Week10hw609

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Page 469, Question 3

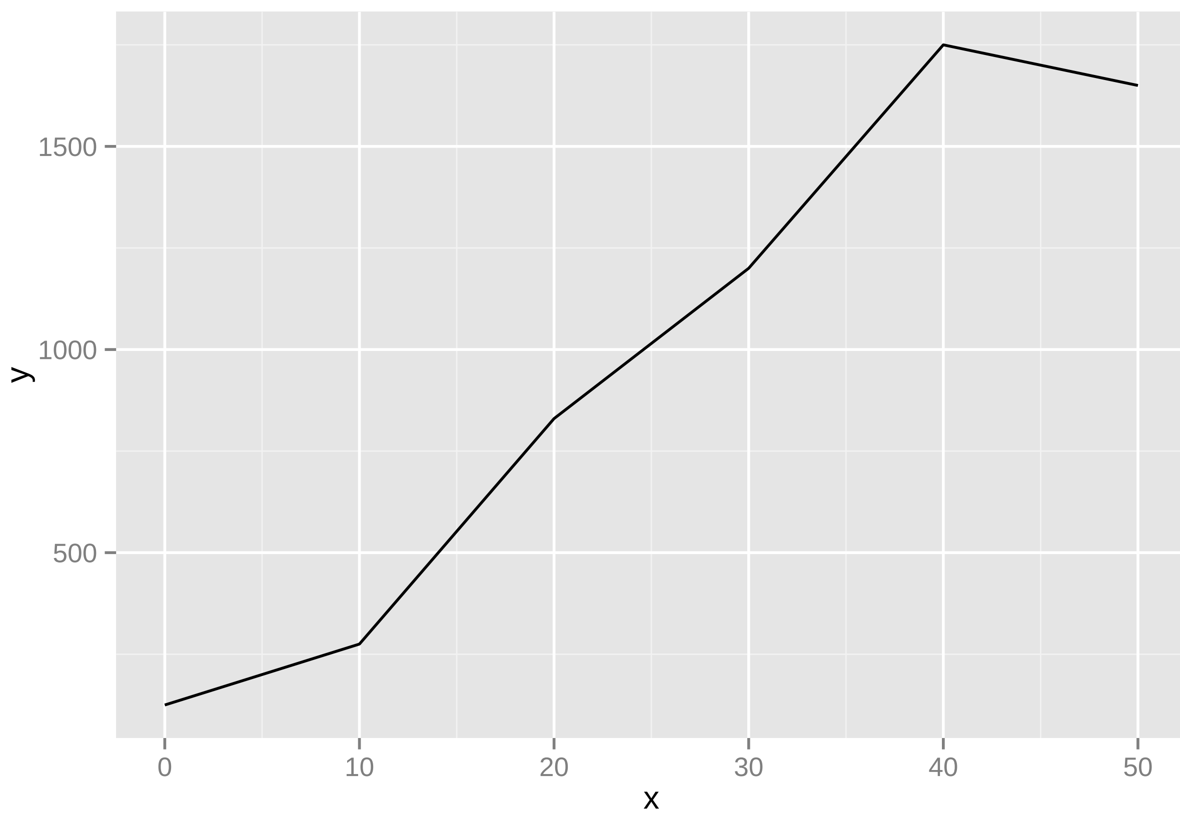
The following data were obtained for thee growth of a sheep population introduced into a new environment on the island of Tasmania.

a. Make an estimate of M by graphing P(t).

```
library(ggplot2)

t <- c(1814, 1824, 1834, 1844, 1854, 1864)
tminus0 <- t-t[1]
p <- c(125, 275, 830, 1200, 1750, 1650)

ggplot(data.frame(x=tminus0,y=p),aes(x=x,y=y)) + geom_line()
```

