Linear Hypothesis Testing Example

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```
# get data from the web
dat = read.table("http://www.ats.ucla.edu/stat/r/library/hsb.txt")

# fit an lm model

lm1 = lm(write ~ math + science + socst + female, data=dat)
summary(lm1)
```

```

Call:
lm(formula = write ~ math + science + socst + female, data = dat)

Residuals:
     Min       1Q   Median       3Q      Max
-18.3086  -3.8149   0.1035   3.8394  15.5882

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.56892    2.81908   2.330   0.0208 *
math         0.28016    0.06393   4.382 1.92e-05 ***
science      0.27865    0.05805   4.801 3.14e-06 ***
socst        0.26811    0.04919   5.450 1.51e-07 ***
female       5.42822    0.88089   6.162 4.03e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.101 on 195 degrees of freedom
Multiple R-squared:  0.594, Adjusted R-squared:  0.5857
F-statistic: 71.32 on 4 and 195 DF,  p-value: < 2.2e-16
```

We use the *car* package below in order to test a hypothesis that the influeces of *math* and *science* are equal.

```
library(car)

# just a reminder of what the coefficients are
coef(lm1)
```

```
(Intercept)        math     science       socst      female
  6.5689235   0.2801611   0.2786543   0.2681117   5.4282152
```

```
# now we build the hypothesis matrix
hyp = c(0,1,-1,0,0)
rhs = c(0)

linearHypothesis(lm1,hyp,rhs)
```

```
Linear hypothesis test
```

```
Hypothesis:
math - science = 0

Model 1: restricted model
Model 2: write ~ math + science + socst + female

  Res.Df    RSS Df Sum of Sq     F Pr(>F)
1    196 7258.8
2    195 7258.8  1 0.0075416 2e-04 0.9887
```

```
# same result
linearHypothesis(lm1, c("math=science"))
```

```
Linear hypothesis test

Hypothesis:
math - science = 0

Model 1: restricted model
Model 2: write ~ math + science + socst + female

  Res.Df    RSS Df Sum of Sq     F Pr(>F)
1    196 7258.8
2    195 7258.8  1 0.0075416 2e-04 0.9887
```

```
linearHypothesis(lm1, c("math=2*science"))
```

```
Linear hypothesis test

Hypothesis:
math - 2 science = 0

Model 1: restricted model
Model 2: write ~ math + science + socst + female

  Res.Df    RSS Df Sum of Sq      F  Pr(>F)
1    196 7372.9
2    195 7258.8  1    114.08 3.0647 0.08158 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```