Sum-to-Product Formulas

Sin A Cos B =
$$\frac{1}{2}$$
 [Sin (A + B) + Sin (A - B)]
Let $A = \frac{x+y}{2}$ and $B = \frac{x-y}{2}$
 $A + B = \frac{x+y}{2} + \frac{x-y}{2} = \frac{x+y+x-y}{2} = \frac{2x}{2} = x$
 $A - B = \frac{x+y}{2} - \frac{x-y}{2} = \frac{x+y-x+y}{2} = \frac{2y}{2} = y$
Sin $\frac{x+y}{2}$ (os $\frac{x-y}{2} = \frac{1}{2}$ [Sin $x +$ Sin y]
 $2 \sin \frac{x+y}{2}$ (os $\frac{x-y}{2} = \frac{1}{2} \sin x + \sin y$
Sin $x +$ Sin $y = 2 \sin \frac{x+y}{2}$ (os $\frac{x-y}{2}$

Sinx + Siny = 2 Sin
$$\frac{x+y}{2}$$
 Cos $\frac{x-y}{2}$

Replace y with $-y$,

Sin x + Sin $(-y)$ = 2 Sin $\frac{x+(-y)}{2}$ Cos $\frac{x-(-y)}{2}$

Sin $(-y)$ = $-\sin y$

Sin x - Sin y = 2 Cos $\frac{x+y}{2}$ Sin $\frac{x-y}{2}$

Cos x + Cos y = $2\cos \frac{x+y}{2}\cos \frac{x-y}{2}$

Cos x - Cos y = $-2\sin \frac{x+y}{2}\cos \frac{x-y}{2}$

Write
$$\sin 2x - \sin 7x$$
 as a product

Use $\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}$
 $\sin 2x - \sin 7x = 2 \cos \frac{2x+7x}{2} \sin \frac{2x-7x}{2}$
 $= 2 \cos \frac{9x}{2} \sin \frac{-5x}{2}$

Recall $\sin (-A) = -\sin A$
 $= -2 \cos \frac{9x}{2} \sin \frac{5x}{2}$

Show Cos 87° + Cos 33° = Sin 63°

Use Cos
$$\chi$$
 + Cos χ = 2 Cos $\frac{\chi + \chi}{2}$ Cos $\frac{\chi - \chi}{2}$

Cos 87° + Cos 33° = 2 Cos $\frac{87° + 33°}{2}$ Cos $\frac{81° - 33°}{2}$

= 2 Cos $\frac{(20°)}{2}$ Cos $\frac{54°}{2}$

Cos A=Sin(90°-A) = 2 Cos 60° Cos A7°

= $\frac{2}{2}$ Cos $\frac{1}{2}$ Cos $\frac{1}{2}$

Find the exact value of
$$(0s 25)^{\circ} - (0s 195)^{\circ}$$

Use $(0s x - (0s y = -2 sin \frac{x+y}{2} sin \frac{x-y}{2})$
 $(0s 25)^{\circ} - (0s (95)^{\circ} = -2 sin \frac{255^{\circ} + 195^{\circ}}{2} sin \frac{255^{\circ} - 195^{\circ}}{2}$
 $= -2 sin 235^{\circ} sin 30^{\circ}$
 $= -2(-sin 45^{\circ}) \cdot \frac{1}{2}$
 $= -2 \cdot \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{2}}{2}$

Graph
$$y = \frac{Sin3x}{Sinx} - \frac{Cos3x}{Cosx}$$

$$y = \frac{Sin3x \cdot Cosx}{Sinx} - \frac{(os3x \cdot Sinx)}{Sinx} - \frac{SinAcosB}{SinAcosx} - \frac{(os3x \cdot Sinx)}{SinAcosx} = \frac{Sin(A - B)}{Sinx(osx)}$$

$$= \frac{Sin(3x - x)}{Sinx(osx)} = \frac{Sin2x}{Sinx(osx)}$$

$$y = 2$$

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$$Sinx(osx) = 4$$

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