DIFFERENSIAL TENGLAMALARNI YECHISHDA DASTURLAR MAJMUASIDAN FOYDALANISH

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Tevarak atrofimizdagi har qanday harakat yoki sodir bo‘layotgan hodisa, albatta, biror qonuniyat, ya’ni funksiya asosida sodir bo‘ladi. Bu funksiyalar esa qandaydir tenglamalarning yechimlari hisoblanadi. Shu kabi oddiy ayrim oddiy differensial tenglamalar yaqin-yaqingacha asosan analitik usulda ishlab kelingan. Bu tenglamalarning umumiy va xususiy yechimlarni WolframAlpha dasturidan foydalanib ham olish mumkin.

1-misol. Koshi masalasini yeching:

$$\frac{2xdx}{x^2-1}+\frac{dy}{y^2}=0.$$

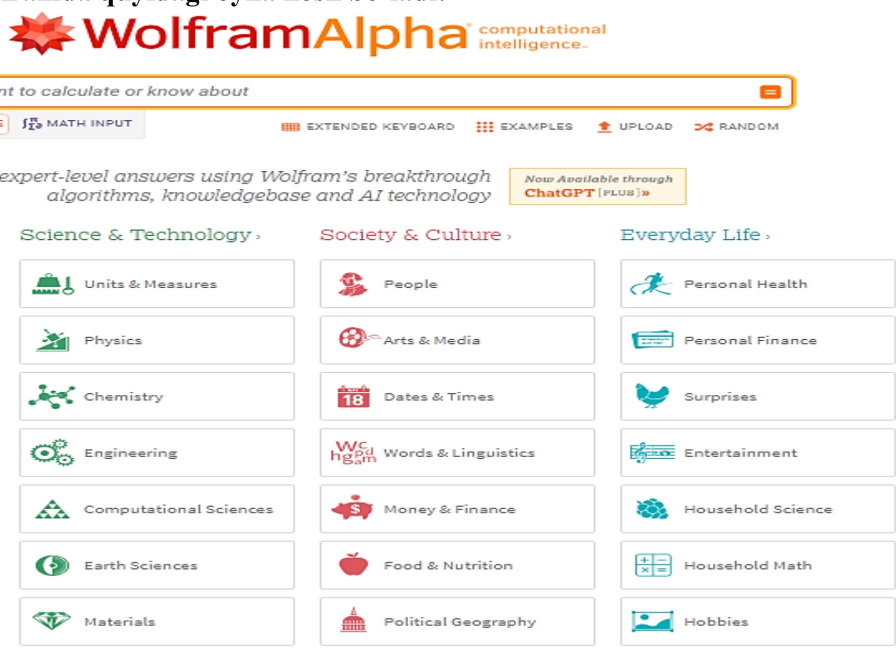
O‘zgaruvchilari ajralgan differensial tenglama berilgan. Uni hadma-had integrallaymiz:

$$\int\frac{2xdx}{x^2-1}+\int\frac{dy}{y^2}=0.$$

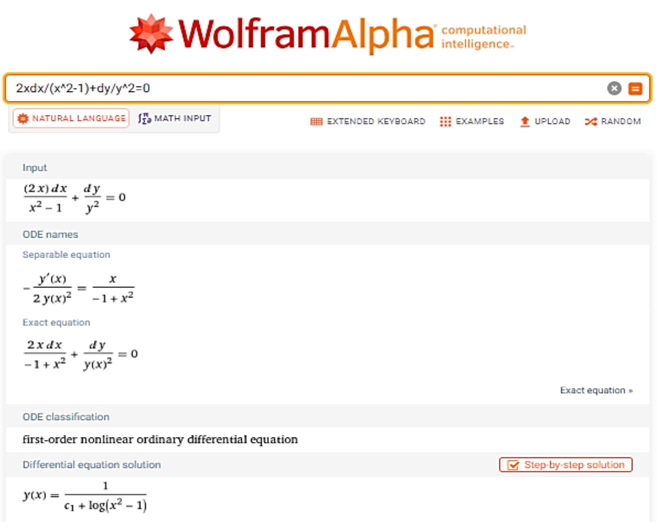
Bundan tenglamaning umumiy yechimini topamiz:

$$\ln\left|x^2-1\right|-\frac{1}{y}=C \quad \text{yoki} \quad y=\frac{1}{\ln\left|x^2-1\right|-C}.$$

