DEFINITION Differential Equation

An equation involving a derivative is called a **differential equation.** The **order of a differential equation** is the order of the highest derivative involved in the equation.

1. Find the general solution of the exact differential equation:
   a. $\frac{dy}{dx} = \sec x \tan x - e^x$
   b. $\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}} - \frac{1}{\sqrt{x}}$
   c. $\frac{dy}{dt} = \cos t(e^{\sin t})$
   d. $\frac{dy}{du} = 4(\sin u)^3(\cos u)$

2. Solve the initial value problem explicitly:
   a. $\frac{dy}{dx} = 2e^x - \cos x$ and $y = 3$ when $x = 0$
   b. $\frac{dA}{dx} = 10x^9 + 5x^4 - 2x + 4$ and $A = 6$ when $x = 1$
   c. $\frac{dy}{dx} = 5\sec^2 x - \frac{3}{2}\sqrt{x}$ and $y = 7$ when $x = 0$
   d. $\frac{ds}{dt} = t(3t - 2)$ and $s = 0$ when $t = 1$

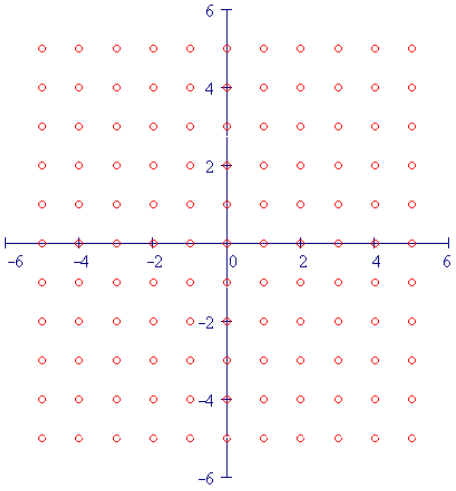
3. Solve the initial value problem using the Fundamental Theorem (Your answer will contain a definite integral)

a. $\frac{du}{dx} = \sqrt{2+\cos x}$ and $u = -3$ when $x = 0$

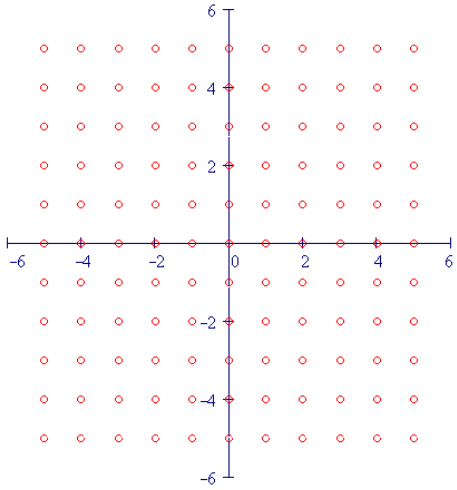
a. $G'(s) = \sqrt[3]{\tan s}$ and $G(0) = 4$

4. Draw a slope field for each of the following:

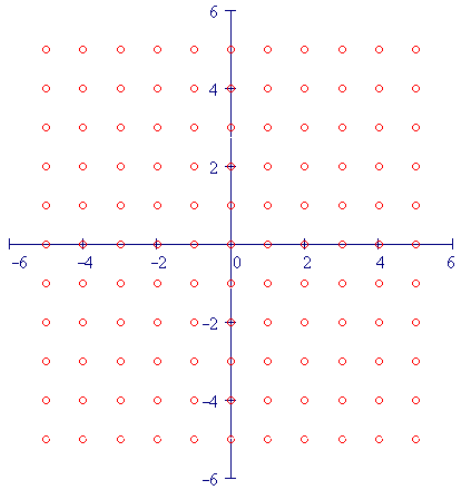
a. $\frac{dy}{dx} = x + 1$



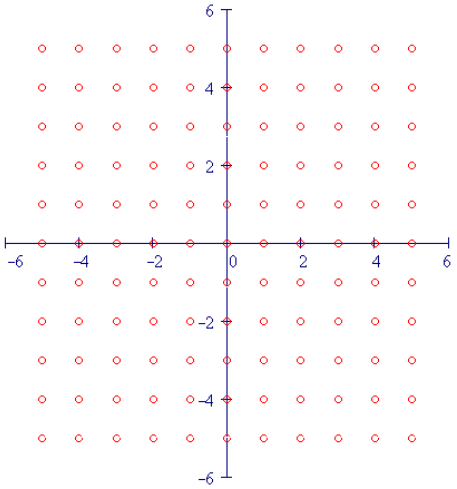
b. $\frac{dy}{dx} = 2y$



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

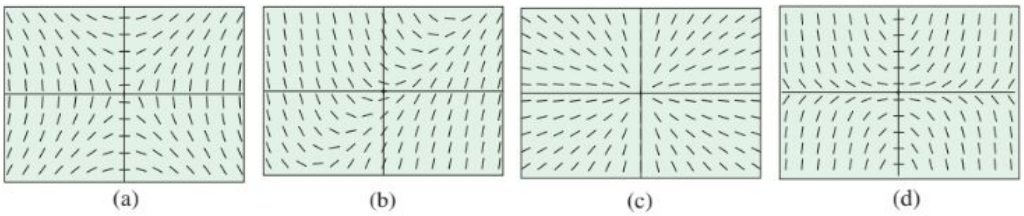


d. $\frac{dy}{dx} = -\frac{x}{y}$



5. Use slope analysis to match each of the following differential equations with one of the slope fields (a) through (d). (Do not use your graphing calculator.)

1. $\frac{dy}{dx} = x - y$ **2.** $\frac{dy}{dx} = xy$ **3.** $\frac{dy}{dx} = \frac{x}{y}$ **4.** $\frac{dy}{dx} = \frac{y}{x}$



6. Use Euler's Method with increments $\Delta x = 0.1$ to approximate the value of y when $x = 1.3$

   a. $\frac{dy}{dx} = y - 1$ and $y = 3$ when $x = 1$

   b. $\frac{dy}{dx} = 2x - y$ and $y = 0$ when $x = 1$

7. Use Euler's Method with increments $\Delta x = -0.1$ to approximate the value of y when $x = 1.7$

   a. $\frac{dy}{dx} = 1 + y$ and $y = 0$ when $x = 2$

   b. $\frac{dy}{dx} = x - 2y$ and $y = 1$ when $x = 2$