```
# rabbit1.R - output

> library(nlme)
> rabbiteye <- read.table(file = "n:/courses/stat8230/Fall09/rabbiteye.dat", header = T)
> rabbiteye$logLens <- log(rabbiteye$Lens)
> par(mfrow = c(2, 2))
> plot(rabbiteye$Age, rabbiteye$Lens, xlab = "Age (days)", ylab =
+       "Lens Weight (mg)")
> plot(rabbiteye$Age, rabbiteye$logLens, xlab = "Age (days)", ylab =
+       "log Lens Weight")
> m1rabbit.nls <- nls(Lens ~ theta1 * exp( - theta2/(theta3 + Age)), data =
+       rabbiteye, start = c(theta1 = 250, theta2 = 130, theta3 = 37))
> summary(m1rabbit.nls)

Formula: Lens ~ theta1 * exp(-theta2/(theta3 + Age))

Parameters:
      Estimate Std. Error t value Pr(>|t|)
theta1  279.820      4.654  60.129  < 2e-16 ***
theta2  127.565      7.123  17.908  < 2e-16 ***
theta3   36.037      4.477   8.049 1.78e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 7.971 on 68 degrees of freedom

Number of iterations to convergence: 3
Achieved convergence tolerance: 1.348e-07

> m1rabbit.gnls <- gnls(Lens ~ theta1 * exp( - theta2/(theta3 + Age)), data =
+       rabbiteye, start = c(theta1 = 250, theta2 = 130, theta3 = 37), weights
+        = varFixed(~ Age))
> summary(m1rabbit.gnls)
Generalized nonlinear least squares fit
  Model: Lens ~ theta1 * exp(-theta2/(theta3 + Age))
  Data: rabbiteye
      AIC      BIC    logLik
  495.2832 504.3339 -243.6416

Variance function:
 Structure: fixed weights
 Formula: ~Age

Coefficients:
        Value Std.Error  t-value p-value
theta1 281.7646  5.818860 48.42265       0
theta2 130.2931  6.217497 20.95588       0
theta3  37.4860  2.781859 13.47516       0
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 Correlation:
      theta1 theta2
theta2 0.911
theta3 0.796  0.952

Standardized residuals:
       Min         Q1        Med         Q3        Max
-2.79265768 -0.53534462  0.03123041  0.51469488  2.20068921

Residual standard error: 0.6090826
Degrees of freedom: 71 total; 68 residual
