Exercise 3

Same data as the in the previous exercise

In [9]:

```
srand(1)
n = 100
x = randn(n)
y = x - 2x.^2 + randn(n)
;
```

We now fit for degrees 1,2,3,4 a polynomial regression as before and for each one compute the AIC. We first define an AIC function, we have:

$\mathrm{AIC} = 2p - 2\ln(\hat{L})$

Reference (https://en.wikipedia.org/wiki/Akaike_information_criterion)

In [10]:

```
function Logl(β, σ2, error)
    n = length(error)
    -(n / 2) * log(2pi * σ2) - (error' * error ) / (2σ2)
end
function AIC(βhat, σ2hat, error)
    logl = Logl(βhat, σ2hat, error)
    2(length(βhat) - logl)
end
;
```

Now train the models

In [11]:

```
Xfull = [ones(length(y)) x x.^2 x.^3 x.^4]
# store space
aic = Array{Float64}(4)
for deg in 1:4 # inner loop fits different polynomial models
    # X data
    X = Xfull[:, 1:(1 + deg)]
    # regression
    βhat = Symmetric(X' * X) \ (X' * y)
    yhat = X * βhat
    e = y - yhat
    σ2hat = e' * e / n
    aic[deg] = AIC(βhat, σ2hat, e)
end
```

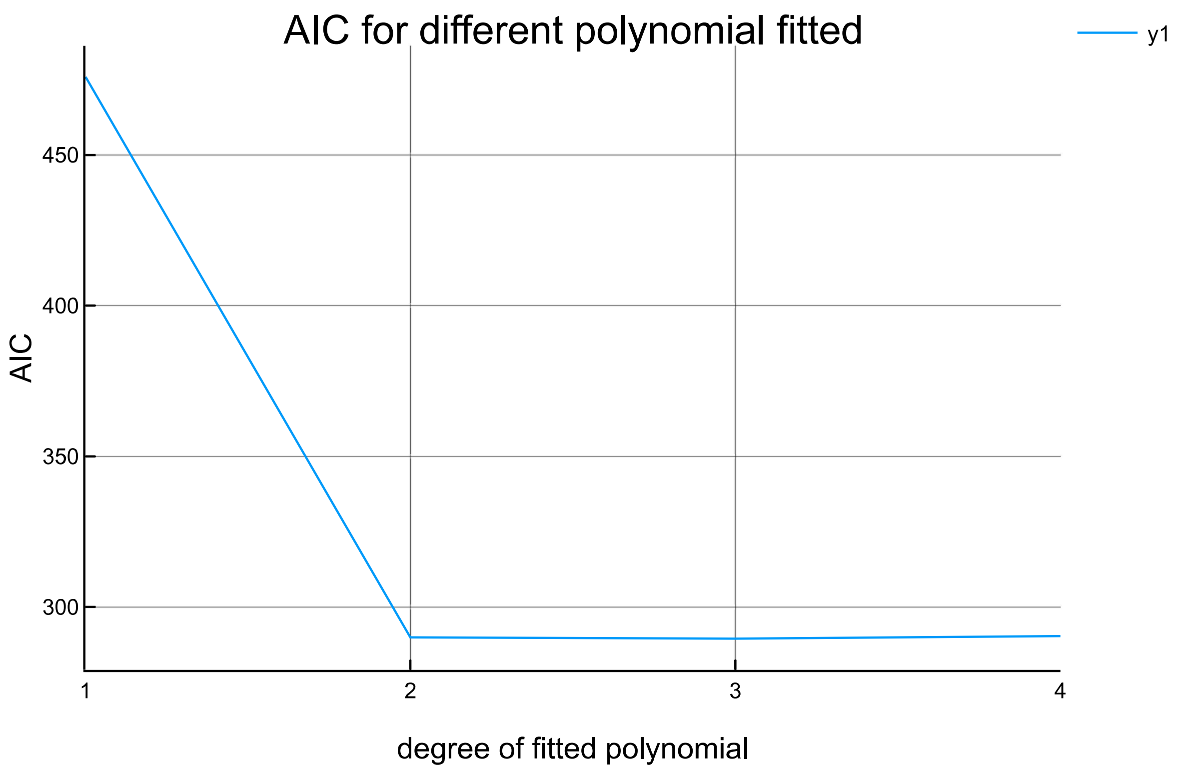
In [12]:

```
using Plots
```

In [13]:

```
plot(1:4, aic, xlab = "degree of fitted polynomial", ylab = "AIC",
    title =  "AIC for different polynomial fitted")
```

Out[13]:



In [17]:

```
for i in 1:4
   @printf("Degree: %i, AIC: %0.2f\n", i, aic[i])
end
```

```
Degree: 1, AIC: 475.85
Degree: 2, AIC: 289.89
Degree: 3, AIC: 289.50
Degree: 4, AIC: 290.34
```

According to the AIC criterion, both 2 and 3 seem reasonable degrees (although we know the true model is 2).

NOTE: I am not combining AIC with cross-validation since I asked in class if there was any point to combine the AIC with cross-validation and the professor answered that it's usually one or the other.