Homework 11

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529.1

$$x = -e^t, y = e^t$$

$$\frac{dx}{dt} = -y, \frac{dy}{dt} = -x$$

$$\frac{dx}{dt} = -e^t, y = e^t, \frac{dx}{dt} = -y$$

$$\frac{dy}{dt} = e^t, x = -e^t, \frac{dy}{dt} = -x$$

529.6

$\frac{dx}{dt}$ and $\frac{dy}{dt} = 0$ at (2,1)

Finding other points can be done with $rcos(\theta), rsin(\theta)$ where r is the radius from the stable point (2,1), and theta is the angle from (2,1).

536.7

a.

$$\frac{dx}{dt} = (a - by)x, \frac{dy}{dt} = (m - nx)y$$

$$\frac{dy}{dx} = \frac{(m - nx)y}{(a - by)x}$$

b.

integrating gives:

$$\frac{y(mln(x) - nx)}{a - by} + K$$

exponetiation gives

$$y^a e^{-by} = Kx^m e^{-nx}$$

546.1

$$f(y) = \frac{y^a}{e^{by}}$$

$$f'(y) = \frac{y^{a-1}(by - a)}{e^{by}}$$

Setting $f'(y) = 0$ gives:

$$y = a/b$$

This means that the above is a critical point, but we are unsure if its a maxima or minima. Let's take the 2nd derivative.

$$f''(y) = \frac{y^{a-2}(b^2y^2 - 2aby + a^2 - a)}{e^{by}}$$

We can then substitute y for a / b, but it becomes impossible to assign a maxima or minima without knowing `a` and `b`. The end result is we know we have a critical point at (2,1), but we do not know if it a max or min.

566.1

Not really sure how to do this at the moment with an immense amount of work. Working on figuring it out...

A potential solution is:

x:

```
x1 <- matrix(c(1,.985,.97,1,.925,.85), ncol = 2)
x1
```

```
##       [,1]  [,2]
## [1,] 1.000 1.000
## [2,] 0.985 0.925
## [3,] 0.970 0.850
```

```
x2 <- matrix(c(1,.99,.97,1,.95,.9017), ncol = 2)
x2
```

```
##      [,1]   [,2]
## [1,] 1.00 1.0000
## [2,] 0.99 0.9500
## [3,] 0.97 0.9017
```

y:

```
y1 <- matrix(c(1,.985,.97,1,.925,.85), ncol = 2)
y1
```

```
##       [,1]  [,2]
## [1,] 1.000 1.000
## [2,] 0.985 0.925
## [3,] 0.970 0.850
```

```r
y2 <- matrix(c(1,.99,.98,1,.95,.9013), ncol = 2)
y2
```

```
##      [,1]   [,2]
## [1,] 1.00 1.0000
## [2,] 0.99 0.9500
## [3,] 0.98 0.9013
```