they learn. If I, as an instructor, tend to make decisions based on objective criteria and principles rather than the feelings of those affected (a "thinking decider"), I may be seen as cold and uncaring. People who are "feeling deciders" like to build consensus and actively seek to make personal connections with others when they make decisions. Students in this latter category need to develop a personal relationship with an instructor, whereas those in the former category seek competence as the major attribute in a professor.

Students who are "sensors" learn best by having material presented in sequential steps, needing detail first before they see the big picture. Students who are "intuitives" prefer to see the big picture first and then focus on the detail. To say it another way, "sensors" see the trees first and then the forest, whereas "intuitives" see the forest first and then the trees.

The challenge for us as instructors is to be aware of our own personality type and how that influences our approach to teaching. And then we need to be alert to, and appreciate, the personality types of our students and how it affects the way they learn. If we can vary our approach from time to time to accommodate these different learning styles, we will have a more dynamic classroom environment and reach more students at the same time.

If anyone would like to learn more about the MBTI or take the official inventory to clarify their type, contact Tom Wilson at 512-2244 or stop by his office at 1322.

Tom Wilson ■

An Application of Analytic Geometry to Designing Machine Parts–and Dresses *Part II*

by Karl Hess

[We resume Karl's article which we started in the last issue of *Mathnet*.]

At this point we need to name the other two design parameters of the tube. We'll let *a* represent the height of the tube at the shortest point, and *b* represent the height at the tallest point. (See Figure 1.)

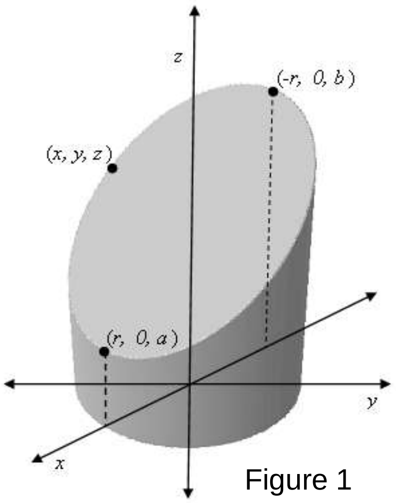

Figure 1

The plane which contains the top of the tube is perpendicular to the *x*-*z* plane, so finding its formula is equivalent to constructing a line in the *x*-*z* plane. You can confirm for yourself that the correct formula is

$$z=\left(\frac{a-b}{2r}\right)x+\left(\frac{a+b}{2}\right).$$

Since a, b, and *r* are all constant for a given tube, what we now have is *z* given as a function of *x*.

Now remember, our goal is to get *z* as a function of *s (see Figure 2)*. We have *z* as a function of *x*, and θ as a function of *s*, so all we need to bridge the gap is to express *x* as a function of θ. Consider the arbitrary point (*x*, *y*, *z*) in Figure 1 that represents any point on the top edge of the tube. If we project this point into the *x*-*y* plane, then we can see that $x=r\cos\theta$.

We have all the pieces we need to construct the desired function. If we compose the functions $z=\left(\frac{a-b}{2r}\right)x+\left(\frac{a+b}{2}\right)$, $x=r\cos\theta$, and $\theta=\frac{s}{r}$, we get:

$$z=\left(\frac{a-b}{2}\right)\cos\left(\frac{s}{r}\right)+\left(\frac{a+b}{2}\right)$$

Now, remembering that *s* and *z* are the only variables here, it becomes clear that the curve we were seeking is **<u>just a sine curve</u>!** Could it really be that simple? What's more, the period of this function is $2\pi r$, which is exactly the circumference of the tube. You might also notice that the cosine function has a negative coefficient (*b* is greater than *a*, so *a* – *b* is negative). Therefore, a period starting at the *z*-axis would begin and end at the lowest part of the curve.

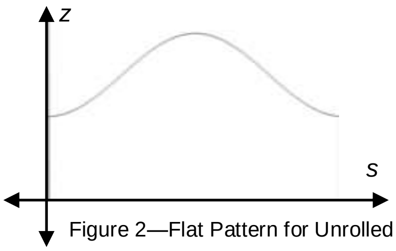

Figure 2—Flat Pattern for Unrolled Tube

So, all it takes to create a tube with a slanted top is to cut out a sheet whose top edge is one period of a sine curve? (See Figure 2) Despite the fact that I had derived the result myself, I had to see it to believe it. I drew a similar sine curve using a computer graphing program and then printed it out. I cut along one period of the curve, beginning and ending at low points. I then cut straight down at each end of the period and squared off the bottom.

This brought me to the moment of truth. Would the piece of paper really form the type of tube I desired when I rolled it up?

I brought the seam together and examined the tube. It did look like the top had been sliced by an imaginary plane. I taped the seam, and then set the tube top-down on a flat surface. It matched up almost perfectly. I could see very little or no light all the way around the top.

Excited by my discovery, I cut the tape along the seam and hurried off to show it to my wife, who was reading in bed and patiently waiting for me to join her. When I held up the sheet of paper, she put down her book, looked at the paper for about three seconds, and then declared matter-of-factly that I was showing her a sleeve pattern. What?

