Waves

Basic: $y = A\sin(kx - \omega t)$ where $k = \frac{2\pi}{\lambda}$ and $\omega = \frac{2\pi}{T}$. We also have $f = \frac{1}{T}$. $c = \frac{\omega}{k} = \lambda f$

Velocity of wave in string: $c = \sqrt{\frac{T}{\mu}}$

Power transmitted in string with sinusoidal waves: $P = \frac{1}{2}\mu\omega^2 A^2 c$

Trig. Identity: $\sin(\alpha + \beta) = 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$

Standing waves is the sum of two waves $y = y_1 + y_2$, where $y_1 = A\sin(kx - \omega t + \phi)$ and $y_2 = A\sin(kx + \omega t)$

Interference. Given: $y_1 = A\sin(kr - \omega t)$ and $y_2 = A\sin(k(r + \Delta r) - \omega t)$ adding them we have $y = y_1 + y_2 = 2A\sin(kr - \omega t + k\Delta r)\cos(k\Delta r/2)$; thus, the effective amplitude that determines constructive and destructive interference is: $A_{eff} = 2A\cos(k\Delta r/2)$

Intensity: $I = \frac{P}{4\pi r^2}$ in 3D; $I = \frac{P}{2\pi r}$ in 2D; constant in 1D.

Sound intensity level (Volume) $\beta = 10\log(I/I_0)$

Beats: $f_{beat} = f_a - f_b$

Doppler effect: $f_O = \frac{c \pm v_O}{c \pm v_S} f_S$; for light: $f_0 = \sqrt{\frac{c-v}{c+v}} f_s$ where v is the relative velocity ($\pm$)

Angle of a shock wave: $\sin\alpha = \frac{c}{v_S}$