**Trigonometria: transformação de soma em produto**.

Sabemos que:

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

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

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

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

Somando (I) e (II): $2(\sin a)(\cos b) = \sin(a+b) + \sin(a-b)$.

Subtraindo (II) de (I): $2(\sin b)(\cos a) = \sin(a+b) - \sin(a-b)$.

Somando (III) e (IV): $2(\cos a)(\cos b) = \cos(a+b) + \cos(a-b)$.

Subtraindo (IV) de (III): $-2(\sin a)(\sin b) = \cos(a+b) - \cos(a-b)$.

Fazendo $p = a+b$ e $q = a-b$, teremos que $a = \dfrac{p+q}{2}$ e $b = \dfrac{p-q}{2}$. Substituindo:

$$\boxed{\begin{aligned}
\sin p + \sin q &= 2\left(\sin\frac{p+q}{2}\right)\left(\sin\frac{p-q}{2}\right)\\
\sin p - \sin q &= 2\left(\cos\frac{p+q}{2}\right)\left(\sin\frac{p-q}{2}\right)\\
\cos p + \cos q &= 2\left(\cos\frac{p+q}{2}\right)\left(\cos\frac{p-q}{2}\right)\\
\cos p - \cos q &= -2\left(\sin\frac{p+q}{2}\right)\left(\sin\frac{p-q}{2}\right)
\end{aligned}}$$

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