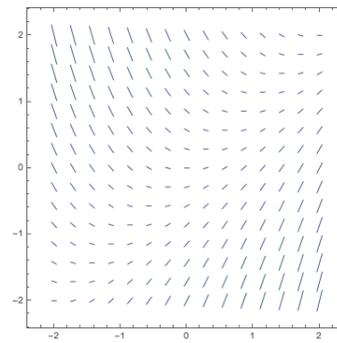
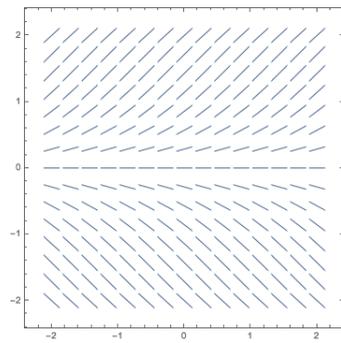
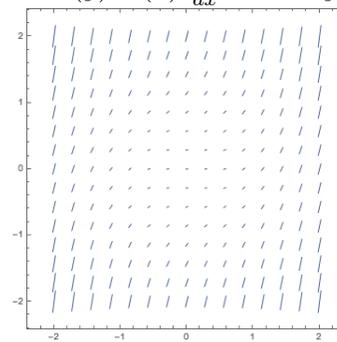
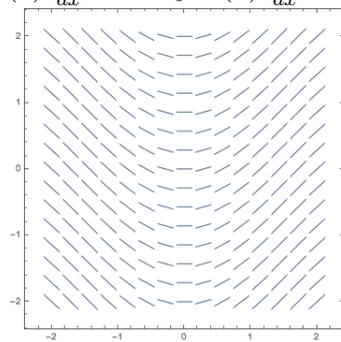


Name: \_\_\_\_\_

Solve the following problems.

1. Identify which of the following differential equations are associated to each of the following direction fields:

(a)  $\frac{dy}{dx} = x - y$     (b)  $\frac{dy}{dx} = \sin(x)$     (c)  $\frac{dy}{dx} = \sin(y)$     (d)  $\frac{dy}{dx} = x^2 + y^2$



2. Solve the following initial value problem exactly, then compute its degree two Taylor polynomial around zero and use this to compute an estimate for  $y(.3)$ . Then use Euler's method with step size  $\Delta x = .1$  to estimate  $y(.3)$ .

$$\frac{dy}{dx} = -2xy$$

$$y(0) = 1$$

3. Compute the degree two Taylor polynomial of the function  $f(x) = e^{\tan(x)}$  around 0. Use this to estimate  $e^{\tan(.1)}$ .
4. For  $f(x) = \int_0^x e^{-t^2} dt$ , find the degree three Taylor polynomial of  $f(x)$  around 0 and use this to estimate  $f(.1)$ .
5. A 100 litre vat of water begins with an algae concentration of 1,000 organisms per litre. Suppose that the algae naturally reproduce at a rate of five percent per minute and die at a rate of four percent per minute. If the vat is being drained at a rate of one litre per minute, what will the algae concentration be ten minutes from now? You should assume that the algae are uniformly distributed in the vat. Remember to define your variables with units.