My wife sews, so I immediately knew what she was referring to, but it took me a minute to see what she meant. A simple dress sleeve is just a tube. At the cuff end, the tube is cut perpendicular to the central axis. However, at the shoulder the sleeve joins the body of the shirt at an acute angle. The principle is the same as designing a sheet metal tube.

I examined one of the paper templates that my wife uses for sleeves. I'm sure I had seen them lying around before, but hadn't given them much thought. With a new perspective, I immediately recognized the pattern as a sine curve, or at least an approximation to one. In fact, it was one period of a sine curve that began and ended at the lowest point of the curve.

I conducted an internet search, but wasn't able to find any evidence that the connection between sine curves and this type of flat pattern is known, although I assume it must be. Many types of machines and systems of duct work contain circular tubes meeting at various angles. These junctions require tubes whose ends are cut at various angles. These tubes are not always constructed from flat patterns, but they often are. My internet searching indicated that many tailors create these flat patterns by hand on graph paper from detailed measurements and the use of a generic "curve tool". I'm not certain whether engineers also rely on approximation techniques or if they are aware of the sine-curve connection. All I know for certain is that my brother-in-law and his colleagues weren't aware of the connection.

I called James back the same night and explained what I had found. He was able to complete the design and eventually the machine was actually built. I think I got the better end of this deal though. I've been using this problem in an assignment for my trigonometry classes. I give the students specific dimensions for a tube with a slanted top and ask them to find a formula for the necessary flat pattern. I tell them that the curve at the top of the flat pattern is a sine curve, but I leave it to them to determine the exact formula. They don't have too much difficulty in finding the amplitude, period, and shifts or reflections of the curve from the dimensions of the tube. Once they have done so, it simply becomes a problem of creating a formula for a sine curve based on the characteristics of its graph. This is a common "drill" problem in trigonometry courses.

For students to actually derive this result from scratch, they would need to have already covered parametric equations of circles and rectangular equations of planes. I like to incorporate problems such as this into my classes. Of course, not all math students are engineering majors, although in trigonometry and calculus courses usually a plurality are. However, I wish to impress upon all of my students the pervasiveness of mathematics. Complex mathematical ideas can and regularly do emerge from the most unexpected places. It is my admittedly lofty goal for students to leave my courses with the understanding that mathematical skill can conquer much more than degree requirements.

This article is an excerpt from K. Hess, "An Application of Analytic Geometry to Designing Machine Parts – and Dresses," *Elec. Proc. Undergraduate Math. Days*, Vol. 3 (2008), No. 5, 6 pp. The full article may be found at http://academic.udayton.edu/EPUMD/.

CSEM Scholarships

Please make your students aware of the CSEM Scholarships that are available through the department for qualified students. Students must have a minimum 3.0 GPA for recent high school graduates, or a 2.5 for current college students. They must be full time students (12 credit hours per quarter) in CIS, Engineering Technology, or Math. Also, they must be a U.S. citizen or a permanent resident and they must be very low income students. If they think they qualify, they can come see me or talk to Linda Will in Scholarships and Financial Aid. The last day to apply is December 31, 2008. We have a LOT of money that we need to give away and scholarships are still available for Winter Quarter for students who register before December 31, 2008.

Vickie Lair ■

Video Tapes

A year or so ago I had the tapes from the video courses for Mat 101 and Mat 102 reproduced and placed in the LRC. There are several sets of each that students can check out, and they can check out individual tapes or the entire set. Copies are also available in the Math Lab for students to view there.

This might be worth mentioning to our students as an extra resource. Online students may find them especially helpful if they are able to get to campus. Tom Wilson ■

Reminders

Incomplete grades (I) may be given only to students who are doing passing work. The remaining work should normally not comprise more than one or two tests or assignments.

Please turn in grades promptly.

Please return unused textbooks to the Math Department office.

TEST YOUR SKILLS

by David Stott

The issue came up in my linear algebra class as to whether you need to check *both* products to show that a matrix B is the inverse of a matrix A, that is, $AB = BA = I$, which is what the definition states. Investigation into this issue leads us to the following two Test Your Skills problems:

1. Find the flaw in the argument below that purports to show that if $AB = I$, then $BA = I$.

Let A and B be n x n matrices. Let I be the n x n identity matrix.

Suppose $AB = I$. We need to show $BA = I$.

Now A can be written $A = IA = (AB)A$.

Since A also equals AI, we can write $AI = A = IA = (AB)A$, or more simply $AI = (AB)A$.

By the associative property, the right hand side can be rewritten as $A(BA)$.

So we now have $AI = A(BA)$.

Since these are equal, this would have to imply then that $I = BA$.

2. Either prove or disprove the proposition that if A and B are n x n matrices and $AB = I$, then $BA = I$, where I is the n x n identity matrix.

Harvey's Joke Corner

Algebra "UFO" (Unidentified Factoring Objective)

Q. What is the most popular old song in Greenwich, England?
A. "In the Meantime"

Triangle Inequality
Hypotenuse Gallery

"Do Not Enter" "Welcome"