

Second order inhomogeneous

$$a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = f(x)$$

Solve complementary equation:

$$a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$$

$$f(x) = px^{2} + qx + r$$

trial function $y_{p} = Ax^{2} + Bx + C$

Equate coefficients to fix constants in trial function

Add solution of complementary equation to trial function and use initial conditions to fix aribtrary constants

$$f(x) = A \exp[\gamma x]$$

$$\gamma \neq m_1, \ \gamma \neq m_2 \ \text{try } y_p = C \exp[\gamma x]$$

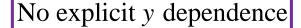
$$\gamma \neq m_1, \ \gamma = m_2 \ \text{try } y_p = Cx \exp[\gamma x]$$

$$\gamma = m_1 = m_2 \ \text{try } y_p = Cx^2 \exp[\gamma x]$$

$$f(x) = C\cos\gamma x + D\sin\gamma x$$

$$\gamma \neq \beta \operatorname{try} y_p = A\sin\gamma x + B\cos\gamma x$$

$$\gamma = \beta \operatorname{try} y_p = x(A\sin\gamma x + B\cos\gamma x)$$



$$f\left(\frac{d^2y}{dx^2}, \frac{dy}{dx}, x\right) = 0$$

Substitute:

$$v(x) = \frac{dy}{dx}, \ \frac{d^2y}{dx^2} = \frac{dv}{dx}$$

No explicit *x* dependence

$$f\left(\frac{d^2y}{dx^2}, \frac{dy}{dx}, y\right) = 0$$

Substitute:

$$v(y) = \frac{dy}{dx}, \ \frac{d^2y}{dx^2} = v\frac{dv}{dy}$$

Solve as first order equation