Solution to 1

a.

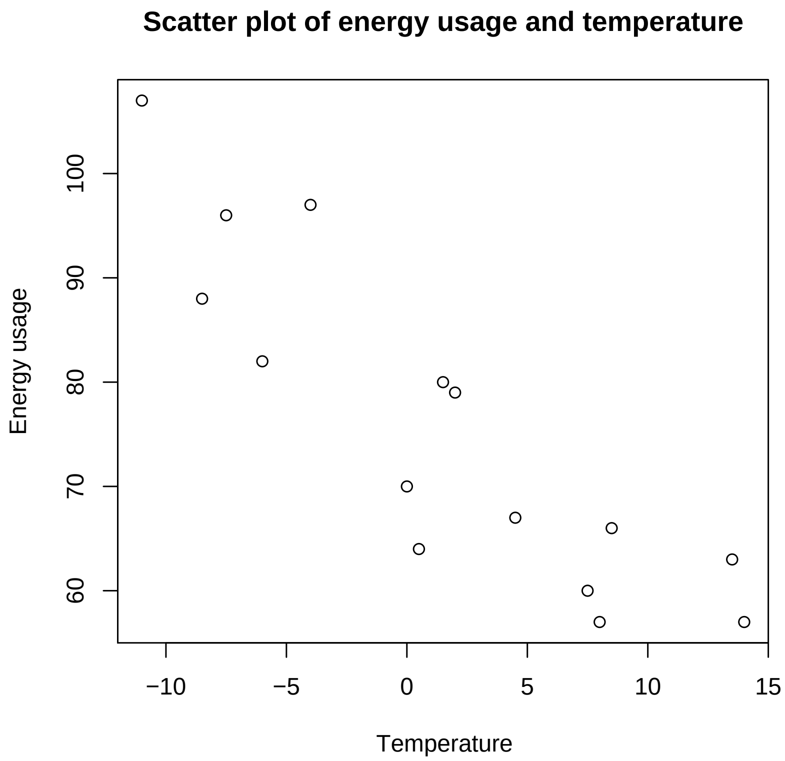

Figure 1: graph in a.

b. Model : define Y as energy usage and x as temperature

$$Y_i = \beta_0 + \beta_1 x_i + \epsilon_i \qquad \epsilon_i \sim i.i.d.(0,\, \sigma^2)$$

Estimated equatoin is

$$\hat{Y_i} = 78.259 - 1.778 x_i \qquad \hat{\sigma^2} = 60.2178$$

Details of estimation are illustrated in excel file.

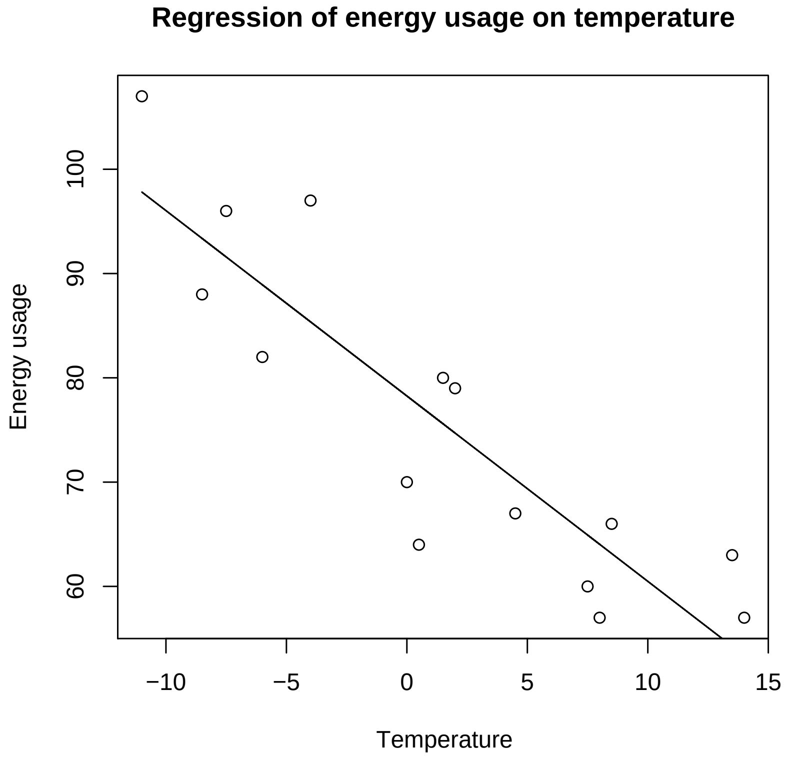

Figure 2: graph in b.

