2.9 : Some Special 2nd order D.E's :-

The General form of 2nd Order dif. Eq :-

$$y'' = f(t, y, y')$$

- To Solve it t or y should be Missing

y missing

steps :-

→ let $v = y'$

- So v' Becomes a a first order derivative
- $v' = f(t, v)$ ← first Order D.E

Ex: Outline 3s

- $y'' + t(y')^2 = 0$

$v = y'$

$v' + t(v)^2 = 0$

$\frac{dv}{dt} = -tv^2$

$\frac{dv}{v^2} = -t\,dt$

$-v^{-1} = -\frac{t^2}{2}$

$\frac{2}{t^2} + c = v$

$\frac{dy}{dt} = \frac{2}{t^2} + c$ Solve it

t missing

steps :-

→ let $v = y'$

- So $y'' = f(y, y')$

$v' = f(y, y')$

is a first Order D.E

$yy'' + (y')^2 = 0$

$(v = y')$

$yv' + (v)^2 = 0$

$y\frac{dv}{dt} + v^2 = 0$

$\frac{dv}{dt} = \frac{dv}{dy} \cdot \frac{dy}{dt}$ ← v

$y\frac{dv}{dy}v + v^2 = 0.$

$y\frac{dv}{dy} + v = 0$

$y\frac{dv}{dy} = -v$

$-\frac{dv}{v} = \frac{dy}{y} \Rightarrow -\ln v = \ln y + c$

$v = e^c y \rightsquigarrow \frac{dy}{dt} = e^c y$