Re: Need source for math posters and such?

Source: http://sci.tech−archive.net/Archive/sci.math/2007−01/msg03918.html

- *From*: "Dave L. Renfro" <renfr1dl@xxxxxxxxx>
- *Date*: 18 Jan 2007 13:05:37 −0800

me@xxxxxxxxxxx wrote:

> Being an adult college student its been a long time
> since I've had any math.
>
> Taking Trig and and Calculus next fall.
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> I'm looking for ANYTHING to give me and edge on these
> classes and was thinking maybe some posters of the Trig
> function.....ANYTHING.....that I could put on my home
> office wall. Maybe looking at them on daily basis help
> me?
>
> Anyway..... does anyone have a source for such things?
> Or any advice on videos to buy and watch or any other
> "tool" to get?
>
> Maybe some kind of Math lab software for my PC?

Often just having a good conceptual framework to
keep everything organized can make a huge difference.
Regarding trig., I recently posted some comments about
the unit circle serving this purpose in another group
(ap−calculus at The Math Forum), and perhaps posting
it here will help you or others.

I've found the unit circle interpretation to be
a huge savings on memorization and it allows you
to efficiently catalogue & cross−check a large
number of pertinent facts about the trig.
functions (sine and cosine). All you have to
know is that cosine goes with the x−coordinate
and sine goes with the y−coordinate, and for
this you just remember that it's alphabetical:
c & s go with x & y, respectively.

Using this, we can get the values of sine

and cosine at integer (positive _and_ negative)
multiples of 90 degrees.

Using this, we know that cos^2 + sin^2 = 1,
from which so much else arises. (Essentially
everything if you work hard enough [1] [2].)

[1] Andy R. Magid, "Trigonometric identities",
Mathematics Magazine 47 #4 (September 1974), 226−227.

[2] David E. Dobbs, "Proving trig. identities to
freshpersons", Mathematics and Computer Education
14 #1 (Winter 1980), 39−42.
http://tinyurl.com/y8lpja [ZDM review]

Using this, we can get the signs of sine and
cosine in the four quadrants.

Using this, we can deduce that sin(−theta)
is −sin(theta) and cos(−theta) is cos(theta).
[In practice, when you already know one of
them is an even function and one of them is
an odd function, it's easy to figure out
which has to be which by looking at how
the x− and y−coordinates for −45 degrees
compare with the x− and y−coordinates for
45 degrees.]

Using this, we know, given an interval,
whether sine is increasing on that interval,
decreasing on that interval, or neither.
We also know this for cosine. [In fact,
since sine is increasing just to the right
of 0, cosine is decreasing just to the right
of 0, and both are positive there, it follows
that cosine is the one you have to use a
negative sign with its derivative. That's
assuming you remember the derivative of
the sine is cosine and the derivative of
the cosine is sine, modulo one of them
requiring a negative sign. I didn't expect
(nor ever see) this from students, however.]

By considering a right triangle with one vertex
at the origin, one vertex on the x−axis between
x=0 and x=1, and one vertex on x^2 + y^2 = 1
in the first quadrant, you can see whether
sine, cosine are opp./adj. or adj./opp.
[This also comes from knowing which of these
two trig. functions starts at 0 for zero degrees,
and then increases as the angle's degree increases.]

You can even essentially derive the sine and cosine of 30 degrees, 45 degrees, and 60 degrees if you know that 1/2 shows up as a value for at least one of them: x^2 + (1/2)^2 = 1 gives you x = sqrt(3)/2. Since sqrt(3)/2 > 1/2 (square both sides), it must be that these are the values for when x > y, so this has to be for 30 degrees. Since x = 1/2 and y = sqrt(3)/2 also satisfies x^2 + y^2 = 1 (no work needed; you just switch the arithmetic addition order), and here x < y, these must be the values for 60 degrees. As for the values at 45 degrees, clearly this is when x = y, which you can easily substitute into x^2 + y^2 = 1 and get x = y = sqrt(2)/2. No, I didn't expect any students to do this, nor did any of them do so to my knowledge. I'm just showing how much you can get from the unit circle with a bit of ingenuity and a few scraps of incompletely remembered results (one of the outputs being 1/2 in this case).

As for converting between degrees and radians, the only thing you need to remember is that radians are designed to measure angles by using the corresponding arc lengths on the unit circle. Thus, 90 degrees is pi/2, since this is 1/4'th the circumference of a unit circle. What is 30 degrees in radians? Well, what part of 360 degrees is 30 degrees? The answer is 30/360 = 1/12, so 30 degrees is 1/12'th of 2*pi, or pi/6. What is pi/4 radians in degrees? Well, what part of 2*pi is pi/4? The answer is (pi/4)/(2*pi) = 1/8, so pi/4 radians is 1/8'th of 360 degrees, or 45 degrees. Again, I didn't expect students to do this, but in this case some of them actually did.

Dave L. Renfro

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