

Trigonometric Functions*

A glimpse into what researchers say:

- The law of cosines ($c^2 = a^2 + b^2 - 2ab \cos C$) is a rich area for secondary school teachers to explore with their students¹. There are several links to be made between this and other key areas of trigonometry, such as cosine difference of two angles, Cauchy's inequality and sine difference of two angles.
- A key transition can be made from "triangle" trigonometry to "circle" trigonometry². This can be done by presenting to students how the unit circle can be created by placing right-angled triangles on the axis. These triangles have a hypotenuse of length 1.

Some ideas given by practitioners:

- A technique has been suggested to help students who have difficulty remembering key formulae and waste a lot of time searching for them. The "Carousel-Spoke Method"³ can be used to reduce formulae to simpler versions making them easier to work with.
- Trigonometric operations can also be seen as geometric processes through the use of the unit circle⁴. Teaching students how to draw certain lines, angles, etc. on a unit circle can be valuable for their understanding of

Bymath website suggests seven different methods that can be used to solve trigonometric equations:

1. Algebraic Method
2. Factoring
3. Reducing to a homogeneous equation
4. Transition to a half-angle
5. Introducing an auxiliary angle
6. Transforming a product to a sum
7. Universal substitution

Also, **Bymath** website offers an extensive library of trigonometric functions and their properties. You can find, also, questions and exercise to use with your class, including several with animations for more interactive teaching and learning.

Trigonometric function in digital environment:

- Geogebra,
<https://www.geogebra.org/m/wqxQQBnZ>
- Desmos,
<https://www.desmos.com/calculator/zfbhdeyjsu>
- See also. [Autoaraph](#). [WolframAlpha](#)

¹ Flores, A. (1999). The law of Cosines: connections for future teachers. *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 9(2), 123-132.

² Altman, R. and Kidron, I. (2016). Constructing knowledge about the trigonometric functions and their geometric meaning on the unit circle. *International Journal of Mathematical Education in Science and Technology*, 47(7), 1048-1060.

³ Doucet, C.O. (2001). Reducing trigonometric functions by using spokes on a carousel. *International Journal of Mathematical Education in Science and Technology*, 32(1), 141-145.

⁴ Weber, K. (2008). Teaching trigonometric functions: Lessons learned from research. *Mathematics teacher*, 102(2), 144-150.

* Resources selected and summarised by Rebecca Potiphar. Let us know whether they are useful and how we can improve them at @mathtask or email Irene Biza at i.biza@uea.ac.uk