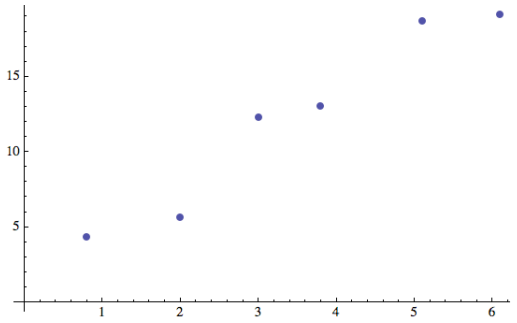
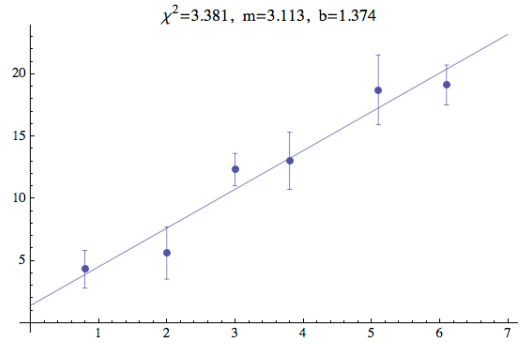
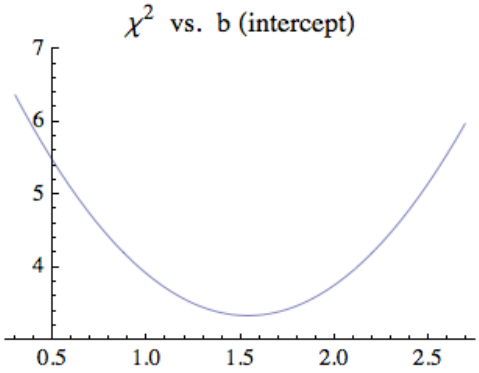
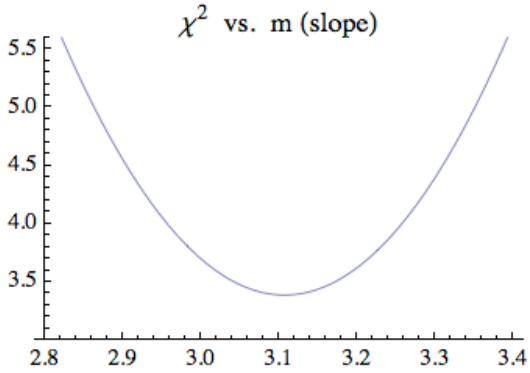
Homework Problem for PS315 (Modern Physics Lab) **January 25, 2011**

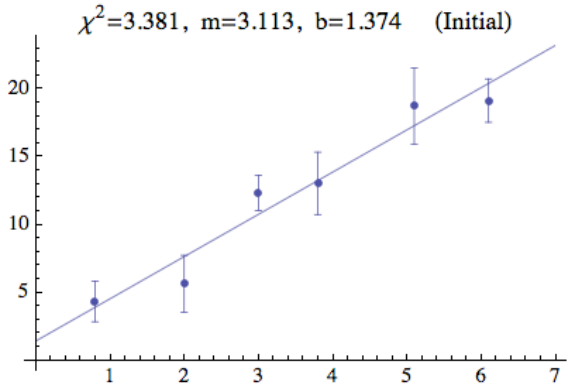
```
xi = {0.8, 2.0, 3.0, 3.8, 5.1, 6.1};
y = {4.3, 5.6, 12.3, 13.0, 18.7, 19.1};
s = {1.5, 2.1, 1.3, 2.3, 2.8, 1.6};
```

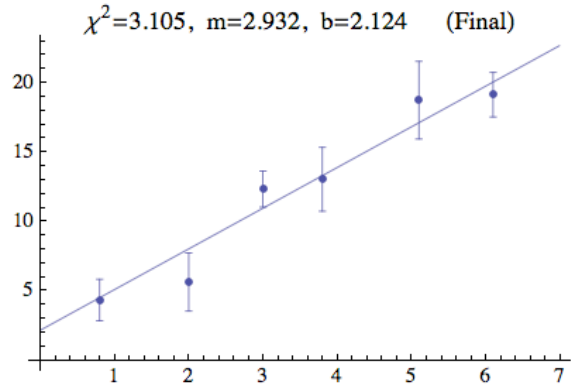












Using the determinant method, we find the following:

In[129]:=

$$\text{delta} = \sum_{i=1}^{\text{num}} \frac{1}{\sigma[[i]]^2} \sum_{i=1}^{\text{num}} \frac{x[[i]]^2}{\sigma[[i]]^2} - \left(\sum_{i=1}^{\text{num}} \frac{x[[i]]}{\sigma[[i]]^2}\right)^2;$$

$$a1 = \frac{1}{\text{delta}} \left(\sum_{i=1}^{\text{num}} \frac{x[[i]]^2}{\sigma[[i]]^2} \sum_{i=1}^{\text{num}} \frac{y[[i]]}{\sigma[[i]]^2} - \sum_{i=1}^{\text{num}} \frac{x[[i]]}{\sigma[[i]]^2} \sum_{i=1}^{\text{num}} \frac{x[[i]]\, y[[i]]}{\sigma[[i]]^2}\right);$$

$$b1 = \frac{1}{\text{delta}} \left(\sum_{i=1}^{\text{num}} \frac{1}{\sigma[[i]]^2} \sum_{i=1}^{\text{num}} \frac{x[[i]]\, y[[i]]}{\sigma[[i]]^2} - \sum_{i=1}^{\text{num}} \frac{x[[i]]}{\sigma[[i]]^2} \sum_{i=1}^{\text{num}} \frac{y[[i]]}{\sigma[[i]]^2}\right);$$

$$\text{deltaa} = \sqrt{\frac{1}{\text{delta}} \sum_{i=1}^{\text{num}} \frac{x[[i]]^2}{\sigma[[i]]^2}};$$

$$\text{deltab} = \sqrt{\frac{1}{\text{delta}} \sum_{i=1}^{\text{num}} \frac{1}{\sigma[[i]]^2}};$$

```
Print["Intercept  a =  ", a1, "  ± ", deltaa]
Print["Slope      b = ", b1, " ± ", deltab]
```

```
Intercept  a =  2.1244  ± 1.43034
Slope      b = 2.93208 ± 0.385662
```