

7.2 Compound Angle Formulas

INVESTIGATE: Evaluate the following expressions. Are these expressions equivalent?

$$\cos\left(\frac{\pi}{2} - \frac{\pi}{3}\right)$$

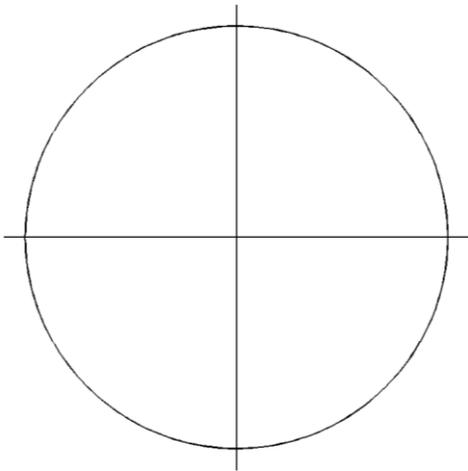
$$\cos\left(\frac{\pi}{2}\right) - \cos\left(\frac{\pi}{3}\right)$$

Remember, the 'distributive property' does not apply to a function i.e. $\cos(a - b) \neq \cos a - \cos b$.

Let's develop a formula...

A **compound angle** is an angle that is created by adding or subtracting two or more angles.

How do we evaluate $\cos(a - b)$?



Compound Angle Formulas

$$\sin(a + b) = \sin a \cos b + \cos a \sin b$$

$$\sin(a - b) = \sin a \cos b - \cos a \sin b$$

$$\cos(a + b) = \cos a \cos b - \sin a \sin b$$

$$\cos(a - b) = \cos a \cos b + \sin a \sin b$$

$$\tan(a + b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$$

$$\tan(a - b) = \frac{\tan a - \tan b}{1 + \tan a \tan b}$$

Ex. 1 Express each of the following as a single trigonometric function.

a) $\sin x \cos 2x - \cos 2x \sin x$

c) $\frac{\tan y + \tan 3y}{1 - \tan y \tan 3y}$

$$\cos \frac{\pi}{3} \cos \frac{\pi}{4} - \sin \frac{\pi}{3} \sin \frac{\pi}{4}$$

b)

c)

Ex. 2 Determine the exact value of each expression.

a) $\cos(\pi + x)$

b) $\sin\left(\frac{\pi}{3} - \frac{\pi}{4}\right)$

c) $\tan\left(\frac{\pi}{4} + \frac{\pi}{6}\right)$

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Ex. 3 Determine the exact value of each trigonometric ratio in simplest exact form.

a) $\sin(15^\circ)$

b) $\sec\left(\frac{\pi}{12}\right)$

c) $\cos\left(\frac{-5\pi}{12}\right)$

Ex. 4 Suppose $\sin x = \frac{4}{5}$, $0 < x < \frac{\pi}{2}$ and $\cos y = -\frac{1}{1}$, $\frac{\pi}{2} < y < \pi$, evaluate

a) $\cos(x - y)$

b) $\tan(x - y)$