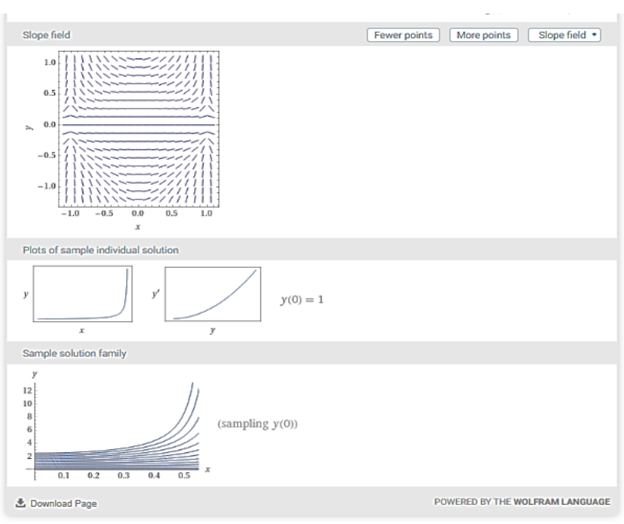
Dastlab kompyuterdagi biror-bir internet brauzerining qidiruv sahifasiga wolframalpha buyrug‘i kiritiladi va kompyuter ekranida quyidagi oyna hosil bo’ladi:



Bu oynaning Mathematics bo’limidan $y''(x)$ Differential Equations bandi tanlanadi. Namunaviy differensial tenglama o’rniga berilgan tenglama va boshlang’ich shart vergul yordamida ajratilib kiritiladi:



Umumiy yechim



Umumiy yechimlar oilasi

2-misol. Koshi masalasini yeching:

$$(1+x^2)dy+(1+y^2)dx=0$$

Tenglamani $(1+x^2)(1+y^2)\neq 0$ ga bo‘lib, o‘zgaruvchilarni ajratamiz:

$$\frac{dx}{1+x^2}+\frac{dy}{1+y^2}=0$$

Bu tenglamani integrallaymiz:

$$arctgx+arctgy=C \quad .$$

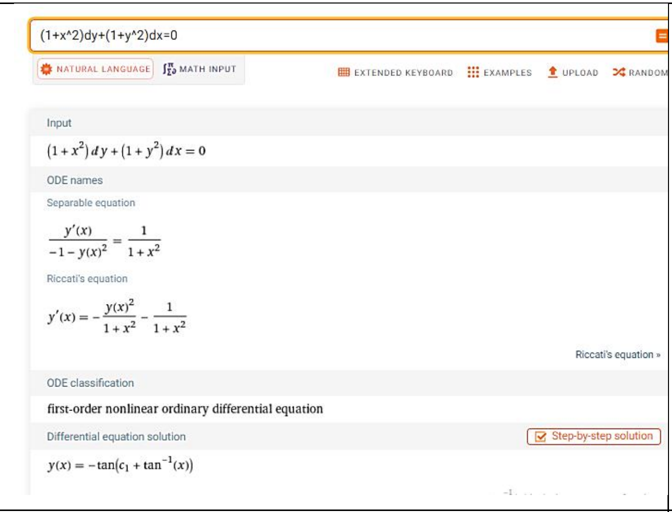
Bundan

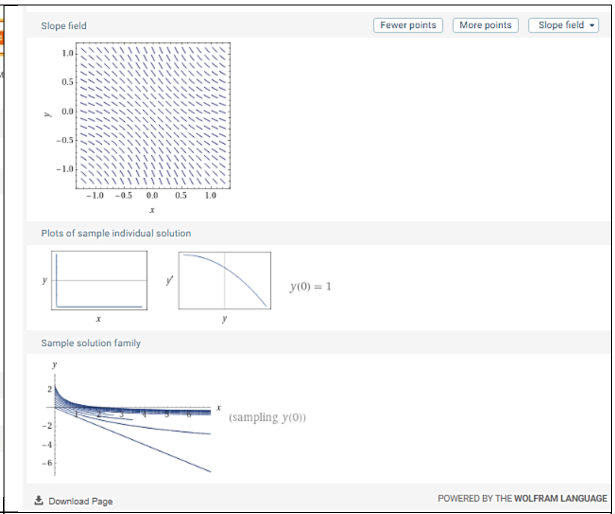
$$tg(arctgx+arctgy)=tgC, \quad \frac{x+y}{1-xy}=C_1,$$

bu yerda $C_1=tgC$ yoki $y=\dfrac{C_1-x}{1+C_1x}$.

