

$$r = -\sqrt{b_{yx} \times b_{xy}} = -\sqrt{\left(-\frac{11}{34}\right) \times \left(-\frac{11}{24}\right)} = -\sqrt{\frac{121}{816}} = -0.385$$

$$(iii) \quad \bar{x} = \frac{\sum x}{n} = \frac{30}{6} = 5 \text{ and } \bar{y} = \frac{\sum y}{n} = \frac{42}{6} = 7$$

$$\therefore \text{The regression line of } y \text{ on } x \text{ is } y - \bar{y} = b_{yx}(x - \bar{x})$$

$$\Rightarrow y - 7 = -\frac{11}{34}(x - 5)$$

$$\Rightarrow 34y - 238 = -11x + 55$$

$$\Rightarrow 11x + 34y - 293 = 0$$

$$(iv) \quad \text{When } x = 10, 110 + 34y - 293 = 0 \Rightarrow y = \frac{183}{34}$$

$$\text{Or } y = 5.382$$

13. Two Regression lines are represented by $4x + 10y = 9$ and $6x + 3y = 4$. Find Regression line of y on x . (ISC 2013)

Solution: Let equation $4x + 10y = 9$ is the regression equation of y on x and equation $6x + 3y = 4$ is the regression equation of x on y .

$$4x + 10y = 9$$

$$\Rightarrow 10y = -4x + 9$$

$$\Rightarrow y = -\frac{4}{10}x + \frac{9}{10}$$

$$\therefore b_{yx} = -\frac{4}{10} = -\frac{2}{5}$$

$$6x + 3y = 4$$

$$\Rightarrow 6x = -3y + 4$$

$$\Rightarrow x = -\frac{3}{6}y + \frac{4}{6}$$

$$\therefore b_{xy} = -\frac{3}{6} = -\frac{1}{2}$$

$$\therefore r^2 = b_{yx} \times b_{xy} = \left(-\frac{2}{5}\right)\left(-\frac{1}{2}\right) = \frac{1}{5} \quad \left[0 < \frac{1}{5} < 1\right]$$

We know, $0 \leq r^2 \leq 1$. So our assumption is correct.

Hence, the equation $4x + 10y = 9$ is the regression equation of y on x .

14. The following table shows the mean and the standard deviation of the marks of Mathematics and Physics scored by the students of a school:

	Mathematics	Physics
Mean	84	81
standard deviation	7	4

The correlation coefficient between the given marks is 0.86. Estimate the likely marks in Physics if the marks in Mathematics are 92. (ISC 2013)

Solution:

Given

	Mathematics (x)	Physics (y)
Mean	$\bar{x} = 84$	$\bar{y} = 81$
standard deviation	$\sigma_x = 7$	$\sigma_y = 4$

$$\text{And } r = 0.86$$

$$b_{yx} = r \frac{\sigma_y}{\sigma_x} = 0.86 \times \frac{4}{7} = \frac{86}{175}$$

The regression line of y on x is

$$y - \bar{y} = b_{yx}(x - \bar{x})$$

$$\Rightarrow y - 81 = \frac{86}{175}(x - 84)$$

$$\Rightarrow 175y - 14175 = 86x - 7224$$

$$\Rightarrow 175y = 86x + 6951$$

$$\text{When } x = 92, 175y = 86 \times 92 + 6951 = 14863$$

$$\therefore y = \frac{14863}{175} = 84.93$$

So when marks in Mathematics are 92, likely marks in Physics = 84.93