This method extends to higher-order differential equations

Eg $\frac{d^2y}{dx^2} = f(x)$ let's do this in terms of the application to kinematics

Notation: t – time
x – position of particle on a line
v – velocity
a – acceleration

Definitions $v = \frac{dx}{dt}$, $a = \frac{dv}{dt} = \frac{d^2x}{dt^2}$

Problem: prescribed acceleration

$a(t) = f(t)$, where $f(t)$ is some fixed function

That is, $\frac{d^2x}{dt^2} = f(t)$

[By Newtons 2nd Law $f(t) = \frac{\text{Force}(t)}{\text{mass}}$
So prescribed acceleration is equivalent to prescribed force.]

Solution integrate twice!

First find $v(t)$ from $\frac{dv}{dt} = a(t) = f(t)$

$$v(t) = \int f(t)\,dt + C$$

C — constant of integration