Rupee paid for a book kept for five day by
$x + y = 21$

$$\begin{array}{r} x + 4y = 27 \\ -\ x + 2y = 21 \\ \hline 2y = 6 \end{array}$$

$y = 3$.

$x = 21 - 6$

$\Rightarrow x = 15$.

Ex-3.5

(i) $x - 3y - 3 = 0$

$3x - 9y - 2 = 0$

$a_1 = 1, b_1 = -3, c_1 = -3$

$a_2 = 3, b_2 = -9, c_2 = -2$

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

$$\frac{x}{(-3)(-2) - (-9)(-3)} = \frac{y}{(-3)(3) - (-2)(1)} = \frac{1}{(1)(-9) - (3)(-3)}$$

$$\frac{x}{6 - 27} = \frac{y}{-9 - (-21)} = \frac{1}{-9 - (-9)}$$

$$\frac{x}{-21} = \frac{y}{-7} = \frac{1}{0}$$

$$\frac{x}{-21} = \frac{1}{0} \qquad \frac{-y}{-7} = \frac{1}{0}$$

$\Rightarrow x = 0$ (No Solution) $\Rightarrow y = 0$

(ii) $2x+y=5$
$3x+2y=8$

$2x+y-5=0$
$3x+2y-8=0$
$a_1=2, b_1=1, c_1=-5$
$a_2=3, b_2=2, c_2=-8$ It is a unique solution

$\frac{a_1}{a_2}=\frac{2}{3}$ | $\frac{b_1}{b_2}=\frac{1}{2}$ | $\frac{c_1}{c_2}=\frac{5}{8}$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\frac{x}{1\times(-8)-2\times(-5)} = \frac{y}{3\times(-5)-2\times(-8)} = \frac{1}{2\times2-3\times1}$

$\frac{x}{-8+10} = \frac{y}{-15+16} = \frac{1}{4-1}$

$\frac{x}{2} = \frac{y}{1} = \frac{1}{1}$

$\frac{x}{2}=\frac{1}{1}$ | $\frac{y}{1}=\frac{1}{1}$

$x=2$ | $y=1$

(iii) $3x-5y=20$
$6x-10y=40$

$3x-5y-20=0$
$6x-10y-40=0$
$a_1=3, b_1=-5, c_1=-20$
$a_2=6, b_2=-10, c_2=-40$

$\frac{a_1}{a_2}=\frac{3}{6}=\frac{1}{2}$ | $\frac{b_1}{b_2}=\frac{-5}{-10}=\frac{1}{2}$ | $\frac{c_1}{c_2}=\frac{-20}{-40}=\frac{1}{2}$

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

We have infinitely many solution

(iv) $x-3y-7=0$
$3x-3y-15=0$

$a_1=1, b_1=-3, c_1=-7$
$a_2=3, b_2=-3, c_2=-15$

$\frac{a_1}{a_2}=\frac{1}{3}$ | $\frac{b_1}{b_2}=\frac{-3}{-3}=1$ | $\frac{c_1}{c_2}=\frac{-7}{-15}$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ We have a unique solution

$\frac{x}{-3\times(-15)-(-3)\times(-7)} = \frac{y}{3\times(-7)-1\times(-15)} = \frac{1}{1\times(-3)-3\times(-3)}$

$\frac{x}{45-21} = \frac{y}{-21+15} = \frac{1}{-3+9}$

$\frac{x}{24} = \frac{y}{-6} = \frac{1}{6}$

$\frac{x}{24}=\frac{1}{6}$ | $\frac{y}{-6}=\frac{1}{6}$

$x=4$ | $y=-1$

2. (i) $2x+3y=7$
$(a-b)x+(a+b)y=3a+b-2$

$2x+3y-7=0$
$a_1=2, b_1=3, c_1=-7$

$(a-b)x+(a+b)y=3a+b-2$
$(a-b)x+(a+b)y-3a+b-2=0$
$a_2=(a-b), b_2=(a+b)$
$c_2=-3a+b-2$

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

$$\frac{2}{a-b} = \frac{3}{a+b} = \frac{-7}{-(3a+b-2)}$$

$$\frac{2}{(a-b)} = \frac{3}{(a+b)}$$

$2(a+b) = 3(a-b)$

$2a+2b = 3a-3b$

$2b+3b = 3a-2a$

$5b = a$

$a = 5b$ — (3)

$$\frac{2}{(a-b)} = \frac{7}{(3a+b-2)}$$

$2(3a+b-2) = 7(a-b)$

$6a+2b-4 = 7a-7b$

$2b-4+7b = 7a-6a$

$9b-4 = a$ — (4)

Comparing (3) & (4)

$5b = 9b-4$

$4 = 9b-5b$

$4 = 4b \Rightarrow b = 1$

Putting $b=1$ in (3)

$a = 5b$

$a = 5(1)$

$a = 5$

So, it has infinitely many solution

(ii) $3x+y = 1$

$(2k-1)x+(k-1)y = 2k+1$

$3x+y-1 = 0$

$a_1 = 3, b_1 = 1, c_1 = -1$

$(2k-1)x+(k-1)y-(2k+1) = 0$

$a_2 = (2k-1), b_2 = (k-1), c_2 = -(2k+1)$

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\frac{3}{(2k-1)} = \frac{1}{(k-1)}$$

