

## Cherry Trees - Part 3

```
# Cherry tree data is already a dataframe in R

#help(trees)
#str(trees)

#x <- trees$Girth (this is mislabeled and is really the tree diameter in inches)
#y <- trees$Volume (timber amount in cubic feet)

Diameter <- trees$Girth
trees1 <- cbind(trees, Diameter)

# 1st order polynomial

model <- lm(Volume ~ Diameter, data = trees1)
summary(model)
```

```
##
## Call:
## lm(formula = Volume ~ Diameter, data = trees1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.065 -3.107  0.152  3.495  9.587
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -36.9435     3.3651  -10.98 7.62e-12 ***
## Diameter      5.0659     0.2474   20.48 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.252 on 29 degrees of freedom
## Multiple R-squared:  0.9353, Adjusted R-squared:  0.9331
## F-statistic: 419.4 on 1 and 29 DF,  p-value: < 2.2e-16
```

```
anova(model)
```

```
## Analysis of Variance Table
##
## Response: Volume
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Diameter   1 7581.8  7581.8  419.36 < 2.2e-16 ***
## Residuals 29  524.3    18.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# 2nd order polynomial
```

```
model1 <- lm(Volume ~ Diameter + I(Diameter^2), data = trees1)
summary(model1)
```

```
##
## Call:
## lm(formula = Volume ~ Diameter + I(Diameter^2), data = trees1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -5.4889 -2.4293 -0.3718  2.0764  7.6447
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  10.78627    11.22282   0.961 0.344728
## Diameter     -2.09214     1.64734  -1.270 0.214534
## I(Diameter^2)  0.25454     0.05817   4.376 0.000152 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.335 on 28 degrees of freedom
## Multiple R-squared:  0.9616, Adjusted R-squared:  0.9588
## F-statistic: 350.5 on 2 and 28 DF,  p-value: < 2.2e-16
```

```
anova(model1)
```

```
## Analysis of Variance Table
##
## Response: Volume
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Diameter    1  7581.8   7581.8  681.766 < 2.2e-16 ***
## I(Diameter^2) 1   212.9    212.9   19.146 0.0001524 ***
## Residuals   28   311.4     11.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Compare the two models
```

```
anova(model, model1)
```

```
## Analysis of Variance Table
##
## Model 1: Volume ~ Diameter
## Model 2: Volume ~ Diameter + I(Diameter^2)
##   Res.Df  RSS Df Sum of Sq    F    Pr(>F)
## 1      29 524.30
## 2      28 311.38  1    212.92 19.146 0.0001524 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```