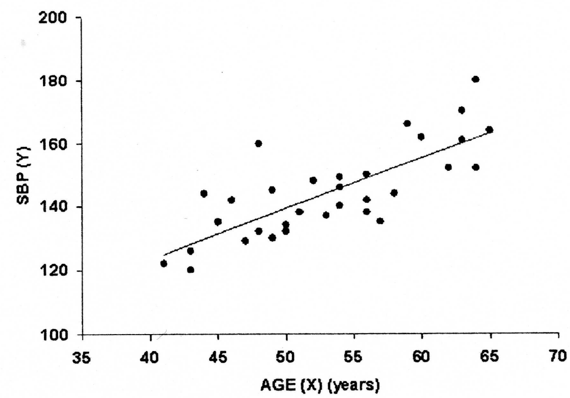
d (1) $\hat{\beta}_0 = 59.092$ $\hat{\beta}_1 = 1.605$

(2) $\hat{Y} = 59.092 + 1.605X$. The lines are close together.



(3) $H_0: \beta_1 = 0$ $H_A: \beta_1 \neq 0$

$T = 6.72$ $P < 0.0001$

Since the P-value is <0.05 we reject H_0 and conclude that the slope is not equal to 0. There is a significant linear relationship between Age and SBP.

(4) Yes.

e. (1) $\hat{\beta}_0 = 140.800$ $\hat{\beta}_1 = 7.024$

(2) Separate calculations show that $\overline{SBP}_{\text{nonsmokers}} = 140.8$, and $\overline{SBP}_{\text{smokers}} =$ 147.824. These values are the same as $\hat{\beta}_0$ and $\hat{\beta}_0 + \hat{\beta}_1$, respectively.

Explanation: $\hat{Y}$ is an estimator of $\mu_{Y|X}$, the true average SBP for any particular value of X. When X=0 (for nonsmokers) we see that $\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1(0) = \hat{\beta}_0 = 140.8$. Since this is an estimate of the true average SBP for nonsmokers, it makes sense that it is equal to $\overline{SBP}_{\text{nonsmokers}}$. When X=1 (for smokers) we have $\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1(1) = 147.824$. This is the estimate of the true average SBP for smokers, so it makes sense that it is equal to $\overline{SBP}_{\text{smokers}}$

(3) $H_0: \beta_1 = 0$ $H_A: \beta_1 \neq 0$

$T = 1.40$ $P = 0.172$

Since the P-value is >0.05, we do not reject H_0 and conclude that the slope is equal to 0. There is not a significant linear relationship between SBP and SMK

(4) Yes the tests are equivalent

$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1(1) = 147.824$

$\bar{Y}_{2\ \text{nonsmokers}} = 140.800$ $S_2^2 = 231.405$ with (n_2-1) = 14 df.

$\bar{Y}_{1\ \text{smokers}} = 147.824$ $S_1^2 = 166.462$ with (n_1-1) = 16 df.

$S_P^2 = [(16)(166.462) + (14)(231.405)]/30 = 201.098$ $S_P = 14.181$

$$T = \frac{\bar{Y}_1 - \bar{Y}_2}{S_P\sqrt{1/n_1 + 1/n_2}} = \frac{147.824 - 140.800}{14.181\sqrt{1/17 + 1/15}} = 1.40$$