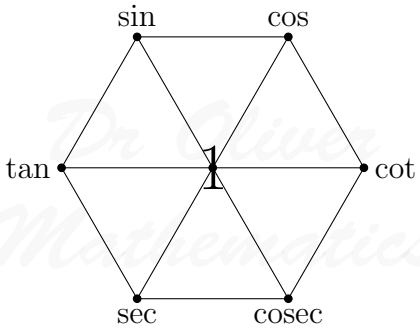
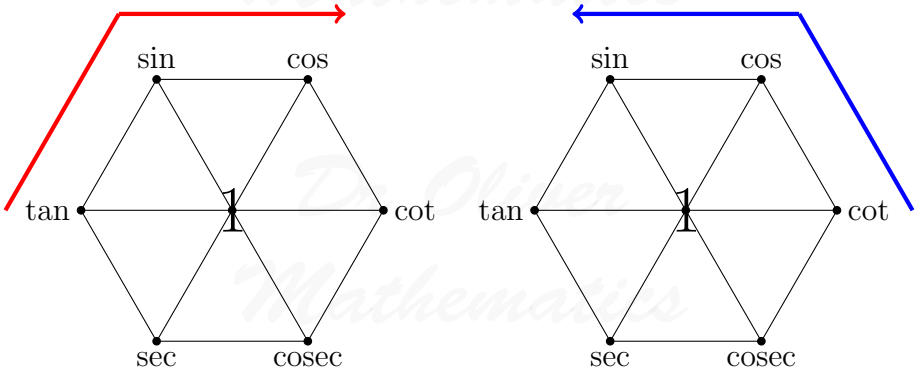
Dr Oliver Mathematics
Magic Hexagon



1 Quotient Identities

All of the quotient identities can be found either by going *clockwise* or *anticlockwise* around the hexagon.



$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{\cos\theta}{\sin\theta}$$

$$\sin\theta = \frac{\cos\theta}{\cot\theta} \qquad \cos\theta = \frac{\sin\theta}{\tan\theta}$$

$$\cos\theta = \frac{\cot\theta}{\operatorname{cosec}\theta} \qquad \sin\theta = \frac{\tan\theta}{\sec\theta}$$

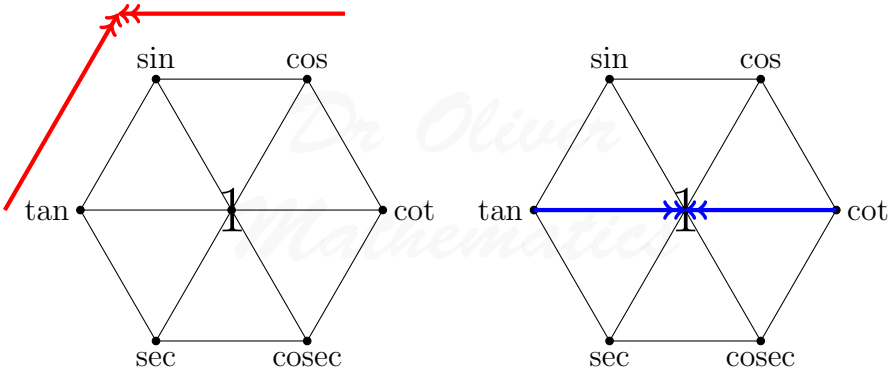
$$\cot\theta = \frac{\operatorname{cosec}\theta}{\sec\theta} \qquad \tan\theta = \frac{\sec\theta}{\operatorname{cosec}\theta}$$

$$\operatorname{cosec}\theta = \frac{\sec\theta}{\tan\theta} \qquad \sec\theta = \frac{\operatorname{cosec}\theta}{\cot\theta}$$

$$\sec\theta = \frac{\tan\theta}{\sin\theta} \qquad \operatorname{cosec}\theta = \frac{\cot\theta}{\cos\theta}$$

2 Product Identities

A function *between* any two functions is equal to those two functions being multiplied. For two functions *opposite* each other, their product is equal to one.

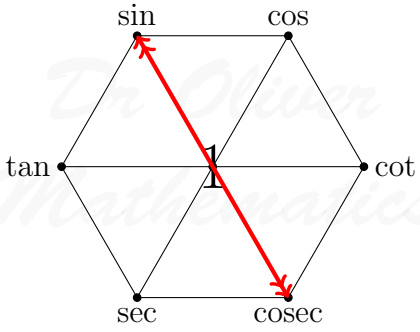


$$(\tan\theta)(\cos\theta) = \sin\theta$$
$$(\sin\theta)(\cot\theta) = \cos\theta$$
$$(\cos\theta)(\operatorname{cosec}\theta) = \cot\theta$$
$$(\cot\theta)(\sec\theta) = \operatorname{cosec}\theta$$
$$(\operatorname{cosec}\theta)(\tan\theta) = \sec\theta$$
$$(\sec\theta)(\sin\theta) = \tan\theta$$

$$(\sin\theta)(\operatorname{cosec}\theta) = 1$$
$$(\cos\theta)(\sec\theta) = 1$$
$$(\tan\theta)(\cot\theta) = 1$$

