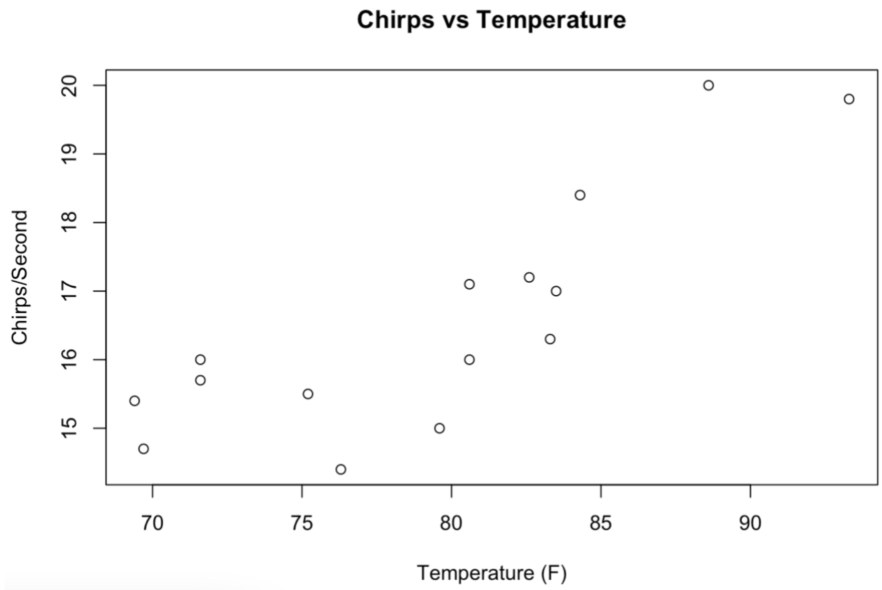
R Code:

```
> chirps <- c(20.0, 16.0, 19.8, 18.4, 17.1, 15.5, 14.7, 15.7, 15.4, 16.3, 15.0, 17.2, 16.0, 17.0, 14.4)
> temperature <- c(88.6, 71.6, 93.3, 84.3, 80.6, 75.2, 69.7, 71.6, 69.4, 83.3, 79.6, 82.6, 80.6, 83.5, 76.3)
> plot(temperature, chirps, main="Chirps vs Temperature", xlab="Temperature (F)",ylab="Chirps/Second")
```

