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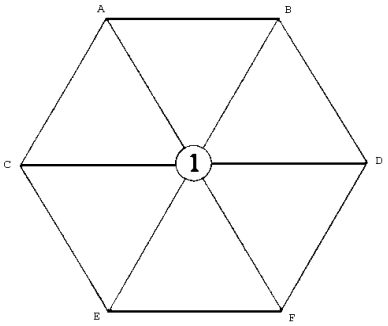
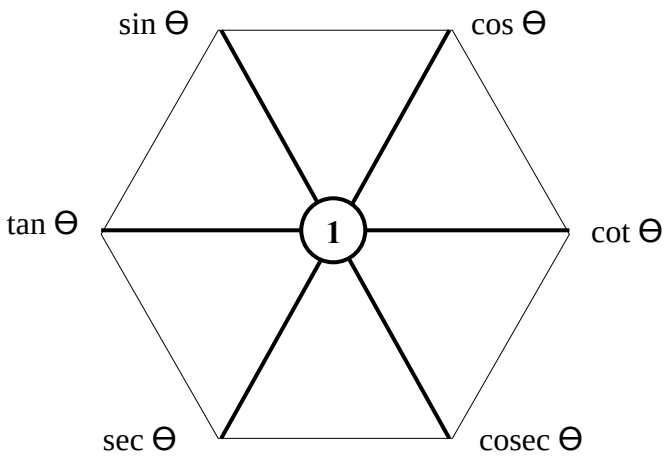
CENTRE FOR THE ADVANCEMENT OF SCIENCE AND MATHEMATICS EDUCATION

The Hexagon 'trig trick'

The relationships between the trigonometric functions can be represented in this fun and easy to remember way:

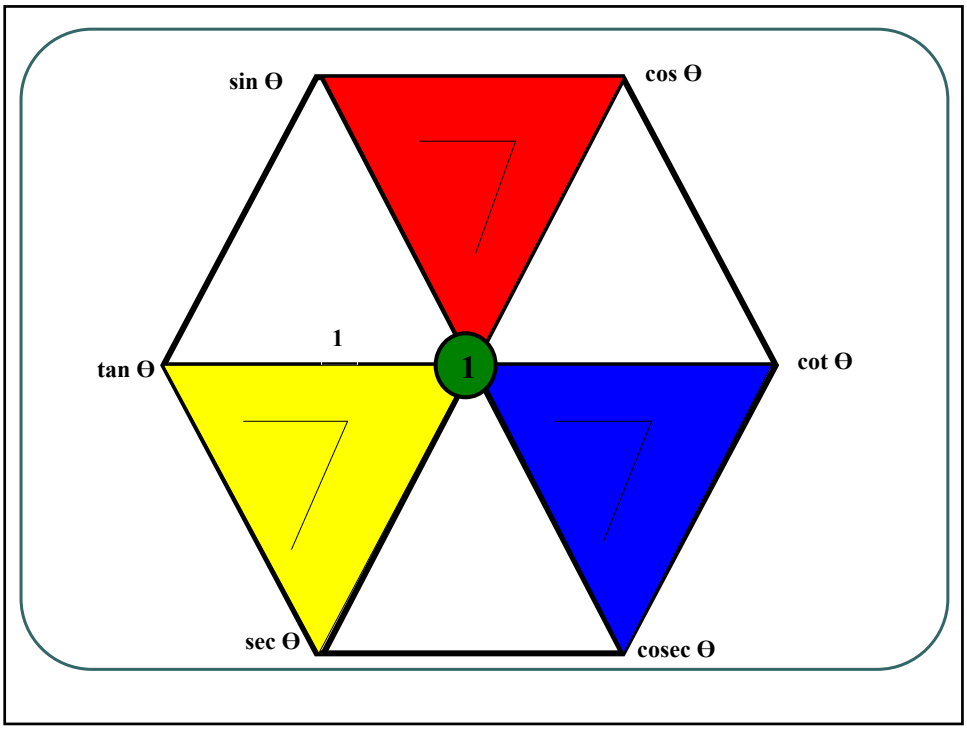
Place the names of the six trigonometric functions sin θ, cos θ, tan θ, cot θ, sec θ, and cosec θ at the vertices labelled A, B, C, D, E, and F, respectively. This step has to be done in this manner or else the trick will not work.





Shading/Colouring

- Shade or colour in the triangle with vertices sin θ, cos θ, and the centre.
- Then shade in the triangle whose vertices are at tan θ, sec θ, and the centre, and the triangle whose vertices are at cot θ, cosec θ , and the centre.



