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# LINEAR AND QUADRATIC EQUATIONS

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# Introduction

This book shows how to solve linear and quadratic equations.



# Chapter 1

## Linear Equations

### 1.1. Two Variables

- 1.1. On comparing the ratios  $\frac{a_1}{a_2}$ ,  $\frac{b_1}{b_2}$ ,  $\frac{c_1}{c_2}$ , find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincident:

$$9x + 3y + 12 = 0 \quad (1.1.1)$$

$$18x + 6y + 24 = 0 \quad (1.1.2)$$

**Solution:**

Equations can be written as:

$$\begin{pmatrix} 9 & 3 \\ 18 & 6 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -12 \\ -24 \end{pmatrix}$$

(1.1.3)

$$x = \frac{\begin{vmatrix} \mathbf{B} & \mathbf{A}_2 \end{vmatrix}}{\begin{vmatrix} \mathbf{A}_1 & \mathbf{A}_2 \end{vmatrix}} = \frac{\begin{vmatrix} -12 & 3 \\ -24 & 6 \end{vmatrix}}{\begin{vmatrix} 9 & 3 \\ 18 & 6 \end{vmatrix}} = \frac{(-12)(6) - (-24)(3)}{(9)(6) - (18)(3)} = \frac{-72 + 72}{54 - 54} = \frac{0}{0}$$

(1.1.4)

$$y = \frac{\begin{vmatrix} \mathbf{A}_1 & \mathbf{B} \end{vmatrix}}{\begin{vmatrix} \mathbf{A}_1 & \mathbf{A}_2 \end{vmatrix}} = \frac{\begin{vmatrix} 9 & -12 \\ 18 & -24 \end{vmatrix}}{\begin{vmatrix} 9 & 3 \\ 18 & 6 \end{vmatrix}} = \frac{9(-24) - 18(-12)}{9(6) - 18(3)} = \frac{-216 + 216}{54 - 54} = \frac{0}{0}$$

(1.1.5)

Hence this equation has infinite number of solutions.

- 1.2. 10 students of Class X took part in a mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.

**Solution:** Let number of boys be  $y$  and number of girls be  $x$ .



$$x + y = 10 \quad (1.2.1)$$

$$y + 4 = x \quad (1.2.2)$$

The 1<sup>st</sup> equation is  $x - y = 4$

The 2<sup>nd</sup> equation is  $y + x = 10$

$$\begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 10 \end{pmatrix} \quad (1.2.3)$$

$$y = \frac{\begin{vmatrix} a_1 & b \\ a_1 & a_2 \end{vmatrix}}{\begin{vmatrix} 1 & 4 \\ 1 & 10 \end{vmatrix}} = \frac{\begin{vmatrix} 1 & 4 \\ 1 & 10 \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 1 \end{vmatrix}} = \frac{10 - 4}{1 - (-1)} = \frac{6}{2} = 3 \quad (1.2.4)$$

$$(1.2.5)$$

$$x = \frac{\begin{vmatrix} b & a_2 \\ a_1 & a_2 \end{vmatrix}}{\begin{vmatrix} 4 & -1 \\ 10 & 1 \end{vmatrix}} = \frac{\begin{vmatrix} 4 & -1 \\ 10 & 1 \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 1 \end{vmatrix}} = \frac{4 - (-10)}{1 - (-1)} = \frac{14}{2} = 7 \quad (1.2.6)$$

$$(1.2.7)$$

$$(1.2.8)$$

Therefore  $y=3$  and  $x=7$

