Mathematical Explanation of Equilibrium Conditions

We can express first condition as —
"At the equilibrium point E the slope of price line should be equal to the slope of indifference curve."

In fig. 19,
the slope of RS price line $\Rightarrow$ tan of $\angle RSX$
$\Rightarrow$ tan of $\angle(180° - RSO)$
$\Rightarrow -\tan RSO$
$\Rightarrow -\frac{RO}{OS}$ ..... (1)

At point E, the slope of indifference curve becomes equal to MRS_{xy}.

or,

$$MRS_{xy} = -\frac{\Delta Y}{\Delta X} \quad \text{------ (2)}$$

According to equation (1),

$$\text{slope of Price line} = -\frac{RO}{OS} = \frac{-\text{Income}/P_y}{\text{Income}/P_x} = -\frac{P_x}{P_y}$$

According to equations (1) and (2), it is clear that in consumer's equilibrium position,

slope of price line = slope of indifference curve

or,
$$-\frac{P_x}{P_y} = MRS_{xy}$$

Thus, with given money income and the prices of two commodities, the consumer will achieve maximum satisfaction, only at the point where his budget line is tangent to the indifference curve and indifference curve is convex to the origin simultaneously.

Important Question.

Q1) Explain the concept of indifference curves by the uses of diagrams. What are the conditions of consumer's equilibrium in the analysis of indifference curves?

Q2) Explain the law of diminishing marginal rate of substitution.

Q3) Write short notes on —
(I) Price line
(II) Marginal rate of substitution.
(III) Why can indifference curve be in circular shape?

Q4) What are the characteristics of the indifference curve?