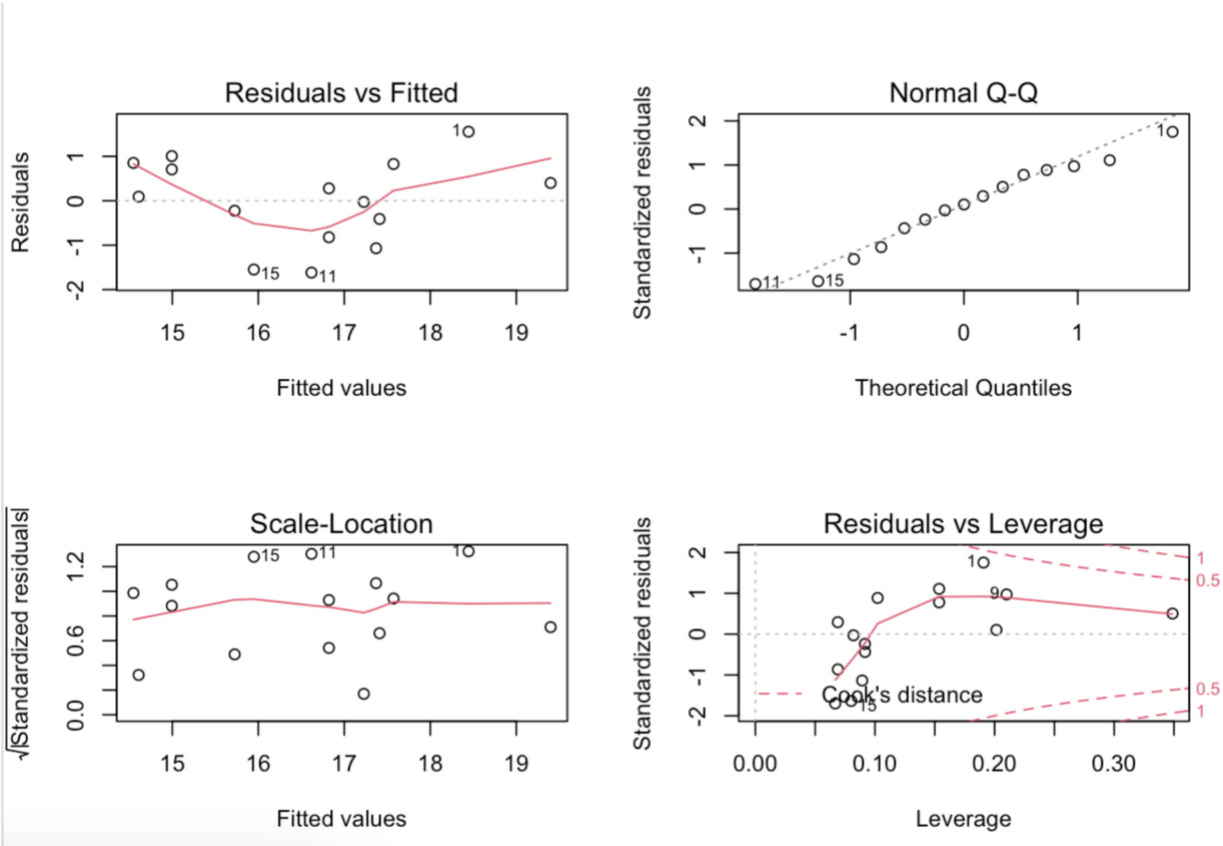


Based on the scatterplot we see that as temperature increases the chirp decreases, it means that there is a negative linear relationship between temperature and chirp.

```
> model <- lm(chirps ~ temperature)
> summary(model)
Call:
lm(formula = chirps ~ temperature)

Residuals:
    Min      1Q  Median      3Q     Max
-1.6181 -0.6154  0.0916  0.7669  1.5549

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.45931    2.98920   0.154 0.880239
temperature  0.20300    0.03754   5.408 0.000119 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.986 on 13 degrees of freedom
Multiple R-squared:  0.6923,	Adjusted R-squared:  0.6686
F-statistic: 29.25 on 1 and 13 DF,  p-value: 0.0001195
```

Based on the table we see that the temperature variable affects on the chirp frequency variable (p-value < 0.001), with a negative coefficient (-0.06107). R2 is 0.8979, means that 89.79% of the variability in chirp frequency is explained by the temperature.

```
> par(mfrow=c(2,2))
> plot(model)
```



The residual plots do not show clear pattern, look normal. The Q-Q plot looks a little not normal, however, since we have a pretty big sample size it’s okay. We can say that he model fits the data well.

Stat 481

HW #6

Problem 2:

Q1

$$\hat{\beta}_2 \pm t_{\alpha/2}(n-p-1)\, SE(\hat{\beta}_2)$$

$$t_{\alpha/2}(n-p-1) = t_{0.025}(18) = 2.101$$

$$CI_{\beta_2} = -0.90 \pm 2.101(0.30) = (-0.270, -1.530)$$

Q2

Source	SS	df	MS	F
R	108	2	54	12
E	81	18	4.5	
Total	189	20		

$n=21$

$$SSR = SST - SSE = 189 - 81 = 108$$

$$MSR = 108/2 = 54$$

$$MSE = SSE/df_E = 4.5$$

$$F = MSR/MSE = 12$$

Q3 $H_0: \beta_1 = \beta_2 = 0$
H_1: at least one of $\beta_1, \beta_2 \neq 0$

test stat is F-stat which is 12.667 from the ANOVA table.

Critical Region:
Reject H_0 if $F > F_{0.05}(2, 18) = 3.5546$
$12 > 3.5546$, reject H_0, there is significant regression relationship.

Q4 $H_0: \beta_1 = 0$
$H_1: \beta_1 \neq 0$

$$t = \frac{\beta_1}{SE(\hat{\beta}_1)} = \frac{1.10}{0.15} = 7.3$$

CR: Reject H_0 if $t(\hat{\beta}_1) > t_{0.025}(18) =$
$= 2.101$

$7.3 > 2.101$ Reject H_0
per capita real income has a significant impact on per capita beer consumption

Q5

$$R^2 = \frac{SSR}{SSTO} = \frac{108}{189} = 57.14\%$$

$$R^2_{adj} = 1 - \frac{81/18}{189/20} = 17.86\%$$