

```
# math 3080 - 1 Spectroscopy Example 2 - 22 - 10
#
# From Walpole Myers Myers Ye "Probability and Statistics for
# Engineers and Scientists 7th ed" p408
#
# From Pachansky et. al., Applied Spectroscopy 1986
#
# A study of infrared reflectance spectra of lubricants used in
# electronics industry
#
# x1 = band freq
# x2 thickness
# y = optical density
# Frequency Thickness Density
"x1" "x2" "y"
7.400000000e+002 1.100000000e+000 2.310000000e-001
7.400000000e+002 6.200000000e-001 1.070000000e-001
7.400000000e+002 3.100000000e-001 5.300000000e-002
8.050000000e+002 1.100000000e+000 1.290000000e-001
8.050000000e+002 6.200000000e-001 6.900000000e-002
8.050000000e+002 3.100000000e-001 3.000000000e-002
9.800000000e+002 1.100000000e+000 1.005000000e+000
9.800000000e+002 6.200000000e-001 5.590000000e-001
9.800000000e+002 3.100000000e-001 3.210000000e-001
1.235000000e+003 1.100000000e+000 2.948000000e+000
1.235000000e+003 6.200000000e-001 1.633000000e+000
1.235000000e+003 3.100000000e-001 9.340000000e-001
```

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Type 'q()' to quit R.

```

> ss <- read.table("M3080DataSpectroscopy.txt", header=TRUE)
> ss
  x1  x2  y
1 740 1.10 0.231
2 740 0.62 0.107
3 740 0.31 0.053
4 805 1.10 0.129
5 805 0.62 0.069
6 805 0.31 0.030
7 980 1.10 1.005
8 980 0.62 0.559
9 980 0.31 0.321
10 1235 1.10 2.948
11 1235 0.62 1.633
12 1235 0.31 0.934

> attach(ss)
> f <- lm(y ~ x1 + x2)
> summary(f); anova(f)

```

```

Call:
lm(formula = y ~ x1 + x2)

```

```

Residuals:
    Min       1Q   Median       3Q      Max
-0.45373 -0.20243 -0.08618  0.20204  0.81167

```

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -3.3726733  0.6359963  -5.303 0.000492 ***
x1           0.0036167  0.0006121   5.908 0.000227 ***
x2           0.9475989  0.3608943   2.626 0.027552 *
---

```

