Case Study 1 A mobile service provider offers two different monthly plans. Plan A charges a fixed rental of Rs.200 and Rs.1.5 per local call. Plan B has a fixed rental of Rs.300 but charges only Rs.1 per local call. Two friends, Aman and Ravi, subscribe to Plan A and Plan B respectively. They end up paying the same total monthly bill. Assuming they made the same number of local calls in a month, analyze this situation using graphical and algebraic methods of solving linear equations in two variables.

Theoretical Background:

- **General form of a pair of linear equations:**

$$a_1x + b_1y = c_1, \quad a_2x + b_2y = c_2$$

- **Graphical Interpretation:**
  - Intersecting lines ⇒ Unique solution
  - Parallel lines ⇒ No solution
  - Coincident lines ⇒ Infinitely many solutions
- **Methods of Solution:**
  - Substitution Method
  - Elimination Method
  - Cross-Multiplication Method

MCQ Questions:

1. If the number of local calls made is x, what equation represents Aman's total bill under Plan A?

   (a) $200 + x = 300$
   (b) $200 + 1.5x =$ Total Bill
   (c) $x + 200 = 1.5$
   (d) $1.5x = 300$

   Answer: (b)

   Solution: Aman pays Rs.200 fixed and Rs.1.5 per call. Hence, his total bill is $200 + 1.5x$.

2. What is the equation for Ravi's bill under Plan B, if x calls were made?

   (a) $300 + x$
   (b) $300x + 1$
   (c) $300 + 1x$
   (d) $x + 200$

   Answer: (c)

   Solution: Ravi pays Rs.300 fixed and Rs.1 per call. So, the bill is $300 + x$.

3. If both friends pay the same total amount, what is the resulting equation?

   (a) $200 + 1.5x = 300 + x$

(b) $300 + 1.5x = 200 + x$

(c) $200 + x = 300 + 1.5x$

(d) $200x + 300x = x$

Answer: (a)

Solution: Set the total bills equal:

$$200 + 1.5x = 300 + x$$

4. Solve: $200 + 1.5x = 300 + x$

(a) $x = 10$

(b) $x = 50$

(c) $x = 100$

(d) $x = 200$

Answer: (d)

Solution:

$$200 + 1.5x = 300 + x \Rightarrow 0.5x = 100 \Rightarrow x = 200$$

5. Graphically, the equations $y = 200 + 1.5x$ and $y = 300 + x$ represent:

(a) Parallel lines

(b) Coincident lines

(c) Intersecting lines

(d) No lines

Answer: (c)

Solution: The lines have different slopes (1.5 and 1), so they intersect at one point $\Rightarrow$ unique solution.