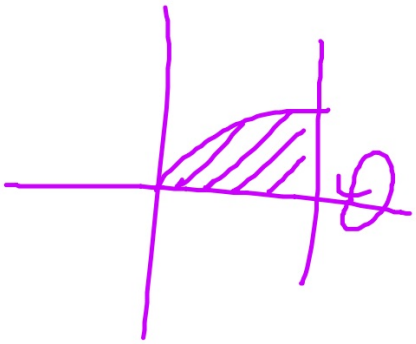
Diff equ.
Slope fields
area
volume
rate in rate out

x-axis

$y = \sqrt{x}$

$x = 4$

revolve x-axis



$$\pi \int_0^4 (\sqrt{x} - 0)^2 \, dx$$

① $\frac{dy}{dx} = 3x^2 y$ $(0, 8)$

$\int \frac{dy}{y} = \int 3x^2 dx$

$\ln|y| = x^3 + C$

$e^{\ln|y|} = e^{x^3 + C}$

$|y| = Ce^{x^3}$

$8 = C$

$|y| = 8e^{x^3}$

$y = 8e^{x^3}$

$u = 2y - 5$
$du = 2\,dy$

$$\int \frac{dy}{2y-5} = \int x\,dx$$

$$\frac{1}{2}\ln|2y-5| = \frac{1}{2}x^2 + C$$

(2) $\frac{dy}{dt} = -2y$

$\int \frac{dy}{y} = \int -2\,dt$

$\ln|y| = -2t + C$

$e^{\ln|y|} = e^{-2t+C}$

$|y| = Ce^{-2t}$

$(0,1)\quad (t, \frac{1}{2})$

$|y| = e^{-2t}$

$\ln \frac{1}{2} = \ln e^{-2t}$

$\frac{\ln \frac{1}{2}}{-2} = -2t$

$\frac{\ln 1 - \ln 2}{-2}$

The rate of change of y is proportional to y.

$$\frac{dy}{dx} = ky$$

$$\downarrow$$

$$y = Ce^{kt}$$

3.) $\int_0^5 3000e^{2+15}\,dt = \frac{5}{2}\cdot 3000e^{2+15}\Big]_0^5$

$7500e^{2+15}\Big]_0^5$

$u = \frac{2+}{5}$

$du = \frac{2}{5}dt$

$7500 + (7500e^2 - 7500)$

4.) $\frac{dy}{dx} = \frac{-x}{ye^{x^2}}$

$(0, 2)$

$\int y\,dy = \int -xe^{-x^2}\,dx$

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

$2 = \frac{1}{2} + C$

$\frac{3}{2} = C$

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

$\sqrt{y^2} = \sqrt{e^{-x^2} + 3}$

$y = \pm\sqrt{e^{-x^2} + 3}$

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