c. You may choose hypothesis testing or confidence interval estimation.
Hypothesis testing of β_0
$H_0 : \beta_0 = 0$
$H_a : \beta_0 \neq 0$
T.S.

$$t = \frac{\hat{\beta}_0 - 0}{S.E.(\hat{\beta}_0)} = \frac{78.259}{2.044} = 38.285 \quad \nu = n - p - 1 = 13$$

R.R. Reject H_0 if $|t| > t_{.025}(13) = 2.160$
Conclusion: Since observed t is so much larger than 2.16, we can reject H_0 at 5% level of significance, so β_0 is significantly different from zero.

Hypothesis testing of β_1
$H_0 : \beta_1 = 0$
$H_a : \beta_1 \neq 0$
T.S.

$$t = \frac{\hat{\beta}_1 - 0}{S.E.(\hat{\beta}_1)} = \frac{-1.778}{0.264} = -6.732 \quad \nu = n - p - 1 = 13$$

R.R. Reject H_0 if $|t| > t_{.025}(13) = 2.160$
Conclusion: Since observed t is larger than 2.16, we can reject H_0 at 5% level of significance, so β_1 is significantly different from zero.

d. Residuals are calculated in excel file. The residuals seem to be uncorrelated.

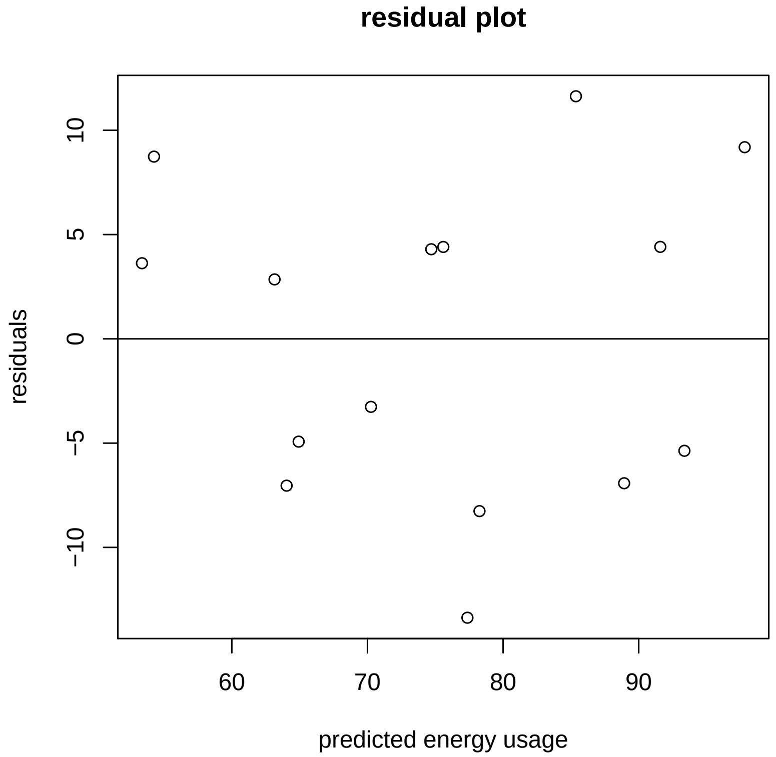

Figure 3: Graph in d.

e. Necessary statistics are calculated in excel file.

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-1535.2667}{\sqrt{863.733 \times 3511.733}} = -0.8815$$

$r^2 = (-0.8815)^2 = 0.7771$ or

$$r^2 = \frac{\text{SSM}}{\text{SST}} = \frac{2728.902}{782.831 + 2728.9021} = 0.7771$$