MathSnacks
Mnemonically Mnumerical

by Marty Ross, Burkard Polster, and QED (the cat)

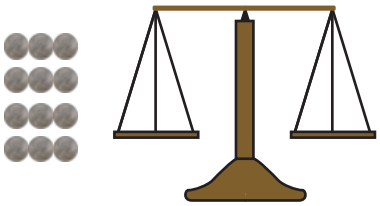
SOHCAHTOA*

$$\text{sine} = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \text{cosine} = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{tangent} = \frac{\text{opposite}}{\text{adjacent}}$$

SOHCAHTOA is just one of the many catchy mnemonics for remembering the definitions of the trigonometric functions. Others, with the functions in the order tangent, sine and cosine, are "Tommy on a ship of his caught a herring" and "The old army colonel and his son often hiccup".

Coin Conundrum*

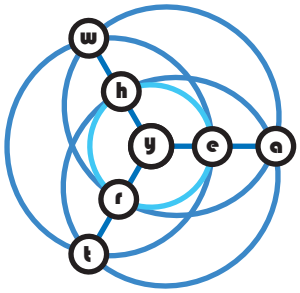


Mother to little Fran: One of the twelve coins is either lighter or heavier than the other eleven. Decide with three weighings which coin it is, and whether it is lighter or heavier, then you can go out to play. Fran ponders, and then writes:

F AM NOT LICKED
followed by
MA DO LIKE
ME TO FIND
FAKE COIN

There are twelve different letters in the first sentence, representing the twelve coins (and F also stands for Fran). The next three lines indicate the three weighings that Fran performs. For each weighing there are 3 possible outcomes, giving 24 (not 27!) possible results for the sequence of weighings. For example, if K is heavier then the result is: (R)ight heavy, then (=), then (L)eft heavy. The 24 different results identify the 24 different possibilities for the fake coin, enabling Fran to solve the problem. This wonderful mnemonic is due to Alan Turing.

YEA WHY TRY HER RAW WET HAT



There are seven letters and seven words in this sentence. Any two of the letters are contained in exactly one word, and any two of the words have exactly one letter in common. If we replace the words "letter" and "word" by "point" and "line", this last sentence becomes: Any two of the "points" are contained in exactly one of the "lines", and any two of the "lines" have one "point" in common. So, these seven words really represent a mini *geometry*, called the *smallest projective plane*. Just as for the Euclidean plane, two points are connected by exactly one line. But, unlike the Euclidean plane, there are no parallels, since any two lines intersect in a point! In the above picture of this mini geometry the lines are represented by circles and line segments.

Eulerian Elegance

$$e^{i\pi} + 1 = 0$$

Euler's formula is perhaps the most beautiful formula of mathematics, tying the fundamental numbers 0, 1, i, e, and π into a tight knot. Unlike 0, 1, and i, the numbers e and π are irrational, and remembering even just a few digits in their decimal expansions is a chore. Here are two mnemonics that help: *How I wish I could calculate pi easily today*. The numbers of letters in the words in this sentence are the first nine digits of π. Using the same principle, here are the first eleven digits of e: *We require a mnemonic to remember e whenever we scribble math.*

Ripper References*

E. Laithwaite, Engineer through the Looking-Glass, BBC, 1980.
Mathworld at http://mathworld.wolfram.com