> m2rabbit.nls <- nls(logLens ~ theta1 - theta2/(theta3 + Age), data = rabbiteye,
+        start = c(theta1 = log(280), theta2 = 130, theta3 = 37))
>
> summary(m2rabbit.nls)

Formula: logLens ~ theta1 - theta2/(theta3 + Age)

Parameters:
       Estimate Std. Error t value Pr(>|t|)
theta1   5.63991    0.01997  282.46   <2e-16 ***
theta2 130.58363    5.72502   22.81   <2e-16 ***
theta3  37.60282    2.32299   16.19   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.06292 on 68 degrees of freedom

Number of iterations to convergence: 2
Achieved convergence tolerance: 1.771e-06

> m1coef <- coef(m1rabbit.nls)
> m1coefg <- coef(m1rabbit.gnls)
> m2coef <- coef(m2rabbit.nls)
> Age0 <- seq(from = 15, to = 860, by = 0.1)
> y0m1 <- m1coef[1] * exp( - m1coef[2]/(m1coef[3] + Age0))
> y0m1g <- m1coefg[1] * exp( - m1coefg[2]/(m1coefg[3] + Age0))
> y0m2 <- m2coef[1] - m2coef[2]/(m2coef[3] + Age0)
> plot(rabbiteye$Age, rabbiteye$Lens, xlab = "Age (days)", ylab =
+        "Lens Weight (mg)")
> lines(Age0,y0m1,lty=2)
> lines(Age0,y0m1g,lty=3)
> legend(locator(1),lty=c(2,3),legend=c("OLS Fitted Curve","WLS Fitted Curve"))
> plot(rabbiteye$Age, rabbiteye$logLens, xlab = "Age (days)", ylab =
+        "log Lens Weight")
> lines(Age0,y0m2,lty=2)
```
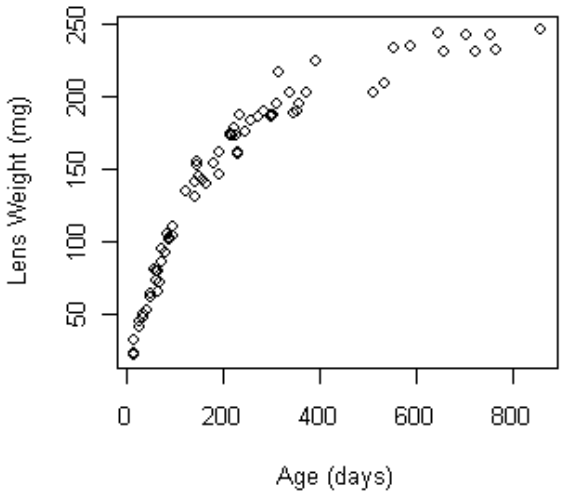
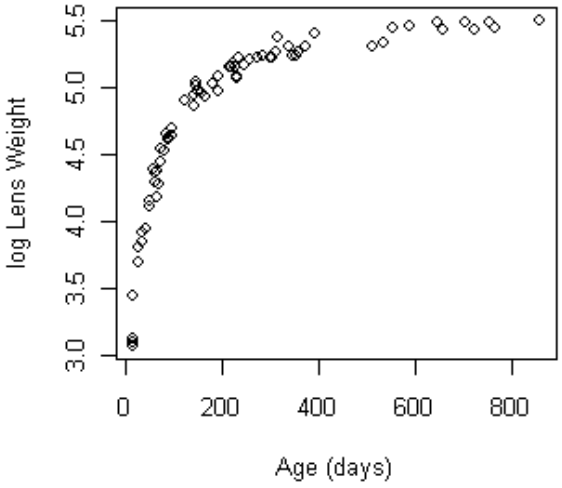
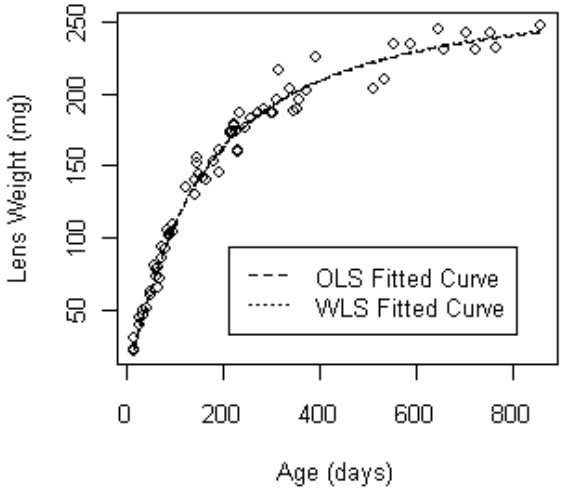
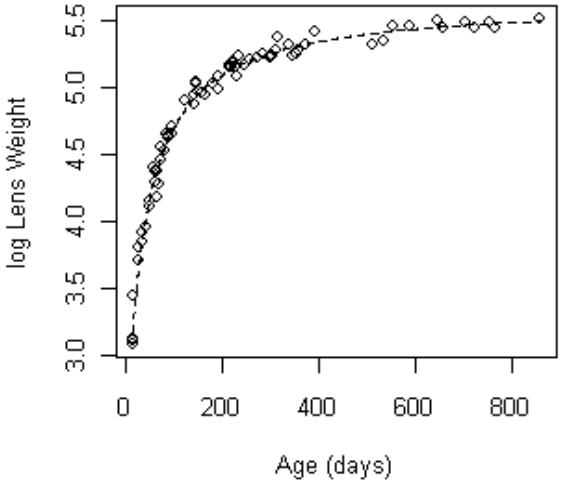
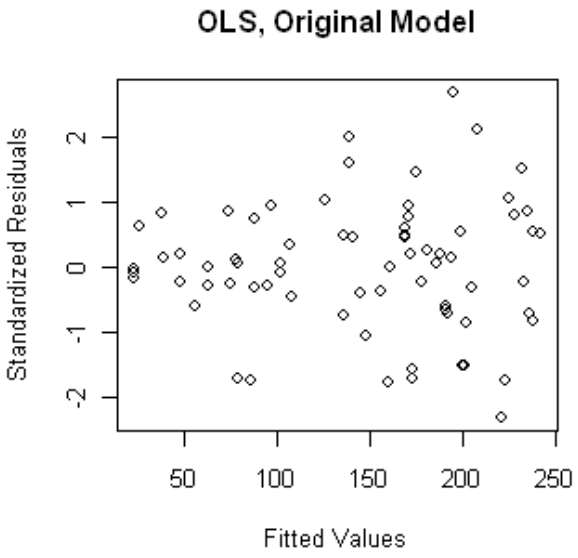

```
> plot(fitted(m1rabbit.nls), resid(m1rabbit.nls, type = "p"), xlab =
+       "Fitted Values", ylab = "Standardized Residuals")
> title(main = "OLS, Original Model")
> plot(fitted(m2rabbit.nls), resid(m2rabbit.nls, type = "p"), xlab =
+       "Fitted Values", ylab = "Standardized Residuals")
> title(main = "OLS, Transformed Model")
> plot(fitted(m1rabbit.gnls), resid(m1rabbit.gnls, type = "p"), xlab =
+       "Fitted Values", ylab = "Standardized Residuals")
> title(main = "WLS, Original Model")
>
```

