GUIDED NOTES (SAMPLE RESPONSES)

Vocabulary

- **differential equation:** an equation that relates an unknown function, *y*, and its derivative(s)

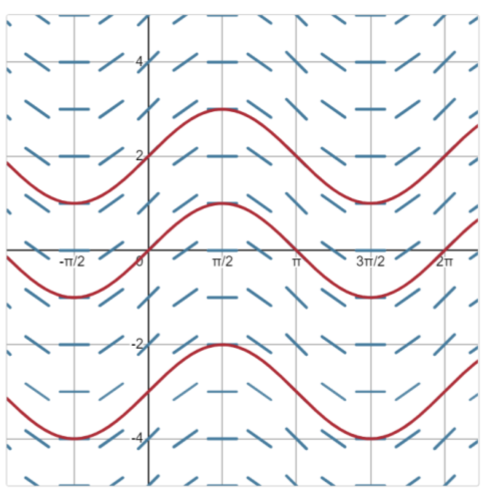
$$\underbrace{\frac{dy}{dx}}_{\text{slope}} = \underbrace{f(x,\ y)}_{\text{function in terms of } x\text{'s and } y\text{'s}}$$

- **lineal element:** a short line segment drawn through $(x,\ y)$ with slope $\frac{dy}{dx}$

- **slope field (direction field):** the graphical representation of a differential equation made up of a collection of lineal elements

Example Problems

1) Use the given slope field to find the general solution of the differential equation: $\frac{dy}{dx} = \cos x$.



$$\left.\frac{dy}{dx}\right|_{x=0} = \cos(0) = 1$$

$$\left.\frac{dy}{dx}\right|_{x=\frac{\pi}{2}} = \cos\left(\frac{\pi}{2}\right) = 0$$

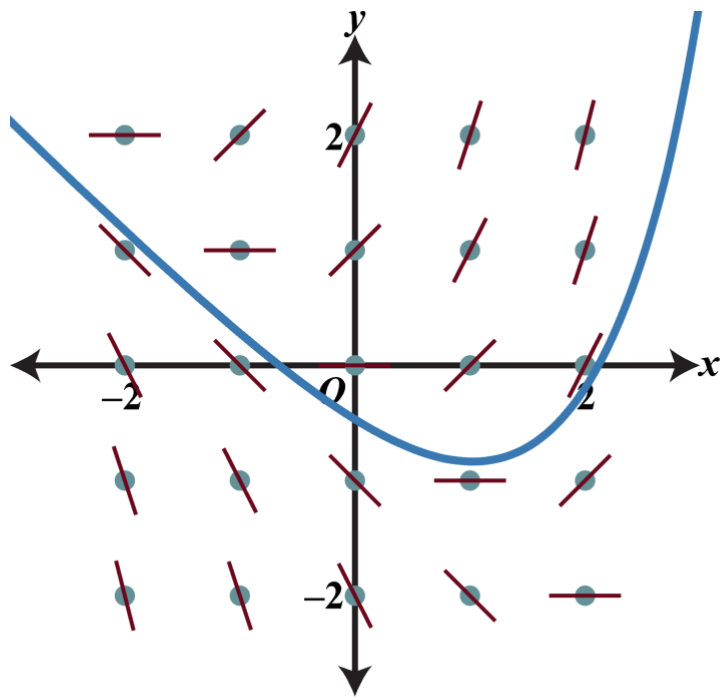
$$\left.\frac{dy}{dx}\right|_{x=\pi} = \cos(\pi) = -1$$

$$\left.\frac{dy}{dx}\right|_{x=\frac{3\pi}{2}} = \cos\left(\frac{3\pi}{2}\right) = 0$$

$$\left.\frac{dy}{dx}\right|_{x=2\pi} = \cos(2\pi) = 1$$

general solution: $y = \sin x + c$

2) Plot the slope field for the differential equation: $\frac{dy}{dx} = x + y$. Sketch a reasonable solution using the initial condition: $(2, 0)$.



$(-2, 2) \Rightarrow 0$	$(-1, 2) \Rightarrow 1$	$(0, 2) \Rightarrow 2$	$(1, 2) \Rightarrow 3$	$(2, 2) \Rightarrow 4$
$(-2, 1) \Rightarrow -1$	$(-1, 1) \Rightarrow 0$	$(0, 1) \Rightarrow 1$	$(1, 1) \Rightarrow 2$	$(2, 1) \Rightarrow 3$
$(-2, 0) \Rightarrow -2$	$(-1, 0) \Rightarrow -1$	$(0, 0) \Rightarrow 0$	$(1, 0) \Rightarrow 1$	$(2, 0) \Rightarrow 2$
$(-2, -1) \Rightarrow -3$	$(-1, -1) \Rightarrow -2$	$(0, -1) \Rightarrow -1$	$(1, -1) \Rightarrow 0$	$(2, -1) \Rightarrow 1$
$(-2, -2) \Rightarrow -4$	$(-1, -2) \Rightarrow -3$	$(0, -2) \Rightarrow -2$	$(1, -2) \Rightarrow -1$	$(2, -2) \Rightarrow 0$