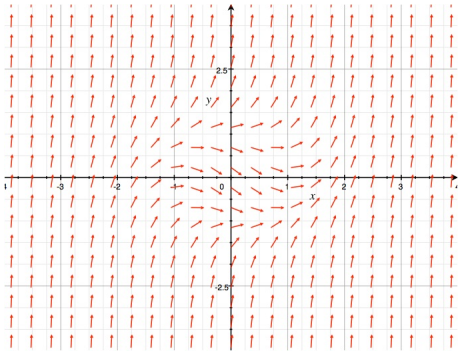
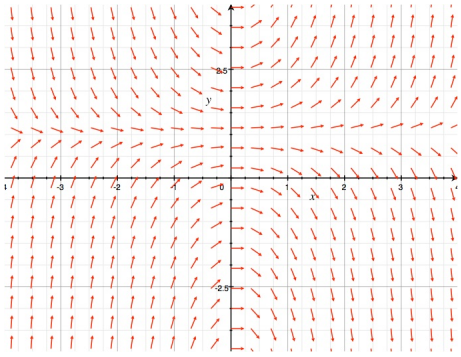
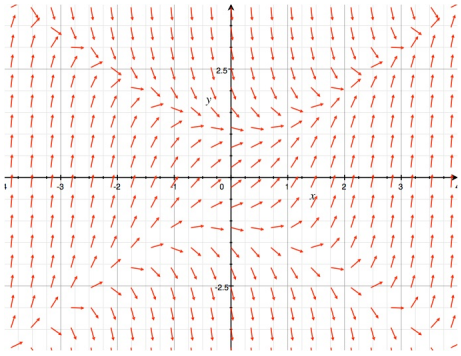
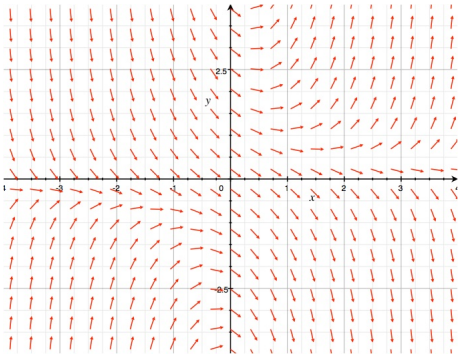
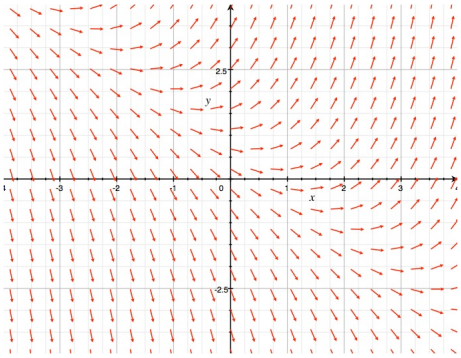
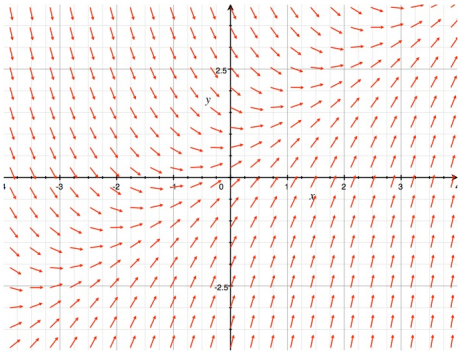
Review: Chapters 9 & 17

Monday, May 4

9.1-9.2: Differential Equations and Direction Fields

1. Show that the function $y = x \sin x$ satisfies the differential equation $y'' + y = 2 \cos x$
2. Show that the function $y = xe^{-x} + 2$ satisfies the differential equation $y - xy' = x^2 e^{-x} + 2$
3. If $y' = y$ and $y(0) = 1$, estimate $y(1)$ using Euler's method with a step size of $\Delta x = 0.5$.
4. Match the following differential equations with the appropriate direction fields:

(a) $y' = x + y - 1$ (b) $y' = xy - 1$ (c) $y' = x^2 + y^2 - 1$ (d) $y' = x - y + 1$ (e) $y' = x(y - 1)$ (f) $y' = x^2 - y^2 + 1$

1. 
2. 
3. 
4. 
5. 
6. 

9.3: Separable Equations

1. $y' = x/y, y(0) = -3$
2. $y' = xy \sin x, y(0) = 1$
3. $xy' - y = 1, y(2) = 3$

9.5: Linear Equations

1. $xy' - y = 1, y(2) = 3$
2. $2xy' + y = 6x, y(4) = 20$
3. $y' + xy = x, y(1) = 1.$

17.1-2: Second-order Linear Equations

Solve each non-homogeneous equation using either variation of parameters or the method of undetermined coefficients, whichever is more appropriate.

1. $y'' + 3y' + 2y = \sin x + 2\cos x$
2. $y'' - 2y' + y = 2xe^x - e^x$
3. $y'' + y = 2\sin x + 3$
4. $y'' + y = \frac{1}{\cos x}$
5. $y'' + 3y' + 2y = \sin(e^x)$