Hooke's Law:

$$F = -kx$$

SHM:

$$\begin{aligned}
x(t) &= A\cos(\omega t) \\
v(t) &= \frac{dx(t)}{dt} \\
a(t) &= \frac{dv(t)}{dt} = \frac{d^2x(t)}{dt^2} \\
T &= \frac{1}{f} = \frac{2\pi}{\omega} \\
\omega &= \sqrt{\frac{k}{m}} = \sqrt{\frac{g}{l}} \\
E &= \frac{1}{2}kA^2 = K + U = \frac{1}{2}mv^2 + \frac{1}{2}kx^2
\end{aligned}$$

Damped Oscillation:

$$\begin{aligned}
x(t) &= A\exp(-bt/2m)\cos(\omega t + \phi) \\
\omega &= \sqrt{\frac{k}{m} - \left(\frac{b}{2m}\right)^2}
\end{aligned}$$

Waves:

$$\begin{aligned}
y(x,t) &= f(x \mp vt) = Asin(kx \mp \omega t) \\
k &= \frac{2\pi}{\lambda} \\
\omega &= \frac{2\pi}{T} \\
v &= \frac{\lambda}{T} \\
v &= \sqrt{\frac{T}{\mu}} \\
E &= \frac{1}{2}\mu\omega^2A^2\lambda \\
P &= \frac{1}{2}\mu\omega^2A^2v
\end{aligned}$$

Doppler Shift:

(source and observer moving towards each other)

$$f' = f\left(\frac{v + v_0}{v - v_s}\right)$$

Standing Waves:

$$y(x,t) = \Big[2A\sin(kx)\Big]\cos(\omega t)$$

Path/Phase difference:

$$\Delta r = \frac{\Delta\phi}{2\pi}\lambda$$

String/Open-End Pipe:

$$f_n = \frac{v}{\lambda_n} = n\frac{v}{2L} = nf_1 \qquad n = 1, 2, \ldots$$

Closed-End Pipe:

$$f_n = \frac{v}{\lambda_n} = (2n-1)\frac{v}{4L} = nf_1 \qquad n = 1, 2, \ldots$$

Beats:

$$f_b = |f_1 - f_2|$$

Radiation Pressure :

$$\begin{aligned}
P &= S/c \qquad \text{(black body)} \\
P &= 2S/c \qquad \text{(Mirror)}
\end{aligned}$$

Polarizers:

$$I = I_0\cos^2\theta$$

Derivatives:

$$\begin{aligned}
\frac{d}{dx}\Big(\sin ax\Big) &= a\cos(ax) \\
\frac{d}{dx}\Big(\cos ax\Big) &= -a\sin(ax)
\end{aligned}$$