Trigonometric Identities

1. Pythagorean Identity: $\cos^2\theta + \sin^2\theta = 1$
2. Odd/even identities
   - $\cos(-\theta) = \cos(\theta)$
   - $\sin(-\theta) = -\sin(\theta)$
3. Shifting identities:
   - $\cos(\theta - \pi/2) = \sin(\theta)$
   - $\sin(\theta + \pi/2) = \cos(\theta)$
   - $\cos(\pi/2 - \theta) = \sin(\theta)$
   - $\sin(\pi/2 - \theta) = \cos(\theta)$
4. Law of Cosines: $a^2 + b^2 - 2ab\cos(C) = c^2$
5. Law of Sines: $\dfrac{\sin(A)}{a} = \dfrac{\sin(B)}{b} = \dfrac{\sin(C)}{c}$.
6. Double angle: $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$, $\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta)$
7. Sums and Differences of Angles:
   - $\sin(\theta \pm \phi) = \sin(\theta)\cos(\phi) \pm \sin(\phi)\cos(\theta)$
   - $\cos(\theta \pm \phi) = \cos(\theta)\cos(\phi) \mp \sin(\theta)\sin(\phi)$
8. Sums and differences of sines and cosines with same amplitude. Note on next 4 identities I used u and v instead of θ and ϕ because of the way I derived the identities in the video. Watch the video and I think it will be clear why I chose these variables. Of course at the end of the day, it doesn't matter if it's u and v or θ and ϕ when we record the final result.
   - $\sin(u) + \sin(v) = 2\sin\left(\dfrac{u+v}{2}\right)\cos\left(\dfrac{u-v}{2}\right)$
   - $\cos(u) + \cos(v) = 2\cos\left(\dfrac{u+v}{2}\right)\cos\left(\dfrac{u-v}{2}\right)$
   - $\sin(u) - \sin(v) = 2\cos\left(\dfrac{u+v}{2}\right)\sin\left(\dfrac{u-v}{2}\right)$
   - $\cos(u) - \cos(v) = -2\sin\left(\dfrac{u+v}{2}\right)\sin\left(\dfrac{u-v}{2}\right)$
9. Sum of sines with same frequency: $\alpha_1\sin(\omega t) + \alpha_2\sin(\omega t) = A\sin(\omega t + \phi)$ where $A = \sqrt{\alpha_1^2 + \alpha_2^2}$ and $\tan\phi = \frac{\alpha_2}{\alpha_1}$