

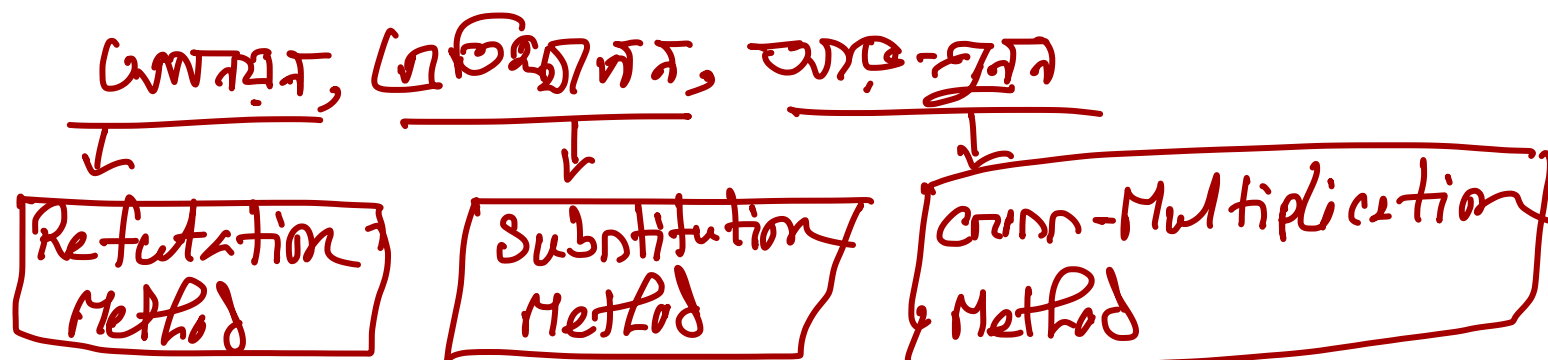
Equation/Simplification (Written)

Instructor:

Md. Abu Yousuf

Assistant Director, Bangladesh Bank

Basic Insight



$$\begin{aligned}
 a_1x + b_1y &= c_1 \quad \text{--- (1)} \\
 a_2x + b_2y &= c_2 \quad \text{--- (2)}
 \end{aligned}
 \begin{cases}
 \rightarrow x = \\
 \rightarrow y =
 \end{cases}$$

$$\begin{cases}
 a_1x + b_1y = c_1 \\
 a_2x + b_2y = c_2
 \end{cases}$$

~~→~~

$$\text{(1)} \times 3 - \text{(2)} \times 4$$

$$\begin{aligned}
 x &= \\
 y &=
 \end{aligned}$$

$$\left\{ \frac{x}{b_2c_1 - b_1c_2} = \frac{y}{a_2c_1 - a_1c_2} = \frac{1}{a_1b_2 - b_1a_2} \right\}$$

1. Solve the following system of equations using the Substitution Method:

Given that

$$3x - 2y = 8 \quad \text{---} \quad \textcircled{1}$$

$$\underline{y} = 2x - 5 \quad \text{---} \quad \textcircled{11}$$

Substitute the value of y at eqⁿ $\textcircled{1}$

$$3x - 2(2x - 5) = 8$$

$$\Rightarrow 3x - 4x + 10 = 8$$

$$\Rightarrow -x = -2$$

$$\therefore x = 2$$

Substitute the value of x at eqⁿ $\textcircled{11}$,

$$y = 2 \cdot 2 - 5 \\ = -1$$

Ans: $x = 2, y = -1$

HW \rightarrow Refutation method }
Cross multiplication }

2. Solve the following system of equations using the Cross-Multiplication Method:

Given that,

$$\begin{aligned} \underline{2x+3y=5} & \text{ --- (I)} \\ \underline{4x-y=3} & \text{ --- (II)} \end{aligned}$$

compare equation (I) and (II) with $a_1x+b_1y=c_1$ and $a_2x+b_2y=c_2$ respectively. we get,

$$\begin{aligned} \underline{a_1} &= 2 & b_1 &= 3 & c_1 &= 5 \\ a_2 &= 4 & b_2 &= -1 & \underline{c_2} &= 3 \end{aligned}$$

from cross multiplication formula we have,

$$\frac{x}{b_2c_1 - c_2b_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

$$\frac{x}{b_2c_1 - b_1c_2} = \frac{1}{a_1b_2 - a_2b_1}$$

$$\begin{aligned}\Rightarrow x &= \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \\ &= \frac{5 \cdot 3 - (-1) \cdot 5}{2 \cdot (-1) - 4 \cdot 3} \\ &= \frac{9 + 5}{-2 - 12} \\ &= \frac{14}{-14} = -1\end{aligned}$$

