III. Answer the following questions using this data that was collected to determine whether research and development expenditures affect profit.

A. The coefficient of correlation

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

$$= \frac{6(2{,}010) - (35)(310)}{\sqrt{[6(235) - (35)^2][6(17{,}700) - (310)^2]}}$$

$$= \frac{(12{,}060) - (10{,}850)}{\sqrt{[(1{,}410) - (1{,}225)][(106{,}200) - (96{,}100)]}}$$

$$= \frac{1{,}210}{\sqrt{[185][10{,}100]}} = \frac{1{,}210}{1{,}367} = .885$$

R & D Expenditures Millions (x)	Profits in Millions (y)	xy	x^2	y^2
5	30	150	25	900
3	40	120	9	1,600
7	60	420	49	3,600
6	60	360	36	3,600
10	80	800	100	6,400
4	40	160	16	1,600
35	310	2,010	235	17,700

B. The coefficient of determination and the coefficient of nondetermination

$r^2 = (r)^2 = (.885)^2 = .783$ or 78.3%

$\bar{r}^2 = 1 - r^2 = 1 - .783 = .217$ or 21.7%

C. Could rho be zero at the .05 level of significance?

1. The null hypothesis and alternate hypothesis are $H_o: \rho = 0$ and $H_1: \rho \neq 0$.
2. The level of significance will be .05 for this two-tail problem with n - 2 degrees of freedom.
3. The test statistic is r. $df = n - 2 = 6 - 2 = 4 \rightarrow$ t of 2.776
4. If t from the test statistic is beyond the critical value of t, the null hypothesis will be rejected.
5. Apply the decision rule.

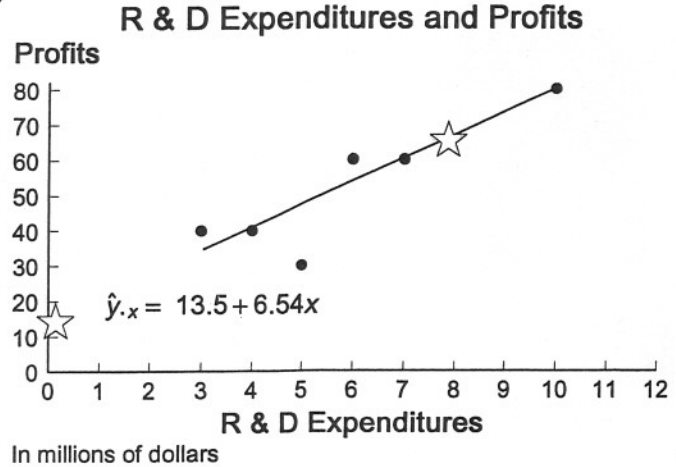
$$t = \frac{r - \rho}{\sqrt{\frac{1 - r^2}{n - 2}}} = \frac{.885 - 0}{\sqrt{\frac{1 - (.885)^2}{6 - 2}}} = 3.80$$

Reject H_0 because 3.80 > 2.776. The population coefficient of correlation could not be zero at the .05 significance level.

IV. Interpret your answers to question III.

A. An r of .885 represents a high positive correlation.
B. Profit variability explained by R & D is 78.3%.
B. Profit variability not explained by R & D is 21.7%.
C. The population coefficient of correlation is not 0.

V. Draw a scatter diagram of the above data and use the eyeball method to estimate the regression curve.



Note: Stars indicate coordinates determined using the regression equation from question VIC.

The line is not extended to the y-intercept because 3 is the lowest recorded R & D expenditure.