1) Regression analysis aims establishing the average relationship between two variables.

2) It is used to predict unknown variable with the help of known variable.

3) There are two types are regression lines:

a) Regression line of x on y   b) Regression line of y on x

Feature	x on y	y on x
1) Regression line general form	X = a + b Y	Y = a + b X
2) Dependent or Explained or Regressed	X	Y
3) Independent or Explanatory or Regressor	Y	X
4) Regression Equation	$X - \bar{X} = r.\frac{\sigma_x}{\sigma_y}(Y - \bar{Y})$	$X - \bar{X} = r.\frac{\sigma_y}{\sigma_x}(X - \bar{X})$
5) Regression Coefficient	$b_{XY} = r.\frac{\sigma_x}{\sigma_y} = \frac{cov(x,y)}{\sigma_y^2}$	$b_{YX} = r.\frac{\sigma_y}{\sigma_x} = \frac{cov(x,y)}{\sigma_x^2}$
6) Deviations from mean	$b_{xy} = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(y-\bar{y})^2}$	$b_{yx} = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}$
7) No deviation	$b_{xy} = \frac{n\sum xy - \sum x.\sum y}{n\sum y^2 - (\sum y)^2}$	$b_{yx} = \frac{n\sum xy - \sum x.\sum y}{n\sum x^2 - (\sum x)^2}$
8) Deviation from assumed mean	$b_{xy} = \frac{n\sum dx.dy - \sum dx.\sum dy}{n\sum dy^2 - (\sum dy)^2}$	$b_{yx} = \frac{n\sum dx.dy - \sum dx.\sum dy}{n\sum dx^2 - (\sum dx)^2}$
9) Identification of regression equation by the value of $\left\lvert\frac{x\ coefficient}{y\ coefficient}\right\rvert$	Maximum	Minimum

PROPERTIES OF REGRESSION COEFFICIENTS:

1) The coefficient of correlation will have the same sign as that of regression coefficients. i.e., r, b_{YX} and b_{XY} will have same sign.

r	b_{YX}	b_{XY}
-	-	-
+	+	+
0	0	0

2) Arithmetic mean of regression coefficients is greater than the correlation coefficient i.e., $\frac{b_{yx}+b_{xy}}{2} \geq r$. [AM ≥ GM]

3) G.M of two Regression Coefficients is Correlation Coefficient i.e., $r = \pm\sqrt{b_{xy} \times b_{yx}}$

4) If one of the regression coefficients is greater than one other must be less than one i.e., $\sqrt{b_{xy} . b_{yx}} \leq 1$

5) Regression Coefficients are Independent of change of Origin but not Scale.

   If U = a + bx, V = c + dy then $b_{uv} = \frac{b}{d} \times b_{xy}$ and $b_{vu} = \frac{d}{b} \times b_{yx}$

6) In case of perfect correlation, two regression coefficients are reciprocal to each other.

   i.e., if $r = \pm 1$ then $r^2 = 1 \Rightarrow b_{yx} . b_{xy} = 1 \Rightarrow b_{yx} = \frac{1}{b_{xy}}$

   or $b_{xy} = \frac{1}{b_{yx}}$.

7) If $\sigma_x = \sigma_y$ then $r = b_{XY} = b_{YX}$.

8) Symmetry property does not hold i.e., $b_{XY} \neq b_{YX}$.

PROPERTIES OF REGRESSION LINES:

If two lines of regression are coincided (Angle between the two lines is 0^0)	$r = \pm 1$
If two regression lines are perpendicular (Angle between the two lines is 90^0)	$r = 0$
Two regression lines meet at	$(\overline{X}, \overline{Y})$