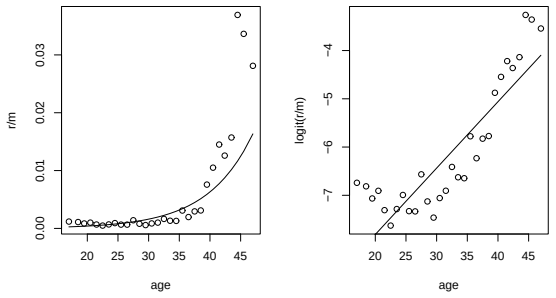
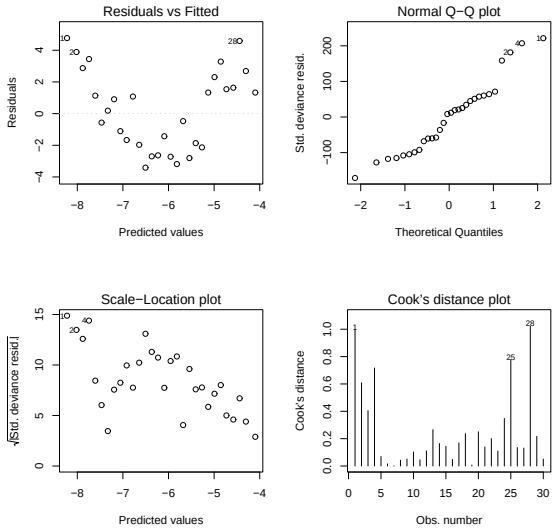
Down's Syndrome Data

```
> library(boot)
> attach(downs.bc)
> downs.glm1 <- glm(cbind(r,m-r) ~ age, family=binomial, data=downs.bc)
> plot(age, r/m)
> lines(age, fitted(downs.glm1))
> plot(age, logit(r/m))
> lines(age, predict(downs.glm1))
```



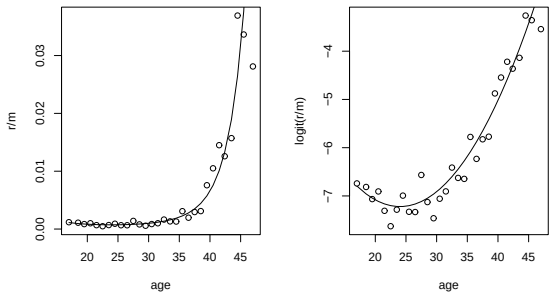
Linear Fit

```
> plot(downs.glm1)
```



Quadratic Fit

```
> downs.glm2 <- glm(cbind(r,m-r) ~ age + I(age^2), family=binomial,
+ data=downs.bc)
> plot(age,r/m)
> lines(age,fitted(downs.glm2))
> plot(age, logit(r/m))
> lines(age, predict(downs.glm2))
```




```
> coef(summary(downs.glm2))
               Estimate   Std. Error   z value     Pr(>|z|)
(Intercept) -2.243581610 0.6634504391 -3.381687 7.204223e-04
age         -0.414359388 0.0436091347 -9.501665 2.065608e-21
I(age^2)     0.008624321 0.0006780733 12.718862 4.645754e-37
>
```


Linear, Quadratic, Cubic?

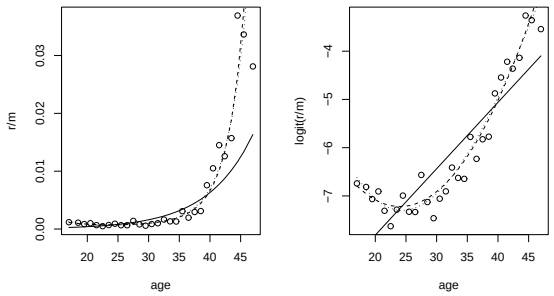
```
> downs.glm3 <- update(downs.glm2, . ~ . + I(age^3))
> anova(downs.glm1, downs.glm2, downs.glm3)
Analysis of Deviance Table

Model 1: cbind(r, m - r) ~ age
Model 2: cbind(r, m - r) ~ age + I(age^2)
Model 3: cbind(r, m - r) ~ age + I(age^2) + I(age^3)
  Resid. Df Resid. Dev Df Deviance
1        28    184.027
2        27     44.787  1  139.240
3        26     42.109  1    2.678
> anova(downs.glm1, downs.glm2, downs.glm3, test="Chisq")
Analysis of Deviance Table

Model 1: cbind(r, m - r) ~ age
Model 2: cbind(r, m - r) ~ age + I(age^2)
Model 3: cbind(r, m - r) ~ age + I(age^2) + I(age^3)
  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
1        28    184.027
2        27     44.787  1  139.240 3.902e-32
3        26     42.109  1    2.678     0.102
>
```

Linear, Quadratic, Cubic?

```
> plot(age, r/m)
> lines(age, fitted(downs.glm1),lty=1)
> lines(age, fitted(downs.glm2),lty=2)
> lines(age, fitted(downs.glm3),lty=3)
> plot(age, logit(r/m))
> lines(age, predict(downs.glm1),lty=1)
> lines(age, predict(downs.glm2),lty=2)
> lines(age, predict(downs.glm3),lty=3)
```



Updating Models

- `update(lm.fit, subset=...)` Fit the model to a different subset of the dataframe.
  - `update(lm.fit, subset=c(-10,-15))` Refit without observations 10 and 15.
  - `update(lm.fit, subset=dose==0)` Refit model to placebo group only.
- `update(lm.fit, .~.`$\pm terms$`)` Add or remove terms from the model.
  - `update(lm.fit, .~.+age-birth.year)` Add `age` and remove `birth.year` terms.
  - `update(lm.fit, . ~ sex/.-1)` Fit the model (whatever it was) separately for both sexes (and remove the common intercept).
- `update(lm.fit, f(.)~.)` Refit the model with transformed response.
  - `update(lm.fit, log(.) ~ .)` Use log-transformation for the response.
  - `update(lm.fit, 1/.^2 ~ .)` Replace the old response y with $1/y^2$.

Another `update` Example

```
> ll <- lm(Gas ~ Temp, data=whiteside)
> lb <- update(ll, subset=Insul=="Before")
> la <- update(ll, subset=Insul=="After")
> coef(lb)
(Intercept)        Temp
  6.8538277  -0.3932388
> coef(la)
(Intercept)        Temp
  4.7238497  -0.2779350
> lcomb <- update(ll, . ~ Insul/.)
> summary(lcomb)
[ . . . ]
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      6.85383    0.13596   50.41  < 2e-16 ***
InsulAfter      -2.12998    0.18009  -11.83 2.32e-16 ***
InsulBefore:Temp -0.39324    0.02249  -17.49  < 2e-16 ***
InsulAfter:Temp  -0.27793    0.02292  -12.12  < 2e-16 ***
[ . . . ]
> lcomb <- update(lcomb, . ~ . -1)
> summary(lcomb)
[ . . . ]
                Estimate Std. Error t value Pr(>|t|)
InsulBefore      6.85383    0.13596   50.41   <2e-16 ***
InsulAfter       4.72385    0.11810   40.00   <2e-16 ***
InsulBefore:Temp -0.39324    0.02249  -17.49   <2e-16 ***
InsulAfter:Temp  -0.27793    0.02292  -12.12   <2e-16 ***
[ . . . ]
```