$$x(t) = A\sin\left(\frac{2\pi}{T}t\right)$$

$$\frac{2\pi}{T} = \omega$$

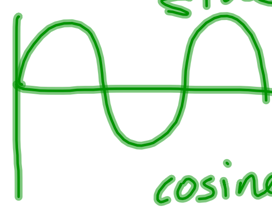
$$x = A_1 \sin(B_1 t) \qquad A_1 = 0.045 \quad B_1 = 6.09$$

$$v = A_2 \sin(B_2 t) \qquad A_2 = 0.26 \quad B_2 = 6.09$$

$$a = A_3 \sin(B_3 t) \qquad A_3 = 1.49 \quad B_3 = 6.09$$

$$\boxed{\begin{aligned} x &= A\sin(\omega t) \\ v &= \omega A\cos(\omega t) \\ a &= -\omega^2 A\sin(\omega t) \end{aligned}}$$

sine



cosine

$$a = -\omega^2 x$$

$$\omega^2 = \frac{k}{m} \qquad \omega = \sqrt{\frac{k}{m}}$$

spring constant

mass

$$\left(T = \frac{2\pi}{\omega}\right)$$

$$T_{spring} = 2\pi\sqrt{\frac{m}{k}}$$

$$\omega = 2\pi f$$

$$\omega = \frac{2\pi}{T}$$

$$T = \frac{2\pi}{\omega}$$

$$T = \frac{2\pi}{\sqrt{\frac{k}{m}}}$$

$$E_{total} = U_s + K$$
$$= \frac{1}{2}kx^2 + \frac{1}{2}mv^2$$
$$= \frac{1}{2}k(A\sin(\omega t))^2 + \frac{1}{2}m(\omega A\cos(\omega t))^2$$
$$= \frac{1}{2}kA^2\sin^2(\omega t) + \frac{1}{2}m\omega^2A^2\cos^2(\omega t)$$
$$= \frac{1}{2}kA^2\sin^2(\omega t) + \frac{1}{2}\cancel{m}\left(\frac{k}{\cancel{m}}\right)A^2\cos^2(\omega t)$$
$$= \frac{1}{2}kA^2\sin^2(\omega t) + \frac{1}{2}kA^2\cos^2(\omega t)$$
$$= \frac{1}{2}kA^2\left(\underbrace{\sin^2(\omega t) + \cos^2(\omega t)}_{1}\right)$$

$$E_{Tot} = \frac{1}{2}kA^2$$

when we first stretch the spring

$$E_{Tot} = U_s = \frac{1}{2}kx^2 \qquad U_s = \frac{1}{2}kA^2$$

Max speed

$$E_{Tot} = K = \frac{1}{2}mv_{max}^2$$

$$2 \cdot \frac{\frac{1}{\cancel{2}}mv_{max}^2}{m} = \frac{\frac{1}{\cancel{2}}kA^2}{m} \cdot 2$$

$$v_{max}^2 = \frac{k}{m}A^2$$
$$v_{max} = \sqrt{\frac{k}{m}}\,A$$
$$v_{max} = \omega A$$