

Section 31.1: cont'd

Thursday, February 2, 2017

1:32 PM

Drop-in tutorial:

on Thursdays at 12:30 - 1:20 pm

in CC121

(except for Mar 2,
in CBA 101)

bring your lunch/questions

Spring Break: Mon, Feb 13 is stat holiday

Tues - Fri, college is open but
no classes running

Test 2: Friday, Feb 24

on Chapter 29 (29.3 and 29.4)

and Chapter 31, section 31.1, 31.2,
31.4, 31.6

more details on the formula sheet later

handout on writing DEs:

① population is P

rate of growth of pop is $\frac{dP}{dt}$

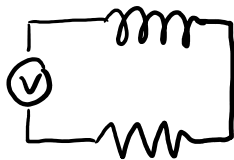
$$\frac{dP}{dt} = kP$$

↑
 k is a constant

② $\frac{dA}{dt} = -kA$

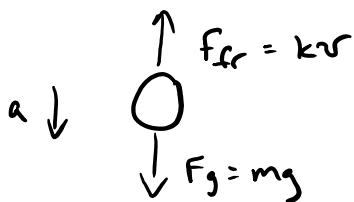
③ $\frac{dT}{dt} = k(T - T_{room})$

⑤



$$V = L \frac{dI}{dt} + IR$$

⑧



$$\sum \vec{F} = m\vec{a}$$

$$F_g - kv = ma$$

$$F_g - kv = m \frac{dv}{dt}$$

the solution to a DE \equiv a relation between variables that satisfies the DE
(note: does not contain derivatives or differentials)

also: does not have to be a function

the DE $\frac{dy}{dx} = x^2 + 3$ has solution $y = \frac{x^3}{3} + 3x + C$

example: show that $y = c \ln x$
 \uparrow
 $c = \text{some constant}$

is a solution to the DE:

$$y' \ln x - \frac{y}{x} = 0$$

answer: how do you do this? plus the solution into the equation and see if you get an identity

$$y = c \ln x$$

$$y' = \frac{c}{x} \quad \text{and plug in:}$$

$$y' \ln x - \frac{y}{x} = 0$$

$$\frac{c}{x} \ln x - \frac{c \ln x}{x} = 0$$

$$0 = 0 \quad \checkmark$$

note: this allows you to check your work!

general solution - a solution to a DE that contains a number of arbitrary constant equal to the order of that DE

example: $y' \ln x - \frac{y}{x} = 0$ with soln $y = c \ln x$

$\underbrace{\hspace{10em}}$
1st order

↑
some constant
how many?
one

so this is a general solution

particular solution - when specific values are given to at least one of the constants

so $y = 3 \ln x$ is a particular solution to

$$y' \ln x - \frac{y}{x} = 0$$

example: show that $y = 3e^{2x}$ and $y = e^{2x} - 5$ are both solutions to the DE

$$y'' = 2y'$$

$$\begin{aligned} y &= 3e^{2x} \\ y' &= 6e^{2x} \\ y'' &= 12e^{2x} \end{aligned}$$

$$\begin{aligned} y'' &= 2y' \\ 12e^{2x} &= 2(6e^{2x}) \end{aligned} \quad \checkmark$$

$$\begin{aligned} y &= e^{2x} - 5 \\ y' &= 2e^{2x} \\ y'' &= 4e^{2x} \end{aligned}$$

$$\begin{aligned} y'' &= 2y' \\ 4e^{2x} &= 2(2e^{2x}) \end{aligned} \quad \checkmark$$

note: these are both particular solutions

so, what do you think the general solution might be?

$$y = C_1 e^{2x} + C_2$$

example: consider the following DE:

$$\frac{dy}{dx} = 2xy$$

is $y = x^2$ a solution?

$$\frac{dy}{dx} = 2x$$

du vu

$\frac{dy}{dx}$ -

$$\frac{dy}{dx} = 2xy$$

$$2x = 2x(x^2)$$

$$2x = 2x^3$$

X

conclusion:

NO