STA 108 HW 1

1.2

$y = 2x + 300$ This is a functional relation because there is no randomness involved. At x visits, we know 100% what y would be.

1.8

Yes, E{Y} will still be 104 because the expected value is calculated over many observations, not on one observation. No, the Y value does not have to be 108, because the sampling is random so the error ($\mathcal{E}_i$) might be different.

1.12

a. Observational data, because the predictor variables are uncontrolled and it didn't come from an experimental study.
b. Validity is questionable because it claims a direct causation between number of colds and time exercised, but we only know that there is a correlation.
c. Underlying illness, mobility issues, daily environment.
d. Add more explanatory variables, and make the study a completely randomized experiment.

1.27

See appendix for R code.

a. My plot supports that musscle mass decreases as age increases because the regression line has a negative slope.
b.
    1. The slope ($\beta_1 = -1.19$) is the point estimate of difference in mean muscle mass for women differing in age by one year.
    2. $\hat{y}_{x=60} = 84.94683$
    3. $\mathcal{E}_8 = 4.443252$

1.30

The implication is that the dependent variable is not affected by the independent variable ($\beta_1 = 0$). The regression function ($y = \beta_0 + \mathcal{E}_i$) would be a horizontal line on a graph with a y-intercept of β_0.

Appendix

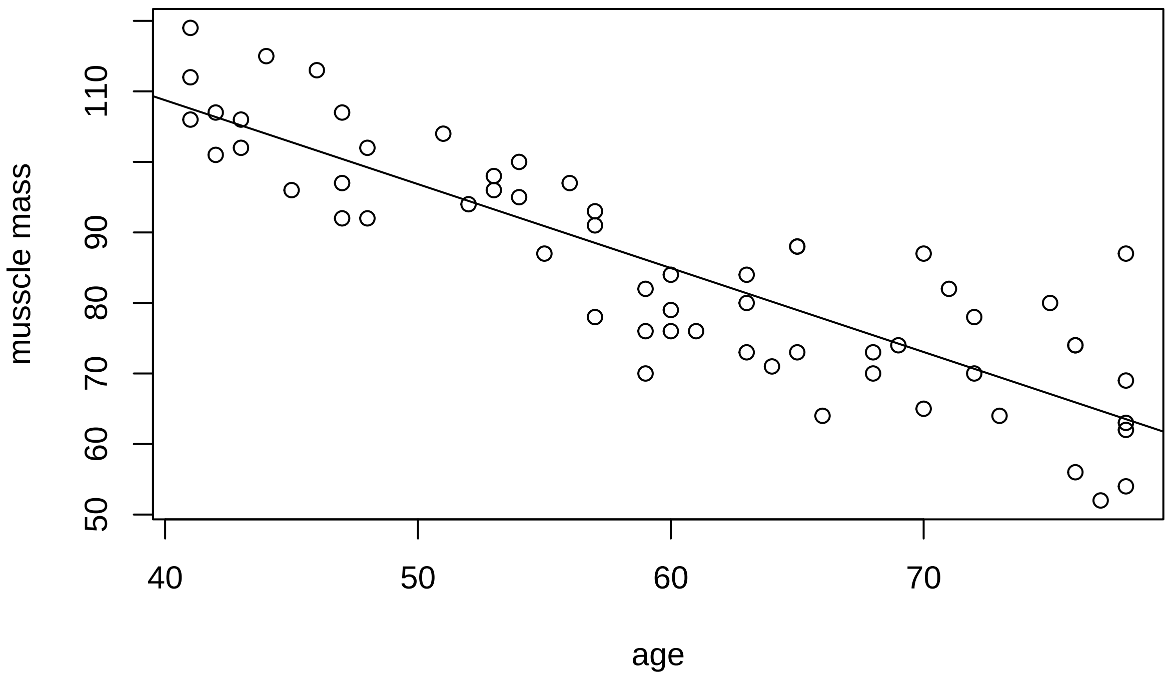
1.27(a)

```
file_path <- "CH01PR27.txt"
data <- read.table(file_path)
y <- data$V1
x <- data$V2
```

```r
model <- lm(y ~ x, data = data)
intercept <- coef(model)[1]
slope <- coef(model)[2]
cat("y = ", round(intercept, 2), " + ", round(slope, 2), "x\n", sep = "")
```

```
## y = 156.35 + -1.19x
```

```r
plot(x, y, xlab = "age", ylab = "musscle mass")
abline(model)
```



1.27(b)

1

```r
slope
```

```
##         x
## -1.189996
```

2

```r
new_age <- 60
predict(model, newdata = data.frame(x = new_age))
```

```
##        1
## 84.94683
```

3

```r
model$residuals[8]
```

```
##        8
## 4.443252
```