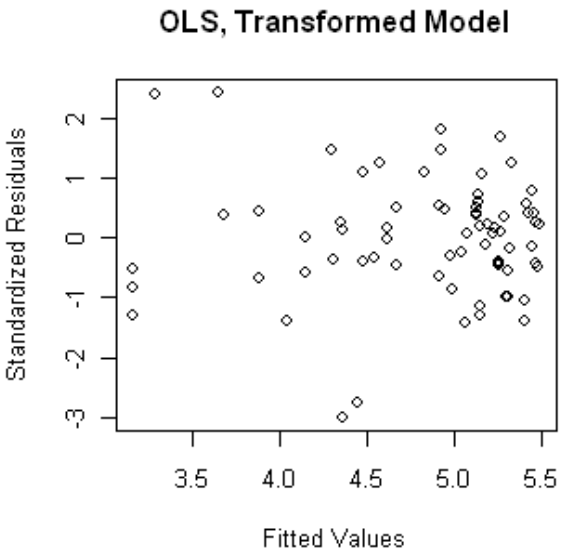


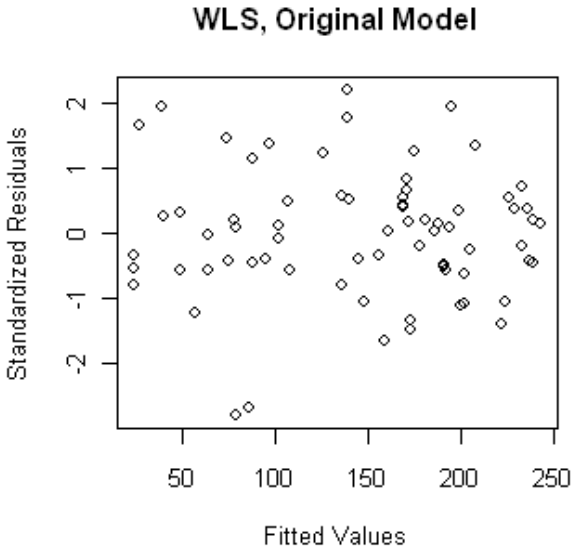







OLS, Original Model
Standardized Residuals
-2
-1
0
1
2
50
100
150
200
250
Fitted Values


OLS, Transformed Model
Standardized Residuals
-3
-2
-1
0
1
2
3.5
4.0
4.5
5.0
5.5
Fitted Values


WLS, Original Model
Standardized Residuals
-2
-1
0
1
2
50
100
150
200
250
Fitted Values