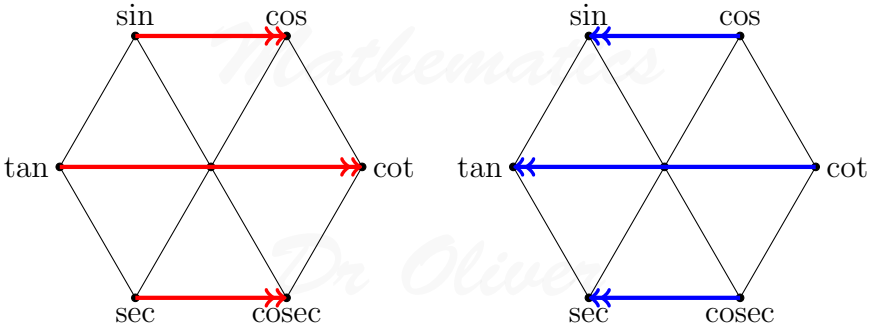
3 Reciprocal Identities

All of the recipriocal identities can be found by going *through the one*.



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

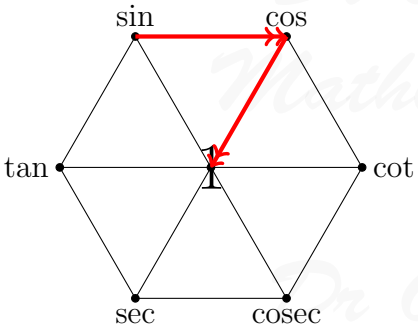
4 Cofunction Identities



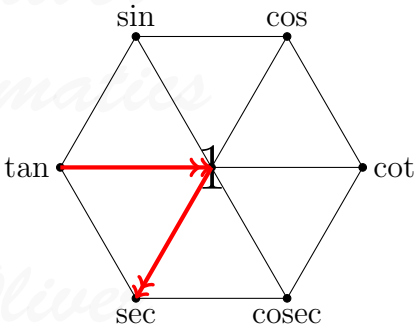
$$\sin\theta = \cos(90^\circ - \theta) \qquad \cos\theta = \sin(90^\circ - \theta)$$
$$\tan\theta = \cot(90^\circ - \theta) \qquad \cot\theta = \tan(90^\circ - \theta)$$
$$\sec\theta = \operatorname{cosec}(90^\circ - \theta) \qquad \operatorname{cosec}\theta = \sec(90^\circ - \theta)$$

5 Pythagorean Identities

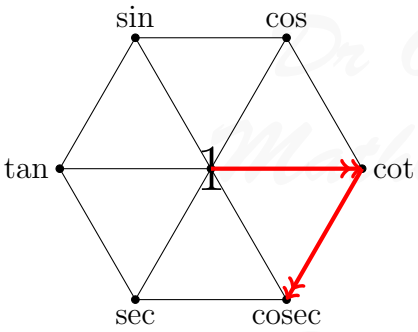
For the Pythagorean identities, going clockwise (anticlockwise) around the three inside triangles starting at the top (bottom) and using addition (subtraction).



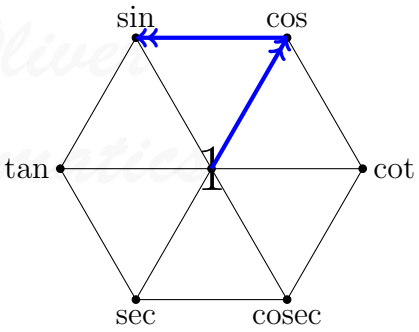
$\sin^2\theta + \cos^2\theta = 1$



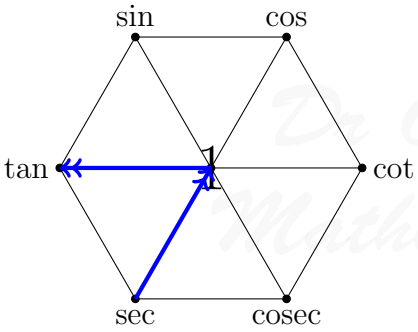
$\tan^2\theta + 1 = \sec^2\theta$



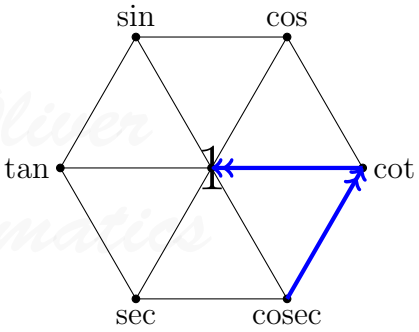
$1 + \cot^2\theta = \operatorname{cosec}^2\theta$



$1 - \cos^2\theta = \sin^2\theta$



$\sec^2\theta - 1 = \tan^2\theta$



$\operatorname{cosec}^2\theta - \cot^2\theta = 1$