1. The following regression output is for predicting annual murders per million from the percentage of citizens living in poverty in a random sample of 20 metropolitan areas.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-29.901	7.789	-3.839	0.001
poverty%	2.559	0.390	6.562	0.000

$s = 5.512$ $R^2 = 70.52\%$ $R^2_{adj} = 68.89\%$

(a) Write out the linear model.

Solution: $\hat{y}_i = -29.901 + 2.559x_i$

(b) Interpret the slope.

Solution: For every additional percentage of citizens living in poverty there is an associated 2.559 increase in murders per million.

(c) Interpret R^2.

Solution: There is good predictive power. 70.52 percent of the variation in annual murders per million can be explained by the percentage of citizens living in poverty.

(d) Calculate the correlation coefficient.

Solution: $r = \sqrt{R^2} = \sqrt{.7052} = .8398$

(e) Interpret the correlation coefficient.

Solution: There is a strong positive linear relationship between the percentage of citizens living in poverty and the number of annual murders per million.

(f) Predict the number of murders per million if one city has a 14% of its citizens living in poverty.

Solution: $\hat{y}_i = -29.901 + 2.559(14) = 5.926$

(g) After a few months, the city with 14% of its citizens living in poverty reported the number of murders per million was 4.773. Calculate the residual for this citys reported murder rate.

Solution: $e_i = y_i - \hat{y}_i = 4.773 - 5.926 = -1.153$

2. A regression line relating y = hours of sleep the previous day to x =hours studied the previous day is estimated using data from n = 10 students. The estimated slope $\beta_1 = -0.30$. The standard error of the slope is 0.20.

(a) What is the value of the test statistic for the following hypothesis test about , the population slope?
H_o: $\beta_1 = 0$
H_a: $\beta_1 \neq 0$

> **Solution:** $t = \dfrac{\hat{\beta}_1 - 0}{SE_{\hat{\beta}_1}} = \dfrac{-0.30 - 0}{0.20} = -1.5$

(b) At the $\alpha = 0.10$ level, would you reject the null hypothesis? State your conclusion in terms of the problem.

> **Solution:** $d.f. = n - (k+1) = 8$
> $t_c = -1.860$
> We fail to reject the null hypothesis and conclude the alternative is not true. There is not a linear relationship between hours studied the previous day, and the hours of sleep the previous day.

(c) What is a 90% confidence interval for β_1, the population slope? Interpret the confidence interval you calculate.

> **Solution:** C.I. = (-0.67, 0.07) We are 90% confident that a one hour increase in hours studied the previous day is associated with somewhere between 0.67 decrease and 0.07 increase in hours of sleep the previous day.