Section 31.1: cont'd

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1:35 PM

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

example: show that $y = c\ln x$ is a solution to the following DE, given that c is a constant

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

$y = c\ln x$
$y' = \frac{c}{x}$

plug in:

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

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

$$0 = 0$$

identity, which means that we've shown that $y = c\ln x$ is a solution to the DE

by the way, was this solution a general or a particular solution?

general - one constant c

and the DE is 1^{st} order

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example: consider the DE:

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

Is $y = x^2$ a solution to this DE?

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

plug in: $2x = 2x(x^2)$

$2x = 2x^3$

conclusion: NO

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no arbitrary constants

example: show that $y = 3e^{2x}$ and $y = e^{2x} - 5$

are both solutions to the DE:

$$y'' = 2y'$$

$y = 3e^{2x}$
$y' = 6e^{2x}$
$y'' = 12e^{2x}$

plug in $y'' = 2y'$
$12e^{2x} = 2(6e^{2x})$ ✓

$y = e^{2x} - 5$

$$y = e^{2x} - 5$$
$$y' = 2e^{2x}$$
$$y'' = 4e^{2x}$$

plug in: $y'' = 2y'$

$$4e^{2x} = 2(2e^{2x}) \checkmark$$

what do you think the general form might look like?

$$y = c_1 e^{2x} + c_2$$

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summary: what is a differential equation?

- an equation containing a <u>rate of change</u>

(derivative or differential)

what does the solution look like?

- a relationship between variables with <u>no</u> derivatives or differentials