5.3 Consider the following model that relates the percentage of a household's budget spent on alcohol *WALC* to total expenditure *TOTEXP*, age of the household head *AGE*, and the number of children in the household *NK*.

$$WALC = \beta_1 + \beta_2 \ln(TOTEXP) + \beta_3 NK + \beta_4 AGE + e$$

This model was estimated using 1200 observations from London. An incomplete version of this output is provided in Table 5.6.

TABLE 5.6 Output for Exercise 5.3

Dependent Variable: *WALC*				
Included observations: 1200				
Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	1.4515	2.2019		0.5099
ln(*TOTEXP*)	2.7648		5.7103	0.0000
NK		0.3695	−3.9376	0.0001
AGE	−0.1503	0.0235	−6.4019	0.0000
R-squared		Mean dependent var		6.19434
S.E. of regression		S.D. dependent var		6.39547
Sum squared resid	46221.62			

a. Fill in the following blank spaces that appear in this table.
   i. The *t*-statistic for b_1.
   ii. The standard error for b_2.
   iii. The estimate b_3.
   iv. R^2.
   v. $\hat{\sigma}$.
b. Interpret each of the estimates b_2, b_3, and b_4.
c. Compute a 95% interval estimate for β_4. What does this interval tell you?
d. Are each of the coefficient estimates significant at a 5% level? Why?
e. Test the hypothesis that the addition of an extra child decreases the mean budget share of alcohol by 2 percentage points against the alternative that the decrease is not equal to 2 percentage points. Use a 5% significance level.

a. (i) $t = \frac{coefficient}{Std.Error} = \frac{1.4515}{2.2019} \approx 0.659$

(ii) Standard error $= \frac{coefficient}{t} = \frac{2.7648}{5.7103} \approx 0.4842$

(iii) The estimate $b_3 = t \times SE = -3.9376 \times 0.3695 \approx -1.45494$

(iv) $R^2 = 1 - \frac{SSE}{SST} = 1 - \frac{46221.62}{49041.5418} \approx 0.05750068$

$SST = (N-1)(S_y)^2 = 1199 \times 6.39547^2 = 49041.5418$

(v) $\hat{\sigma} = \sqrt{\frac{SSR}{n-k-1}} = \sqrt{\frac{46221.62}{1200-3-1}} \approx 6.2166$

k=3 (ln(TOTEXP)、NK、AGE)

b. b2=2.7648: If the household's total spending goes up by 1%, the alcohol budget share goes up by about 2.76 percentage points.

b3=0.3695: Each extra child in the family increases the alcohol budget share by about 0.37 percentage points.

b4=−0.1503: If the head of the household gets one year older, the alcohol budget share goes down by about 0.15 percentage points.

c. $b4 \pm 1.96 \times SE = -0.1503 \pm 1.96 \times 0.0235 = -0.1503 \pm 0.0461$
$\Rightarrow [-0.1964, -0.1042]$