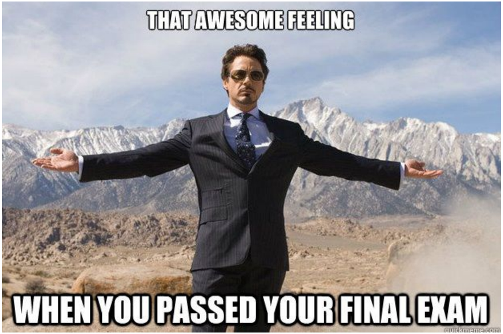
Outline

1. Review session: First order
2. Review session: Autonomous
3. Review session: Second order



Limit

Consider the equation

$$ty' + (t+1)y = 2te^{-t}, y(1) = a, 0 < t \text{ as } t \to 0.$$

Determine the asymptotic behavior.

Homogeneous

Consider the equation

$$\frac{dy}{dx} = \frac{4y - 3x}{2x - y}.$$

Do change of variables $\nu(x) := y/x$ and find the implicit solution for y(x).

integrating factor for exact

Consider the equation

$$(x+2)sin(y) + xcos(y)y' = 0.$$

Make it exact by checking the ratios from the formula sheet. Find the implicit solution.

perpendicular

Find that the lines perpendicular to

$$x^2 + y^2 = kx$$

using the perpendicular line equation $F_y dx - F_x dy = 0$. To make it exact multiply both sides by $x^m y^n$ and pick n,m to make it exact.

Consider the equation

$$\frac{dy}{dx} = y(1 - y^2).$$

Find the critical points, draw the phase line, and determine whether each critical point is asymptotically stable or unstable.

Consider the equation

$$\frac{dy}{dx} = e^{-y} - 2.$$

Find the critical point/s, draw the phase line, and determine whether each critical point is asymptotically stable or unstable.

Consider the equation

$$y'' - 2y' - 3y = -3te^{-t} + 2e^{-t}.$$

What does the stability criterion tell you? Solve and obtain asymptotic behaviour.
For $f(t) = ct^m e^{r_* t}$ the ansatz is

$$y_{nh} = t^s e^{r_* t}(a_0 + a_1 t + ... + a_m t^m).$$

For $f(t) = ct^m e^{\alpha t} cos(\beta t)$ or $= ct^m e^{\alpha t} sin(\beta t)$ the ansatz is

$$y_{nh} = t^s e^{\alpha t}[(a_0 + a_1 t + ... + a_m t^m) cos(\beta t) + (b_0 + b_1 t + ... + b_m t^m) sin(\beta t)].$$

Consider the equation

$$y'' + 2y' + y = -3te^{-t} + 2e^{-t}$$

What does the stability criterion tell you? Solve and obtain asymptotic behaviour.
For $f(t) = ct^m e^{r_* t}$ the ansatz is

$$y_{nh} = t^s e^{r_* t}(a_0 + a_1 t + ... + a_m t^m).$$

For $f(t) = ct^m e^{\alpha t} cos(\beta t)$ or $= ct^m e^{\alpha t} sin(\beta t)$ the ansatz is

$$y_{nh} = t^s e^{\alpha t}[(a_0 + a_1 t + ... + a_m t^m)cos(\beta t) + (b_0 + b_1 t + ... + b_m t^m)sin(\beta t)].$$

undetermined coefficients

Consider the equation

$$y'' - 2y' - 3y = 3sin(t).$$

What does the stability criterion tell you? Solve and obtain asymptotic behaviour.

For $f(t) = ct^m e^{r_* t}$ the ansatz is

$$y_{nh} = t^s e^{r_* t}(a_0 + a_1 t + ... + a_m t^m).$$

For $f(t) = ct^m e^{\alpha t} cos(\beta t)$ or $= ct^m e^{\alpha t} sin(\beta t)$ the ansatz is

$$y_{nh} = t^s e^{\alpha t}[(a_0 + a_1 t + ... + a_m t^m)cos(\beta t) + (b_0 + b_1 t + ... + b_m t^m)sin(\beta t)].$$

Consider the equation

$$y'' + y = 3sin(t).$$

What does the stability criterion tell you? Solve and obtain asymptotic behaviour.

For $f(t) = ct^m e^{r_* t}$ the ansatz is

$$y_{nh} = t^s e^{r_* t}(a_0 + a_1 t + ... + a_m t^m).$$

For $f(t) = ct^m e^{\alpha t} cos(\beta t)$ or $= ct^m e^{\alpha t} sin(\beta t)$ the ansatz is

$$y_{nh} = t^s e^{\alpha t}[(a_0 + a_1 t + ... + a_m t^m) cos(\beta t) + (b_0 + b_1 t + ... + b_m t^m) sin(\beta t)].$$

undetermined coefficients

Consider the equation

$$y'' + y = 3sin(t) + tcos(2t).$$

What does the stability criterion tell you? Solve and obtain asymptotic behaviour.
For $f(t) = ct^m e^{r_* t}$ the ansatz is

$$y_{nh} = t^s e^{r_* t}(a_0 + a_1 t + ... + a_m t^m).$$

For $f(t) = ct^m e^{\alpha t} cos(\beta t)$ or $= ct^m e^{\alpha t} sin(\beta t)$ the ansatz is

$$y_{nh} = t^s e^{\alpha t}[(a_0 + a_1 t + ... + a_m t^m)cos(\beta t) + (b_0 + b_1 t + ... + b_m t^m)sin(\beta t)].$$

The End