6.1 Differential Equations, Initial Value Problems, and Slope Fields

Feb 1-1:00 PM

Find the general solution +c to the ~~initial value problem~~ differential equation

1. $\frac{dy}{dx} = 3x^2 + \cos x$ dx

$\int dy = \int 3x^2 + \cos x \, dx$

$y = x^3 + \sin x + c$

2. $\frac{dy}{dx} = \frac{1}{x^3} + \frac{1}{x}$

$\int dy = \int \frac{1}{x^3} + \frac{1}{x} \, dx$

$y = -\frac{x^{-2}}{2} + \ln x + c$

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Find the general solution to the initial value problem.

3. $\int \frac{dy}{dx} = \int -\frac{1}{x^2+1} + e^{-2x}\, dx$

$y = \cot^{-1} x - \frac{e^{-2x}}{2} + C$

4. $\int \frac{du}{dx} = \int e^{\sin x} \cdot \cos x\, dx$

$u = e^{\sin x} + C$

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Solve the initial value problem. Find the particular solution.

5. $\int \frac{dy}{dx} = \int 4\cos x\, dx;\ y = 3$ when $x = \frac{\pi}{2}$

$y = 4\sin x + C$

$3 = 4\sin\frac{\pi}{2} + C$

$3 - 4\sin\frac{\pi}{2} = C$

$C = -1$

$y = 4\sin x - 1$

6. $\int \frac{dy}{dx} = \int x^2 + \sqrt{x}\, dx;\ y = 4$ when $x = 9$

$x^{3/2} = \sqrt{x^3}$

$4 = \frac{(9)^3}{3} + \frac{2(9)^{3/2}}{3} + C$

$C = -257$

$y = \frac{x^3}{3} + \frac{2x^{3/2}}{3} - 257$

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x = 0 y = 4

7) $\int \frac{dy}{dx}\,dx = \int \sin x\,dx;\ f(0) = 4$

$y = -\cos x + c$

$4 = -\cos 0 + c$

$4 = -1 + c$

$c = 5$

$y = -\cos x + 5$

8. $\frac{dy}{dx} = \frac{1}{x} + 8;\ y = 0 \text{ when } x = e$

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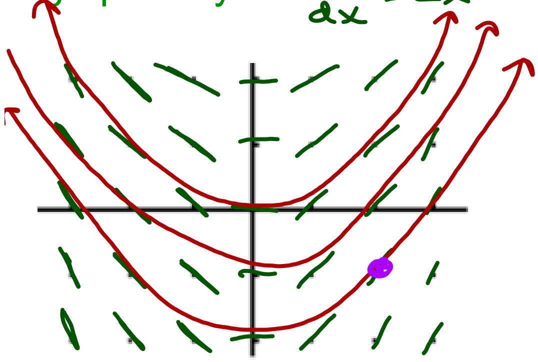
What does this differential function tell us?

$\frac{dy}{dx} = 2x$ ← slope of tan line at any pt.

$y = x^2$

How can we represent what we learn from the equation graphically? $\frac{dy}{dx} = 2x$ $y = x^2 + c$



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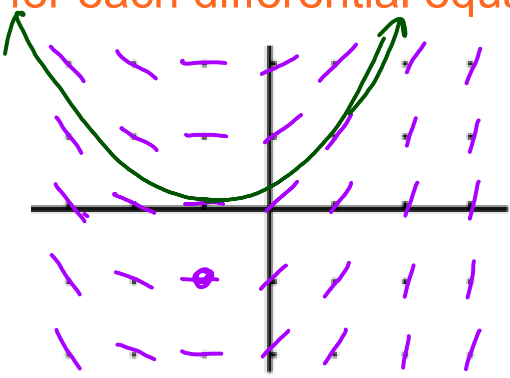
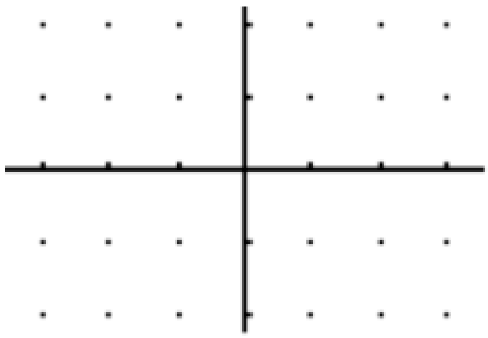
Draw a slope field for each differential equation.

