Chapter 21 Homework 16

p. 364

1. a) $\frac{du}{dt} = \frac{3d^2u}{dx^2} + 2(u - \sin u)$

$u(t,x) = F(x-ct) = f(s)$

$\frac{du}{dt} = \frac{df}{dt} = \frac{df}{ds}\cdot\frac{ds}{dt} = -c\frac{df}{ds}$

$\frac{du}{dx} = \frac{df}{dx} = \frac{df}{ds}\cdot\frac{ds}{dx} = \frac{df}{ds}$

$\frac{d^2u}{dx^2} = \frac{d^2f}{dx^2} = \frac{d}{ds}\left(\frac{df}{ds}\right)\cdot\frac{ds}{dx} = \frac{d^2f}{ds^2}$

so we have

$-c\frac{df}{ds} = 3\frac{d^2F}{ds^2} + 2(f - \sin f)$

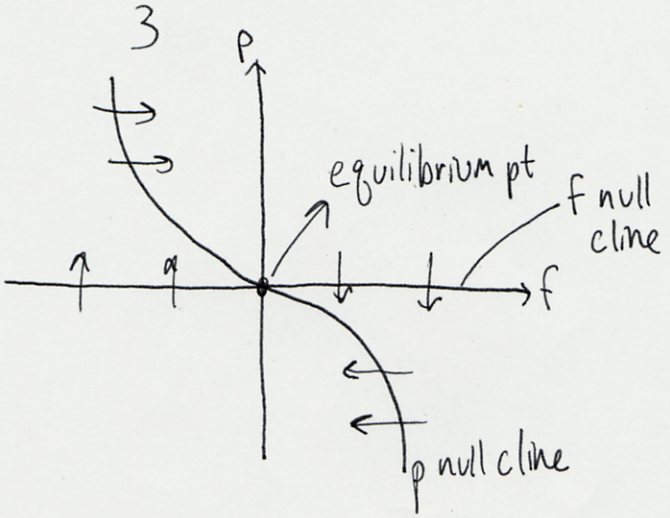
c) $\frac{du}{dt} = -5\frac{d^2u}{dx^2} + e^u$ similar to above, we have

$-c\frac{df}{ds} = -5\frac{d^2f}{ds^2} + e^f$

2. for 1a):

a) $\frac{df}{ds} = p \quad \frac{dp}{ds} = \frac{-cp - 2(f - \sin f)}{3}$

b)



for 1c):

a) $\frac{df}{ds} = p \quad \frac{dp}{ds} = \frac{cp + e^f}{5}$

b)