Ans; $x = -1, y = -1$

HW

Again,

$$\frac{y}{c_2a_1 - c_1a_2} = \frac{1}{a_1b_2 - a_2b_1}$$

$$\begin{aligned}\Rightarrow y &= \frac{c_2a_1 - c_1a_2}{a_1b_2 - a_2b_1} \\ &= \frac{5 \cdot 4 - 3 \cdot 2}{2 \cdot (-1) - 4 \cdot 3} \\ &= \frac{20 - 6}{-14} \\ &= \frac{14}{-14} = -1\end{aligned}$$

3. Solve the following system of equations using the Refutation Method:

Given that,

$$3x + 2y = 6 \quad \text{--- ①}$$
$$2x - 3y = 17 \quad \text{--- ②}$$

from eqⁿ ① $\times 3$ + ② $\times 2$ we get,

$$\begin{array}{r} 9x + 6y = 18 \\ \oplus 4x - 6y = 34 \\ \hline 13x = 52 \end{array}$$

$$\therefore x = 4$$

from eqⁿ ① $\times 2$ - ② $\times 3$ we get,

$$\begin{array}{r} 6x + 4y = 12 \\ \ominus 6x - 9y = 51 \\ \hline 13y = -39 \end{array}$$

$$\therefore y = -3$$

Ans: $x = 4, y = -3$.

HW \rightarrow Substitution
Cross Multiplication.

4. There are two examinations rooms A and B. If 10 students are sent from A to B, then the number of students in each room is the same. If 20 candidates are sent from B to A, then the number of students in A is double the number of students in B. The number of students in room A is:

Let,
A and B be the number of students in room A and B respectively

ATQ,

$$A - 10 = B + 10$$

$$\therefore B = A - 20$$

Again,

$$A + 20 = 2(B - 20)$$

$$\Rightarrow A + 20 = 2B - 40$$

$$\Rightarrow A = 2(A - 20) - 60$$

$$\Rightarrow A = 2A - 40 - 60$$

$$\therefore A = 100$$

So, the number of students in room A will be 100.
Ans

5. The price of 10 chairs is equal to that of 4 tables. The price of 15 chairs and 2 tables together is Tk. 4000. The total price of 12 chairs and 3 tables is:

Let,
the price of 1 chair in tk. C
" " " " table " tk T.

ATQ,

$$10C = 4T.$$

$$\therefore C = \frac{2}{5}T \text{ --- (1)}$$

Again,

$$15C + 2T = 4000$$

$$\Rightarrow 15\left(\frac{2}{5}T\right) + 2T = 4000$$

$$\Rightarrow 6T + 2T = 4000$$

$$\Rightarrow 8T = 4000$$

$$\therefore T = 500$$

So, the price of 1 table is Tk. 500

Substitute the value of T at eqⁿ ①,

$$C = \frac{2}{5} \times 500$$
$$= 200$$

\therefore the price of 1 chair is Tk. 200

So, the price of 12 chairs and 3 tables will be,

$$= 12 \times 200 + 3 \times 500$$

$$= 3900 \text{ Tk.}$$

Ans.

6. One-third of Rahul's savings in National Savings Certificate is equal to one-half of his savings in Public Provident Fund. If he has Tk. 1,50,000 as total savings, how much has he saved in Public Provident Fund ?

Let,
Tk. n be the savings in national savings certificate
Tk. p be " " " " provident fund.

ATQ,

$$\frac{1}{3}n = \frac{1}{2}p$$

$$\therefore n = \frac{3}{2}p \quad \text{--- ①}$$

Again,

$$n + p = 150000$$

$$\Rightarrow \frac{3}{2}p + p = 150000$$

$$\Rightarrow 3p + 2p = 300000$$

$$\Rightarrow SP = 30000$$

$$\therefore P = 60000$$

So the investment in provident fund will be 60000 take.

7. In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Tk. 2.40 per hour for regular work and Tk. 3.20 per hours for overtime. If he earns Tk. 432 in 4 weeks, then how many hours does he work for ?

Ans,

Regular working hours per week is = $(5 \times 8)h$
= 40h.