1. $\frac{dy}{dx} = x + 1$



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



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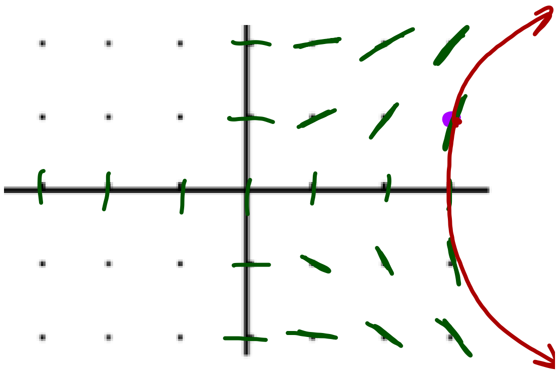
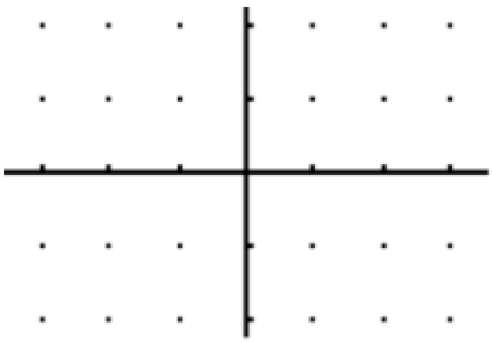
Draw a slope field and find the particular solution the differential equation.

5. $\frac{dy}{dx} = \frac{x^2}{y}; \quad f(3) = 1$



6. $\frac{dy}{dx} = \frac{-xy^2}{2}; \quad f(-1) = 2$



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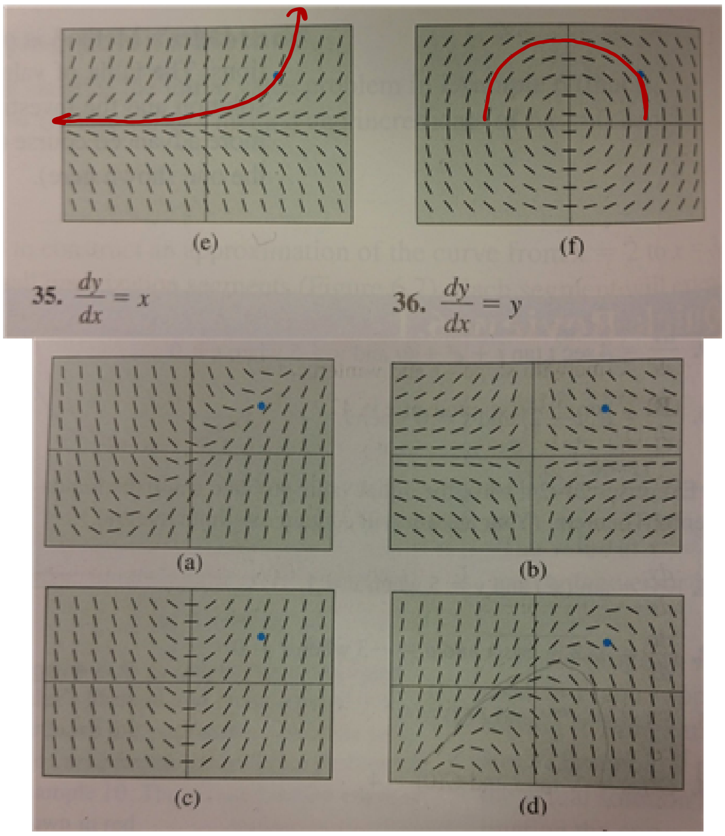

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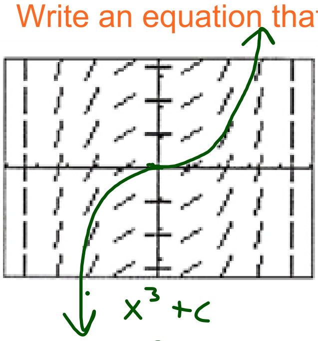
7. Write an equation that the slope field could represent.

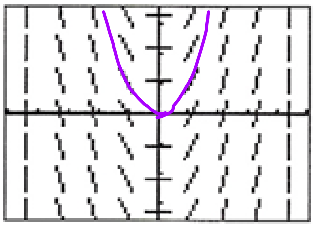
a)



$x^3 + c$

$3x^2$

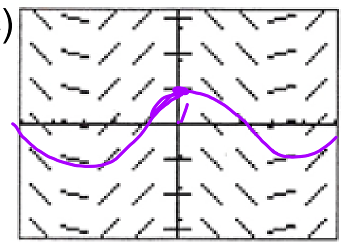
b)



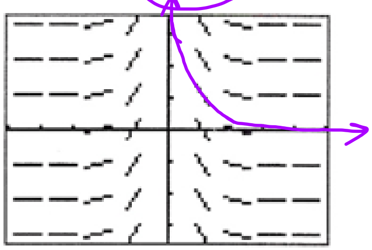
orig: x^2

$2x$

c)



d)



orig: $\cos x$

$-\sin x$

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