Consider the following data with 155 observations of soil concentrations on lead, cadmium, copper, and zinc.

```r
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics100c/soil_complete.txt", header=TRUE)

# Dependent variable:
y <- a$lead

# Independent variables:
x1 <- a$cadmium
x2 <- a$copper
x3 <- a$zinc
```

You will test the hypothesis

\[ H_0 : \beta_2 = 0 \]
\[ H_a : \beta_2 \neq 0 \]

using three different methods:

a. General F test.
b. t test.
c. Extra sum of squares principle.

You will need some of the following information:

1. Vector \( \hat{\beta} \):
   ```r
   > beta_hat[,1]
   [1,] 7.2010775
   x1   -14.1775608
   x2  -0.1865834
   x3   0.4251507
   ```

2. Inverse of the matrix \( X'X \):
   ```r
   > solve(t(X) %*% X)
   ones  7.2010775 0.08964032 -0.001557152 -0.0001023796
   x1  -14.1775608 0.08964032 -0.0003741216 -0.00001957493
   x2  -0.1865834 -0.0003741216 0.00009581905 -0.000002323903
   x3   0.4251507 -0.00001957493 -0.000002323903 0.00003565241
   ```

3. Variance of \( y \):
   ```r
   > var(y)
   [1] 12392.15
   ```

4. Regression of \( y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \epsilon_i \).
   ```r
   > qf <- lm(y ~ x1+x2+x3)
   > summary(qf)
   Call:
   lm(formula = y ~ x1 + x2 + x3)

   Residual standard error: 25.79063 on 151 degrees of freedom
   ```
5. Regression of $y_i = \beta_0 + \beta_1 x_{1i} + \beta_3 x_{3i} + \epsilon_i$.

```r
> qr <- lm(y ~ x1 + x3)
> summary(qr)

Call:
  lm(formula = y ~ x1 + x3)

(OTHER INFORMATION FROM THE OUTPUT WAS REMOVED).

Residual standard error: 25.75210 on 152 degrees of freedom

6. Some percentiles:
```