First order Differential Equations

Linear	a(t)y' + b(t)y = f(t)	Normal form y' + p(t)y = q(t)
Separable	dy/dt = g(y)*h(t)	
Bernoulli	a(t)y' + b(t)y = f(t)y^m	m≠ 0,1
Homogeneous	y' = g(y/t)	
Exact	M(x,y)dx + N(x,y)dy = 0	Exact if and only if the partials My and Nx are equal
Non-Exact	M(x,y)dx + N(x,y)dy = 0	When My≠Nx

First order DE's and their form

Solving first order linear

1. Make sure its in normal form	y' + p(t)y = q(t)
2. Find an integrating factor	μ(t) = $e^{\int p(t)dt}$
3. Multiply both sides of the normal form by μ(t) to get	(μ(t)y)' = μ(t)q(t)
4. Integrate both sides of (μ(t)y)' = μ(t)q(t) and solve for y	

Dont Forget constants of integration

Solving FO Separable DE

1. Rewrite y' and dy/dt and separate the variable y from the variable t to get d	dy/dt =g(y)h(t) where we get... (1/g(y)) dy = h(t)dt
2. Integrate both sides to obtain	

Second and HIgher Order DE's

2^{ND} Order Linear	a(t)y'' + b(t)y' + c(t)y = f(t)	Normal form y'' + p(t)y' + q(t)y = r(t)
Homogeneous (H)	a(t)y'' + b(t)y' + c(t)y = 0	Gen. Soltn. yH(t,c1,c2)
Non-Homogeneous (NH)	a(t)y'' + b(t)y' + c(t)y = f(t)	Gen. Soltn. yH(t,c1,c2) + yp(t)
(H) const. coeff.	ay'' + by' + cy = 0	a≠0, b,c are consts.
Cauchy-Euler	at^2y'' + bty' + cy = 0	a≠0, b,c are consts.

yH(t) = general solution of (H)
yP(t) = particular solution of (NH)

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