Opener

If $\frac{dy}{dx} = 2y^2$ and if $y = -1$ when $x = 1$, then when $x = 2$, $y =$

(A) $-\frac{2}{3}$ (B) $-\frac{1}{3}$ (C) 0 (D) $\frac{1}{3}$ (E) $\frac{2}{3}$

6-1 day 2 Differential Equations and Slope fields

$\frac{1}{2}y^{-2}dy = 1dx$ $\quad -\frac{1}{2}y^{-1} = x + C \quad y^{-1} = -2x + C$

$-1 = \frac{1}{-2+C} \quad C = 1 \quad y = \frac{1}{-2x+C}$

$y = \frac{1}{-2x+1}$ B $\quad y = \frac{1}{-2\cdot 2+1} \quad y = \frac{1}{-4+1} \quad y = -\frac{1}{3}$

6-1 day 2 Differential Equations and Slope Fields

Learning Objectives:

I can graph and interpret a slope field for a given differential equation

Ex2. Solve $\frac{dy}{dx} = x + y$

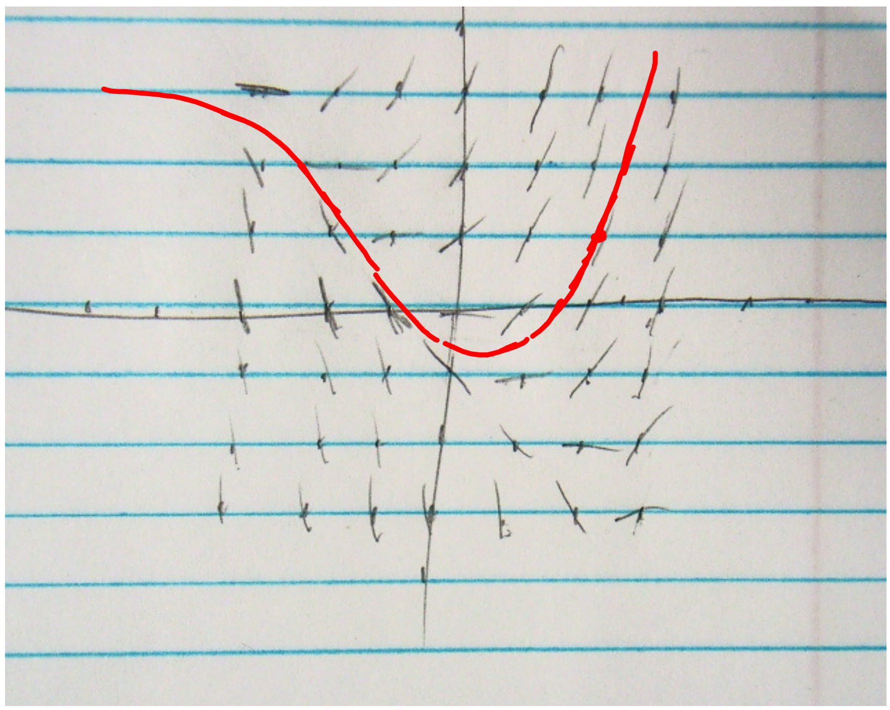
$dy = (x+y)dx$

$dy = x\,dx + y\,dx$

$dy - y\,dx = dx$

Non-sep Diffy Q

$$\frac{dy}{dx} = x + y$$



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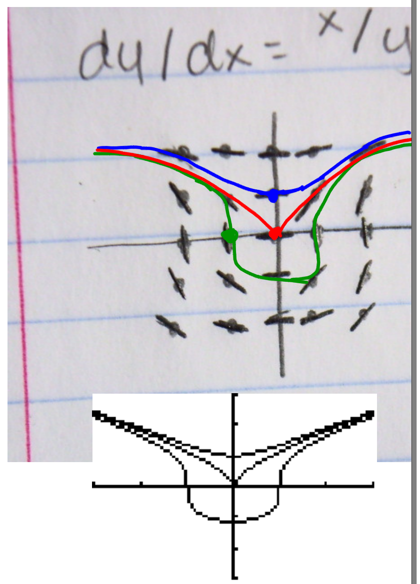
Ex3. Sketch the slope field for the given differential equation. Then solve the differential equation



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

$$dy = \frac{x}{y^2}\,dx$$

$$\int y^2\,dy = \int x\,dx$$

$$\frac{1}{3}y^3 = \frac{1}{2}x^2 + C$$

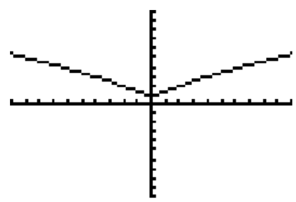
$$y = \sqrt[3]{3/2\,x^2 + C}$$

$(0,1)$

$$1 = \sqrt[3]{\frac{3}{2}(0)^2 + c}$$

$$1 = \sqrt[3]{c}$$

$$c = 1$$



$$y = \sqrt[3]{\frac{3}{2}x^2 + 1}$$

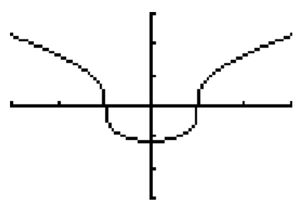
$(-1,0)$

$$0 = \sqrt[3]{\frac{3}{2}(-1)^2 + c}$$

$$0 = \sqrt[3]{\frac{3}{2} + c}$$

$$0 = \frac{3}{2} + c$$

$$-\frac{3}{2} = c$$

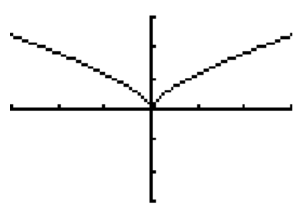


$$y = \sqrt[3]{\frac{3}{2}x^2 - \frac{3}{2}}$$

$(0,0)$

$$0 = \sqrt[3]{\frac{3}{2}(0)^2 + c}$$

$$0 = c$$



$$y = \sqrt[3]{\frac{3}{2}x^2}$$

Ex4. Solve the differential equation

$\frac{dy}{dx} = yx$ initial condition (0,2)

$\frac{1}{y}\,dy = x\,dx \quad \ln|y| = \frac{1}{2}x^2 + c$

$y = \pm e^{1/2 x^2 + c} \quad 2 = e^{1/2\, 0^2 + c}$

$2 = e^c \quad \ln 2 = c$

$y = \pm e^{1/2 x^2 + \ln 2}$

$y = e^{1/2 x^2 + \ln 2}$

$y = e^{1/2 x^2} \cdot \cancel{e^{\ln 2}}$

$y = 2e^{1/2 x^2}$

Homework

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