Not very helpful (sorry) 🥲

Eigenvector dimension: nullspace

dim (colm) = Rank

dim (row) = Rank

# Defective

Defective: repeated and to many pivots in reduced form

Missing vectors: # pivots

Basis: nullspace

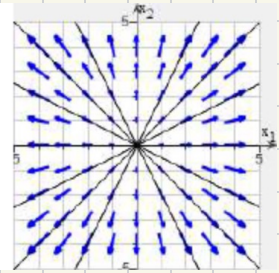
# Nodals

(repetition, state of being, sign)

## Proper Nodal Source

Eigenvalues: repeated, real, positive (rrp)

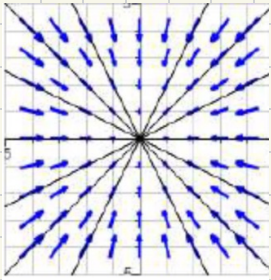
Eigenvectors: two linearly independent



## Proper Nodal Sink

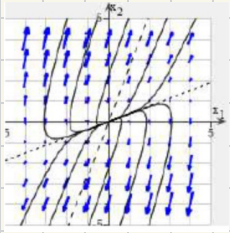
Eigenvalues: repeated, real, negative (rrn)

Eigenvectors: two linearly independent

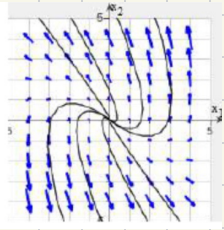


## Improper Nodal Source

Eigenvector: without two linearly indp.



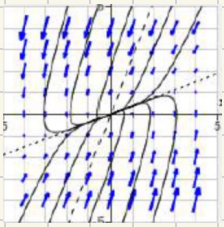
Eigenvalue: Distinct, real, positive (drp)



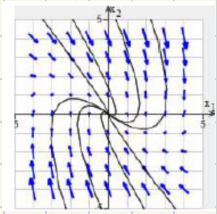
Eigenvalue: repeated, real, positive (rrp)

## Improper Nodal Sink

Eigenvectors: without two linearly ind.



Eigenvalue: Distinct, real, negative (drn)

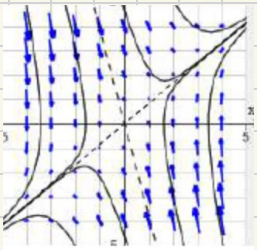


Eigenvalue: Repeated, real, negative (rrn)

# Eigenvalue Dependent

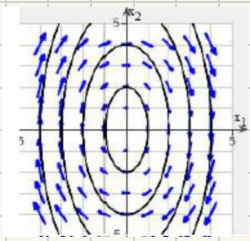
## Saddle point

Eigenvalues: real, opposite sign, (not same magnitude)



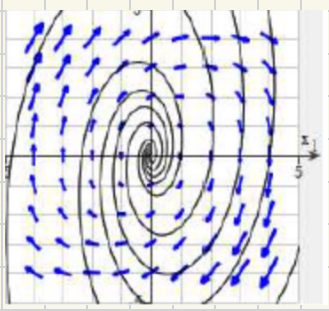
## Center

Eigenvalues: imaginary



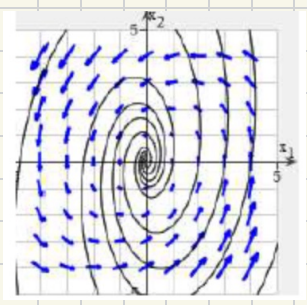
## Spiral Source

Eigenvalues: Complex conjugate, real, positive



## Spiral Sink

Eigenvalues: Complex conjugate, real, negative



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Rules [ Commonality:

Proper: two lin. ind. Eigenvectors, distinct Eigenvalues

Improper: Without two lin. ind. Eigenvectors, Not distinct Eigenvalues

Source: P (positive Eigenvalue)

Sink: N (negative Eigenvalue)

# Review

## Bernoulli

$V = y^{1-n}$ $\quad V' + (1-n)P(x)V = (1-n)Q(x)$

- Leave in terms of $V'$ and $V$ when solving

## Homogeneous

$V = \frac{y}{x}$ $\quad y' = V + V'x$

## Stability

- Set equal to zero, solve for x

Create # line test


## Application

- Newtons Law of Cooling: $\frac{dT}{dt} = K(T - S)$ (Temp of object; Some constant; Temp of surrounding)

- Tank: $\frac{dy}{dt}$ = (concentration in)(flow rate in) − (conc. out)(flow out)

  ↳ $\frac{y}{\text{Volume} + (\text{conc in} - \text{conc out})}$

  $= (\frac{1}{2}\,lb/gal)(4\,gal/min) - (\frac{y}{600}\,lb/gal)(4\,gal/min)$ (salt in tank; volume of water in tank)

  $\frac{dy}{dt} = 2 - (\frac{y}{\text{Volume of water}})(6)$

  ↳ $600 - 2t$ → 4 in, 6 out, net loss of 2 (in − out)

- Spring:

# Variation of parameters

$u_1' y_1 + u_2' y_2 = 0$

$u_1' y_1' + u_2' y_2' =$ right side of given equation