C_1 o‘zgarmasning qiymatini boshlang‘ich shartdan topamiz: $C_1=1$. Demak, berilgan Koshi masalasining yechimi

$$y=\frac{1-x}{1+x} \quad .$$





Umumiy yechim	Umumiy yechimlar oilasi

3-misol. $y' + 2y = 3x + 5$ tenglamaning umumiy yechimini toping. Tenglamani $y' = 3x - 2y + 5$ ko‘rinishda yozib olamiz. $u = 3x - 2y + 5,\ u' = 3 - 2y'$ o‘rniga qo‘yishlar bajarib, $y' = 3x - 2y + 5$ tenglamani o‘zgaruvchilari ajraladigan tenglamaga keltiramiz:

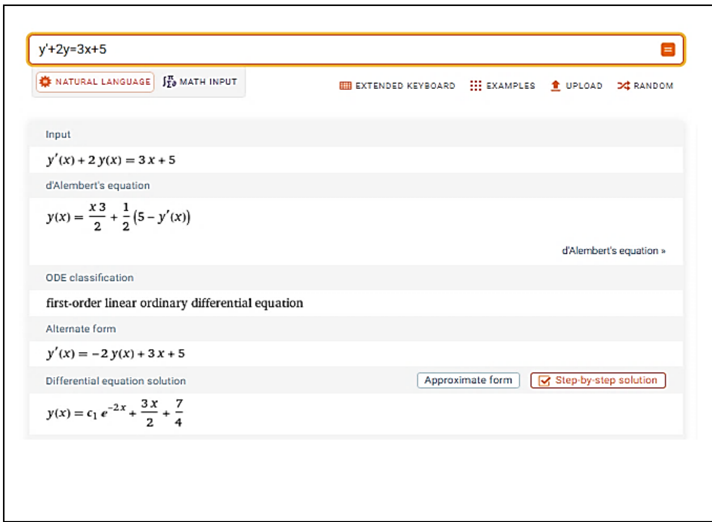
$$3 - u' = 2u \text{ yoki } \frac{du}{dx} = 3 - 2u$$

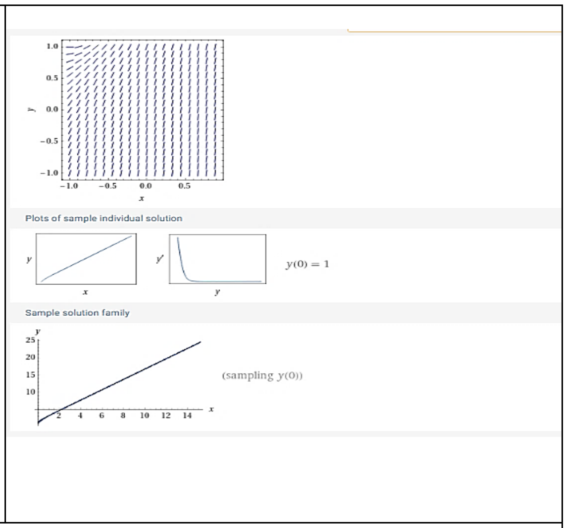
Bundan $\dfrac{du}{2u - 3} = -dx$.

Bu tenglamani integrallaymiz: $\dfrac{1}{2}\ln|2u - 3| = -x + \ln C$ yoki $2u - 3 = Ce^{-2x}$.

Teskari o‘rniga qo‘yish bajarib, berilgan tenglamaning umumiy yechimini topamiz:

$$6x - 4y + 7 = Ce^{-2x}.$$





Umumiy yechim

Foydalanilgan adabiyotlar ro’yxati

1. Sh. R. Xurramov Oliy matematika masalalar to‘plami nazorat topshiriqlari II qism Toshkent 2015

WolframAlpha web sahifasi dasturlar majmuasi