

Going back to our diff. eq:  $x''(t) + \frac{kx(t)}{m} = 0$

$$\frac{x(t + \Delta t) - 2x(t) + x(t - \Delta t)}{\Delta t^2} + \frac{kx(t)}{m} = 0$$

$$\frac{x(t + \Delta t) - 2x(t) + x(t - \Delta t)}{\Delta t^2} = -\frac{kx(t)}{m}$$

$$x(t + \Delta t) - 2x(t) + x(t - \Delta t) = -\frac{kx(t)\Delta t^2}{m}$$

$$x(t + \Delta t) = -\frac{kx(t)\Delta t^2}{m} + 2x(t) - x(t - \Delta t)$$