\therefore " " " in 4 weeks will be = $(4 \times 40)h$
= 160h.

given that,

regular hours working payment Tk. 2.40/hour

overtime " " " " Tk. 3.20/hour

\therefore In 4 weeks regular hours payment will be,
= (160×2.40) Tk

$$= 384 \text{ Tk.}$$

$$\therefore \text{Overtime earnings} = (400 - 384) \text{ Tk.}$$
$$= 16 \text{ Tk.}$$

$$\therefore \text{Overtime hours} = \frac{16}{3.20} \text{ hour.}$$
$$= 5 \text{ hours.}$$

$$\therefore \text{Total hour worked in 4 weeks will be,}$$
$$= (12 + 5) \text{ hour.}$$
$$= 17 \text{ hours.}$$

Ans

8. A man has some hens and cows. If the number of heads be 48 and the number of feet equals 140, then the number of hens will be:

Let,

h be the number of hens.

c be the " " cows.

ATA,

$$h + c = 48$$

$$\therefore c = 48 - h$$

Again,

$$2h + 4c = 140$$

$$\Rightarrow 2h + 4(48 - h) = 140$$

$$\Rightarrow h + 2(48 - h) = 70$$

$$\Rightarrow h + 96 - 2h = 70$$

$$\Rightarrow h = 26$$

\therefore The number of hens will be 26.
Ans

9. Free notebooks were distributed equally among children of a class. The number of notebooks each child got was one-eighth of the number of children. Had the number of children been half, each child would have got 16 notebooks. Total how many notebooks were distributed ?

Let,
 c be the number of children.
 n be the " " notebooks.

ATQ,

$$\frac{n}{c} = \frac{c}{8}$$

$$\therefore n = \frac{c^2}{8}$$

Again,

$$n/c/2 = 16$$

$$\Rightarrow n = \frac{16c}{2}$$

$$\therefore n = 8c$$

We may write,

$$c/8 = 8c$$

$$\therefore c = 64$$

\therefore The number of children will be 64

\therefore The number of notebooks will be,

$$= (64 \times 8)$$

$$= 512.$$

Ans

10. In an examination, a student scores 40% of the total marks and fails by 30 marks. Another student who scores 50% of the total marks gets 20 marks more than the passing marks. Find the passing marks.

Let,

T be the total marks.

P be the passing marks.

ATQ

$$\frac{40}{100} T = P - 30$$

$$\Rightarrow \frac{2}{5} T = P - 30$$

$$\therefore T = \frac{5P - 150}{2}$$

Again,

$$\frac{50}{100} T = P + 20$$

$$\Rightarrow \frac{1}{2} T = P + 20$$

$$\Rightarrow \frac{5P - 150}{2} = 2P + 40$$

$$\Rightarrow 5P - 150 = 4P + 80$$

$$\Rightarrow P = 230$$

\therefore The remaining Mark will be 230
Am.

11. 10% of the voters did not cast their votes in an election between two candidates, 10% of the total votes are declared invalid. The winning candidate secures 54% of the valid votes and wins by 1600 votes. Find the total number of votes cast.

Let, $100x$ be the total number of voters.

\therefore total vote casted 90% of $100x$
 $= 90x$

\therefore valid voters 90% of $90x$
 $= 81x$

Since the winning candidate gets 54% of the valid votes, the other candidate will get 46% of the valid votes

ATA₂

$$\frac{54}{100} \times 81x - \frac{46}{100} \times 81x = 1620$$

$$\Rightarrow 54x - 46x = 2000$$

$$\Rightarrow 8x = 2000$$

$$\therefore x = 250$$

\therefore Total number of voters will be,

$$= 250 \times 100$$

$$= 25000$$

Ans

So the ^{present} age of the Son will be 13 years
Ans.

13. David gets on the elevator at the 11th floor of a building and rides up at the rate of 57 floors per minute. At the same time, Albert gets on an elevator at the 51st floor of the same building and rides down at the rate of 63 floors per minute. If they continue travelling at these rates, then at which floor will their paths cross ?

Let,
t be the time in minutes when they meet.

ATQ,

$$11 + 57t = 51 - 63t$$

$$\Rightarrow 120t = 40$$

$$\therefore t = \frac{1}{3}$$

\therefore They will meet at the floor,

$$\begin{array}{l} \uparrow 11 \\ \downarrow 51 \end{array} \quad 11 + 57t = 51 - 63t$$

$$= \left(11 + 5 \times \frac{1}{3}\right)^{\text{th}} \text{ Floor}$$

$$= (11 + 19)^{\text{th}} \text{ Floor}$$

$$= 30^{\text{th}} \text{ Floor}$$

Ans.

Thank You