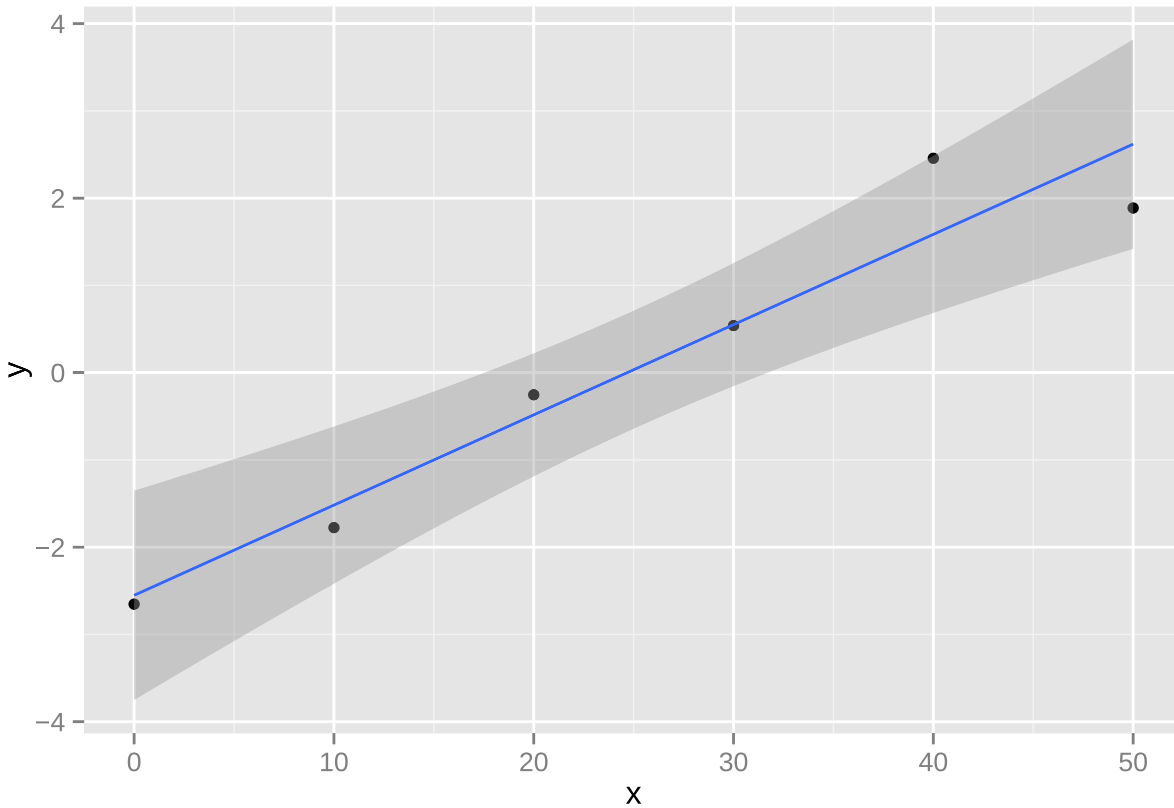


Lets assume that the model isn't perfect, and the decrease to 1650 doesn't imply the cap has been reached already, but rather that the maximum population is being approached. We'll estimate a max population of around 1900.

b. Plot ln[P/(M-P)] against T. If a logistic curve seems reasonable, estimate rM and t^*.

```r
m <- 1900
lnpmp <- log(p/(m-p))

ggplot(data.frame(x=tminus0,y=lnpmp),aes(x=x,y=y)) + geom_point() +
  stat_smooth(method="lm")
```




```r
rm <- lm(lnpmp~t)$coefficients["t"]
rm
```

```
##         t
## 0.1034121
```

```r
tstar <- -(1/rm)*log(p[1]/(m-p[1]))

tstar + t[1]
```

```
##        t
## 1839.657
```

This checks out. The 1834 population is 830, and the 1844 population is 1200, and half our estimated M is 950.

Page 478, Question 6

Suggest other phenomena for which the model described in the text might be used.

This model could be used for any situation where something external is being added, and there's a time that the system takes to "digest" the external variable.

One example could be an electrical system. There could be a safe range of power flow. If you go above this rate, the system could overload, and if you're below the system might not have enough power. This is less of a "dose" problem and more of an analysis of what sort of electrical flow is needed, but it can be modeled in a similar way.

Page 481, Question 1

a. Using the estimate that $d_b = 0.054v^2$, where 0.054 has the dimension $\frac{ft*hr^2}{mi^2}$, show that the constant k has the value 19.9 $\frac{ft}{sec^2}$

0.054 isn't in the correct units, so we'll have to correct them first:

$$0.054\frac{ft * hr^2}{mi^2} \times 12960000\frac{sec^2}{hr^2} \times \frac{1}{27878400}\frac{ft^2}{mi^2}$$

```
c <- 0.054*12960000/27878400
c
```

```
## [1] 0.02510331
```

Then we just solve for k:

$$d_b = 0.025v^2 = \frac{v*}{2k}$$

$$0.025 = \frac{1}{2k}$$

```
k <- 1/(2*c)

k
```

```
## [1] 19.9177
```