

Friday 9/14, Last class w/ new material before Exam 1.

A couple more substitutions: Reducing 2nd order.

• No y , e.g. $y'' + y' = 0$.

This is really first order in $v = y'$. Get

$$v' + v = 0 \rightarrow e^x v' + e^x v = 0 \quad (\text{Integ. factor})$$

$$\rightarrow (e^x v)' = 0$$

$$\rightarrow e^x v = C$$

$$\rightarrow v = C e^{-x} \rightarrow$$

$$y = -C e^{-x} + D.$$

Not on exam!

• No x , e.g. $y'' = y(y')^3$.

Same substitution, but now compute dv/dy .

$$\frac{dv}{dy} = \frac{dv/dx}{dy/dx} = \frac{dv/dx}{y'}$$

$$\therefore y'' = v \frac{dv}{dy}$$

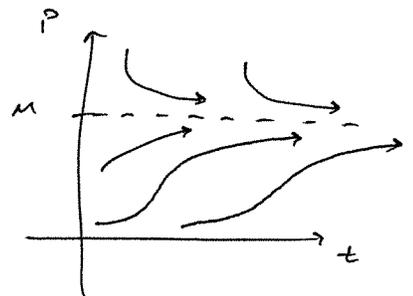
So we get $v \frac{dv}{dy} = y v^3 \rightarrow \frac{dv}{dy} = v^2 y$ is separable.

Logistic Equation is a more realistic population model.

$$P' = k P (M - P)$$

growth rate \leftarrow k \leftarrow Carrying capacity.

This takes finite resources/competition into account.



$P' = kP - kP^2$ is a Bernoulli equation.

We can solve it explicitly!