No computation necessary. Use the printout.

An experiment carried out to study the effect of the mole contents of cobalt (x1) and the calcination temperature (x2) on the surface area of an ironÂcobalt hydroxide catalyst (y) resulted in the following data ("Structural Changes and Surface Properties of CoxFe3ÂxO4 Spinels," J. of Chemical Tech. and Biotech., 1994: 161Â170):

x1: .6 .6 .6 .6 .6 1.0 1.0 1.0 1.0 1.0 2.6 2.6 2.6 2.6
x2: 200 250 400 500 600 200 250 400 500 600 200 250 400 500
y: 90.6 82.7 58.7 43.2 25.0 127.1 112.3 19.6 17.8 9.1 53.1 52.0 43.4 42.4

x1: 2.6 2.8 2.8 2.8 2.8 2.8
x2: 600 200 250 400 500 600
y: 31.6 40.9 37.9 27.5 27.3 19.0

A request to the SAS package to fit a+b1*x1+b2*x2+b3*x3, where x3 = x1*x2 (an interaction predictor), yielded the following output:

Dependent Variable: SURFAREA

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	15223.52829	5074.50943	18.924	0.0001
Error	16	4290.53971	268.15873		
C Total	19	19514.06800			

Root MSE	16.37555	R-square	0.7801
Dep Mean	48.06000	Adj R-sq	0.7389
C.V.	34.07314		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	185.485740	21.19747682	8.750	0.0001
COBCON	1	-45.969466	10.61201173	-4.332	0.0005
TEMP	1	-0.301503	0.05074421	-5.942	0.0001
CONTEMP	1	0.088801	0.02540388	3.496	0.0030

a) Interpret the value of the coefficient of multiple determination.

b) Predict the value of surface area when cobalt content is 2.6 and temperature is 250, and calculate the value of the corresponding residual.

c) Since b1 is about -46.0, is it legitimate to conclude that if cobalt content increases by 1 unit while the values of the other predictors remain fixed, surface area can be expected to decrease by roughly 46 units? Explain your reasoning.

a) $R^2 = 0.78$

78% of the var. in y can be explained by (or attributed to) x_1 and x_2 through the relation

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2$$

b)

$y = 185.49 - 45.97(2.6) - 0.30\ (250) + 0.089(2.6)(250) = \boxed{48.8}$

c)

Were it not for the interaction term, the answer would be Yes. But because $b_3 \neq 0$, the interac. term exists and so, the coeff's can not be interpreted this way.