

AP Calculus AB Course Study Guide

Differential Equations

From Simple Studies, <https://simplestudies.edublogs.org> & @simplestudies4

on Instagram

Differential Equations (Separate the integral)

Example: $dy/dx=e^{3x}/3y^2$

You want to separate x and y	$3y^2 dy = e^{3x} dx$
Integrate	$\int 3y^2 dy = \int e^{3x} dx$ ($u=3x, du=3dx,$ $1/3du=dx$) $\int 3y^2 dy = 1/3 \int e^u dx$ $y^3 = 1/3e^{3x} + c$
Make y by itself	$\sqrt[3]{y^3} = \sqrt[3]{1/3e^{3x} + c}$ $y = \sqrt[3]{1/3e^{3x} + c}$

Example: $dy/dx=xy$

Separate x and y.	$1/y dy = x dx$
Integrate.	$\int 1/y dy = \int x dx$ $\ln y = x^2/2 + c$
Multiply each side by e.	$ y = e^{x^2/2} \cdot e^c$
C will always be positive and will remain as "c" even if multiplied/divided/added/divided by	$ y = e^{x^2/2} \cdot e^c$ $y = Ce^{x^2/2}$

something.	
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Differential Equation with Initial Condition

Example:

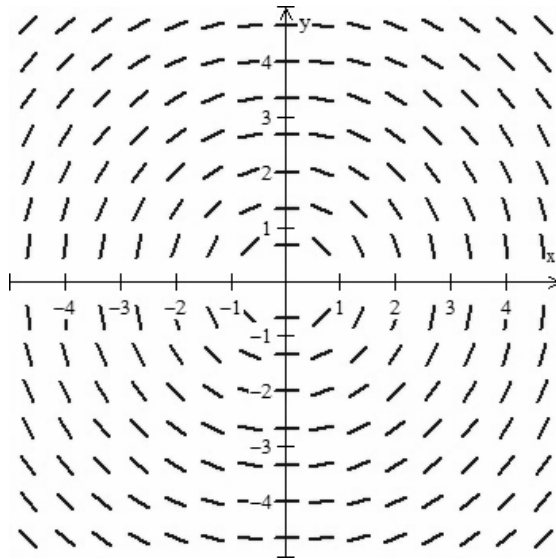
The slope of a curve at each point (x,y) is given by $2\cos x - x$. Which of the following is an equation of the curve if its graph passes through the point (0,1)?

Set up the equation. We know that the “slope of a curve” equals to dy/dx	$dy/dx = 2\cos x - x$
Integrate.	$\int dy = \int 2\cos x - x dx$ $y = 2\sin x - x^2/2 + c$
Using the points they gave us (0,1), plug it into the equation and solve for c.	$1 = 2\sin(0) - (0)^2/2 + c$ $c = 1$
Now that you have c, go back and plug it into the original equation where you found y.	$y = 2\sin x - x^2/2 + 1$

Slope Field

A visual depiction of a differential equation of dy/dx .

- Example of what a slope field looks like:



Picture Credits:

