A solution that is free of arbitrary constants is called a particular solution.

Sometimes a solution to an ODE cannot be found by varying the arbitrary constant. Such a solution is called a singular solution.

Ex: The general soln to $y' = xy^{1/2}$ is given by

$$y = \left(\frac{1}{4}x^2 + c\right)^2$$

Note that $y = 0$ is also a solution, but you can't get it by varying c.

1.2 Some Mathematical Models.

Free falling bodies

$$\frac{d^2s}{dt^2} = -g$$

$s(0) = s_0$ (initial height)

$s'(0) = v_0$ (initial velocity)

Spring Mass $m\frac{d^2x}{dt^2} = -kx$

Units of Measurements

Quantity	Engineering system	SI system	cgs
Force	pounds (lbs)	newton (N)	dyne
Mass	slug	kilograms (kg)	gram (g)
distance	foot (ft)	meter (m)	cm
Acceleration of gravity	32 ft/s^2	9.8 m/s^2	980 cm/s^2

$W = mg \Rightarrow$ weight

EX3 Simple Pedulum

$$\frac{d^2\theta}{dt^2} + \frac{g}{l}\sin(\theta) = 0$$

EX4 Shape of a rotating string

EX5 Charge on a Capacitor

.
.
.

EX11 Spread of a disease

$$\frac{dx}{dt} = kx(n+1-x)$$

EX12 Cont. Compounding Interest