Co-function Relations.

The trig functions cosine, cotangent, and cosecant on the right of the hexagon are co-functions of sine, tangent, and secant on the left, respectively.

- sin (90° - θ) = cos θ
- sec (90° - θ) = cosec θ
- tan (90° - θ) = cot θ

Reciprocal Identities

The two trig functions on any diagonal are reciprocals of each other.

- $\sin \theta = 1 \div \operatorname{cosec} \theta$
- $\cos \theta = 1 \div \sec \theta$
- $\tan \theta = 1 \div \cot \theta$

Product Identities

Along the outside edges of the hexagon any trig function equals the product of the functions on the adjacent vertices:

- $\sin \theta = \cos \theta \times \tan \theta$
- $\cos \theta = \sin \theta \times \cot \theta$
- $\cot \theta = \cos \theta \times \operatorname{cosec} \theta$
- $\operatorname{cosec} \theta = \cot \theta \times \sec \theta$
- $\sec \theta = \tan \theta \times \operatorname{cosec} \theta$
- $\tan \theta = \sin \theta \times \sec \theta$

Quotient Identities

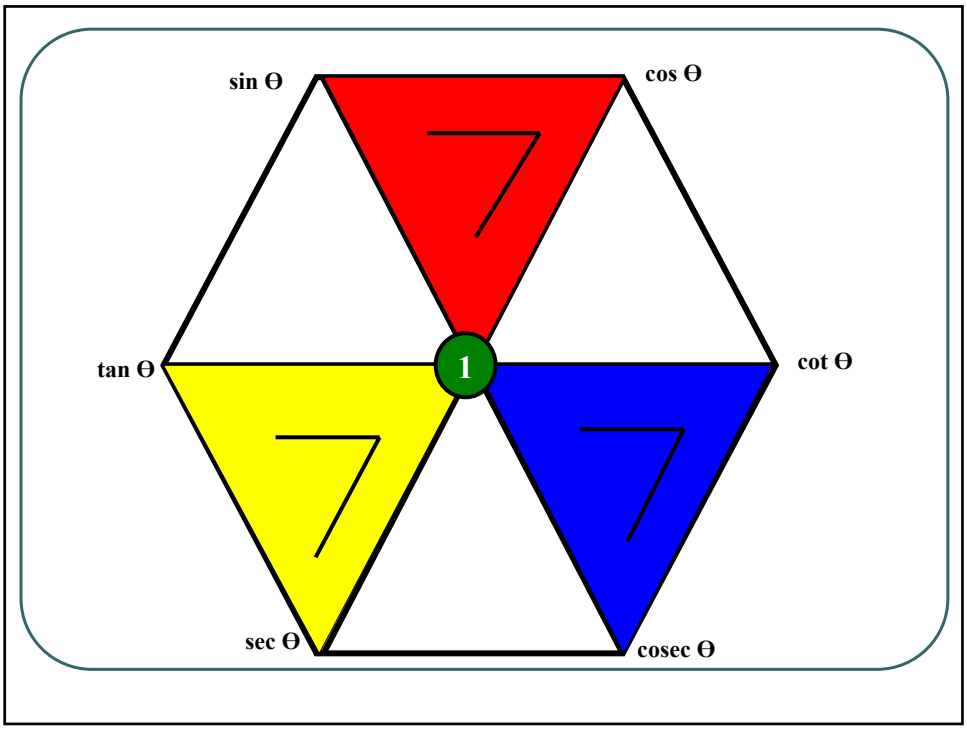
Using the product identities we can also find the quotient identities:

- $\tan \theta = \sin \theta \div \cos \theta$
- $\cot \theta = \cos \theta \div \sin \theta$

Pythagorean Identities

For each shaded triangle, the upper-left function squared plus the upper-right function squared equals the bottom function squared.
You can use the number seven drawn on your diagram to assist you.

- $\sin^2 \theta + \cos^2 \theta = 1$
- $\tan^2 \theta + 1 = \sec^2 \theta$
- $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$



References:

- Chien, V. (n.d) Trigonometry Triangles **www.pen.k12.va.us/Div/Winchester/jhhs/math/lessons/trig/hex.html retrieved 08/06/07**
- Dave's Short Trig Course http://www.clarku.edu/~djoyce/trig/ Retrieved 11/06/07
- Department of Education, (2003). National Curriculum Statement Grades 10-12 (General) Mathematics, Cape Town.