```

Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1 1

```

```

Residual standard error: 0.4063 on 9 degrees of freedom
Multiple R-squared: 0.8228, Adjusted R-squared: 0.7835
F-statistic: 20.9 on 2 and 9 DF, p-value: 0.0004146

```

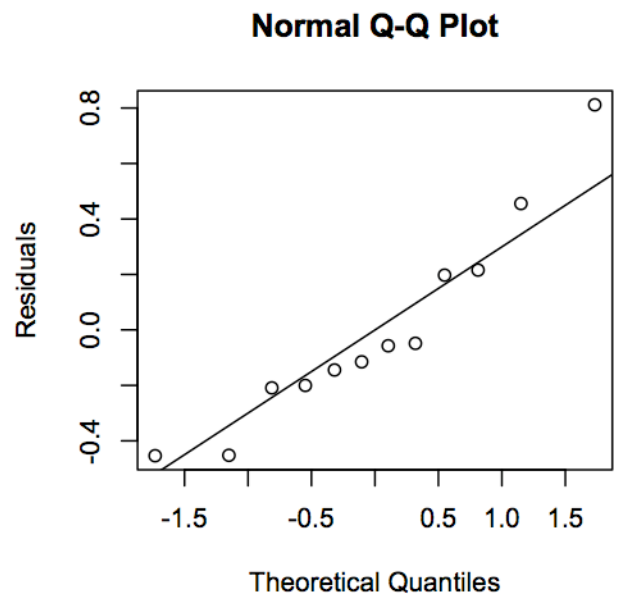
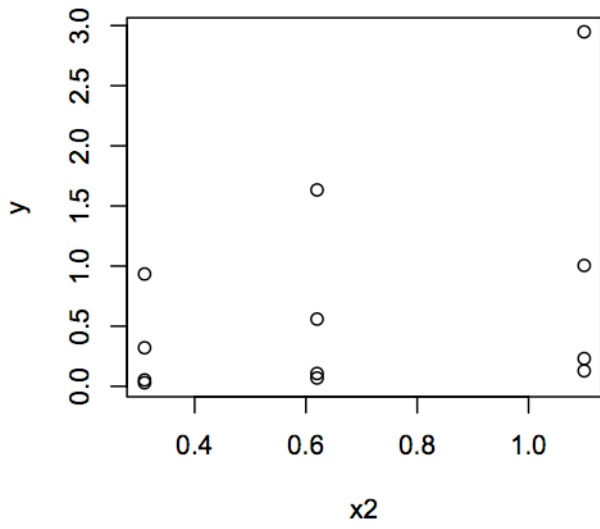
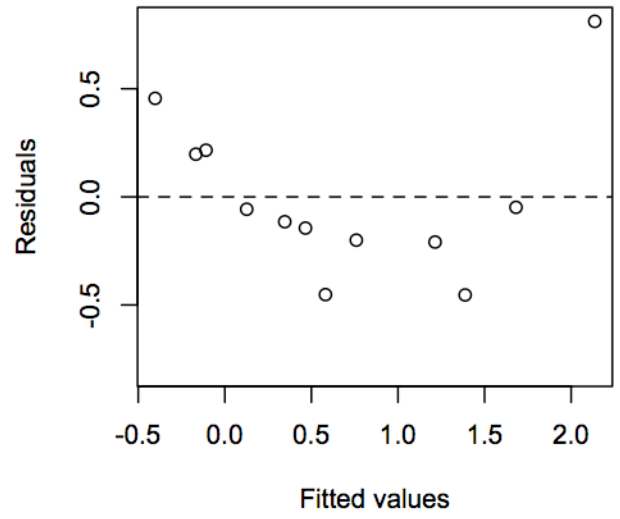
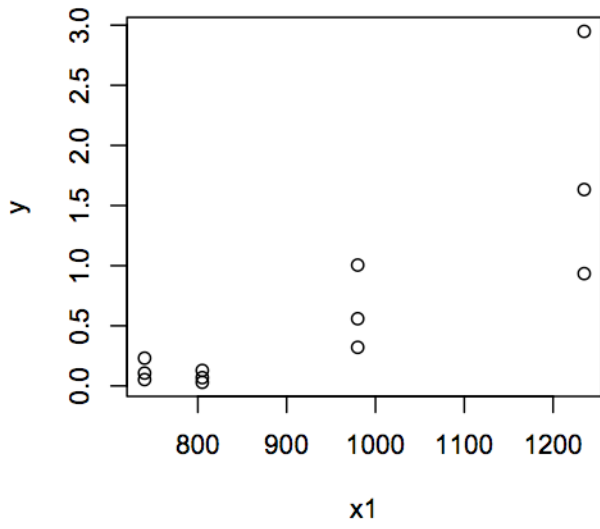
Analysis of Variance Table

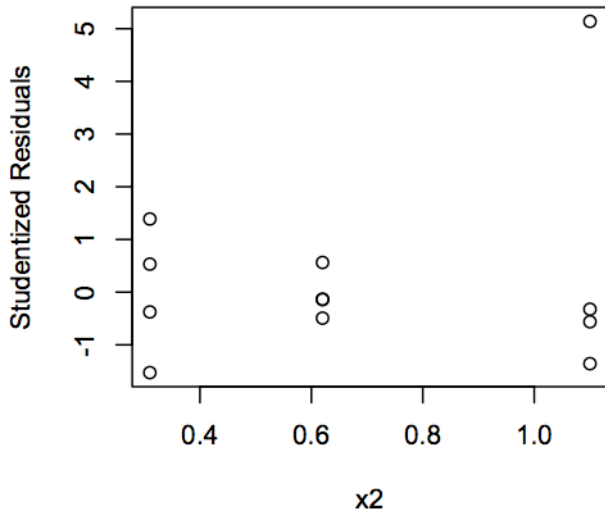
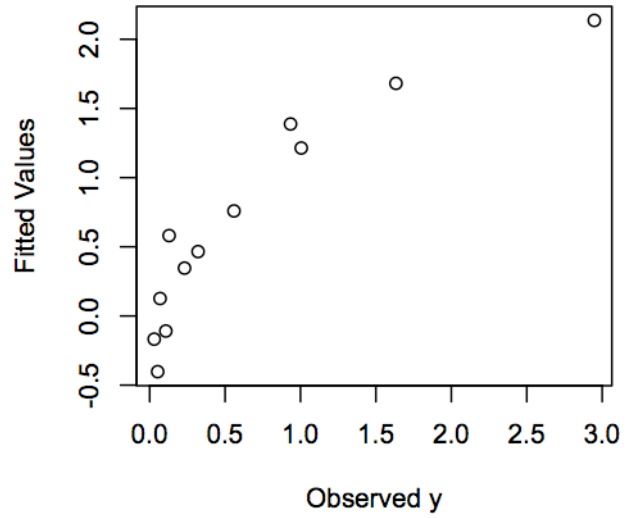
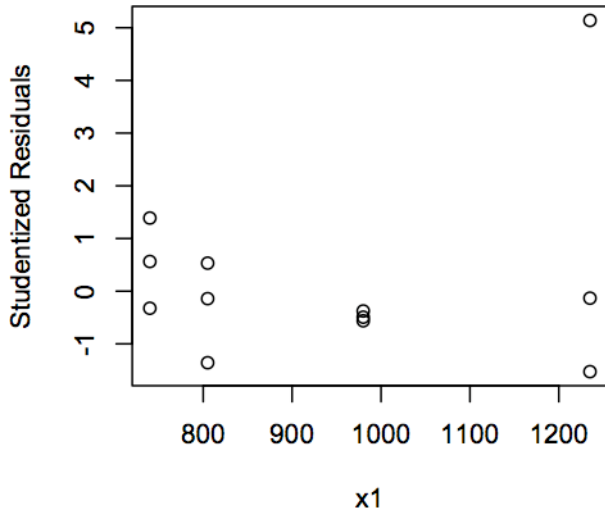
```

Response: y
      Df Sum Sq Mean Sq F value    Pr(>F)
x1      1  5.7627   5.7627  34.9082 0.0002267 ***
x2      1  1.1381   1.1381   6.8943 0.0275524 *
Residuals  9  1.4857   0.1651
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1 1

```

```
> layout(matrix(1:4, nrow = 2))
> plot(y ~ x1)
> plot(y ~ x2)
> eps <- residuals(f)
> yhat <- fitted(f)
> plot(yhat, eps, xlab="Fitted values",ylab="Residuals",ylim=max(abs(eps))*c(-1,1))
> abline(h=0, lty=2)
> qqnorm(eps, xlab="Theoretical Quantiles",ylab="Residuals")
> qqline(eps)
>
> seps <- rstudent(f)
> layout(matrix(1:4, nrow = 2))
> plot(seps ~ x1, ylab = "Studentized Residuals")
> plot(seps ~ x2, ylab = "Studentized Residuals")
> plot(yhat~y,ylab="Fitted Values",xlab="Observed y")
> qqnorm(seps,ylab="Studentized Residuals")
> qqline(seps)
>
```





Normal Q-Q Plot