$3(k-1) = 1(2k-1)$

$3k-3 = 2k-1$

$3k-2k = 3-1$

$3k-2k = 2$

It have no solution

3. Solve the following pair of linear equations by substitution & cross-multiplication method

$8x+5y = 9$

$3x+2y = 4$

Substitution

$8x+5y = 9$

$8x = 9-5y$

$x = \frac{9-5y}{8}$

$3x+2y = 4$

$3\left(\frac{(9-5y)}{8}\right)+2y = 4 \Rightarrow \frac{3(9-5y)}{8}+2y = 4$

$\Rightarrow \frac{3(9-5y)+8(2y)}{8} = 4 \Rightarrow 3(9-5y)+8(2y) = 4\times$

$\Rightarrow 27-15y+16y = 32 \Rightarrow 27+y = 32 \Rightarrow y = 32-27$

$\Rightarrow y = 5$

$3x+2y = 4$

$3x+2(5) = 4$

$3x+10 = 4 \Rightarrow 3x = 4-10 \Rightarrow 3x = -6 \Rightarrow x = -\frac{6}{3}$

$\Rightarrow x = -2$

Cross Multiplication

$8x+9y-9 = 0$

$3x+2y-4 = 0$

$$\frac{x}{5\times(-4)-2\times(-9)} = \frac{y}{(-9)\times 3-(-4)\times 6} = \frac{1}{8\times 2-3\times 5}$$

$$\frac{x}{(-20)+18} = \frac{-y}{(-27)+35} = \frac{1}{16-15}$$

$$\frac{x}{-2} = \frac{y}{8} = \frac{1}{1}$$

$\frac{x}{-2} = \frac{1}{1}$ | $\frac{y}{8} = \frac{1}{1}$

$\Rightarrow x = -2\times 1$ | $\Rightarrow y = 8\times 1$

$\Rightarrow x = -2$ | $\Rightarrow y = 8$

4. (i) let fixed charge be $2x$
" Cost of food per day be $2y$

$x + 20y = 1000$ ——— ①

$x + 26y = 1180$ ——— ②

$x + 26y = 1180$

$\Rightarrow (1000 - 20y) + 26y = 1180$

$\Rightarrow -20 + 26y = 1180 - 1000$

$\Rightarrow 6y = 180 \Rightarrow y = \frac{180}{6} = 30$

$x + 20(30) = 1000$

$x + 60 = 1000$

$x = 1000 - 60$

$\Rightarrow x = 400$

(ii) let numerator be x
" denominator be y

$\frac{x-1}{y} = \frac{1}{3}$

$\Rightarrow 3(x-1) = y \Rightarrow 3x - 3 = y \Rightarrow 3x - y = 3$ ——— ①

$\frac{x}{y+8} = \frac{1}{4}$

$\Rightarrow 4x = y + 8$

$\Rightarrow 4x - y = 8$ ——— ②

$3x = y + 3$

$x = \left(\frac{y+3}{3}\right)$

$4x - y = 8 \Rightarrow 4\left(\frac{y+3}{3}\right) - y - 8 = 0$

$\Rightarrow 4y + 12 - 3y - 24 = 0$

$\Rightarrow 4y - 3y - 24 + 12 = 0$

$\Rightarrow y = 12$

$3x - (12) = 3 \Rightarrow 3x = 12 + 3 \Rightarrow 3x = 15 \Rightarrow x = \frac{15}{3} = 5$

fraction $= \frac{5}{12}$

(iii) let for right answer be x
" wrong answer be y

$3x - y = 40$ ——— ①

$4x - 2y = 50$

$\Rightarrow 2(2x - y) = 50$

$\Rightarrow 2x - y = \frac{50}{2} = 25$

$\Rightarrow 2x - y = 25$ ——— ②

$3x - y = 40$

$\Rightarrow 3x - 40 = y$

$2x - (3x - 40) = 25$

$\Rightarrow 2x - 3x + 40 = 25$

$\Rightarrow 2x - 3x = 25 - 40$

$\Rightarrow -x = -15$

$3(15) - y = 40$

$\Rightarrow 45 - y = 40$

$\Rightarrow 5 = 45 - 40 = y$

$\Rightarrow 5 = y$

Total question $= x + y$

$= 15 + 5 = 20$

(iv) let speed of 1st car be x km/hr

" " " 2nd car be y km/hr

$3x - 5y = 100$

$5(x - y) = 100$

$(x - y) = 100/5$

$\Rightarrow x - y = 20$ ——— (1)

$x + y = 100$ ——— (2)

From (1)

$x - y = 20$

$x = y + 20$

Putting value of x in (2)

$x + y = 100$

$\Rightarrow (y + 20) + y = 100$

$\Rightarrow 2y + 20 = 100 \Rightarrow 2y = 100 - 20$

$\Rightarrow 2y = 80 \Rightarrow y = 80/2 = 40$

$x - y = 20$

$x - 40 = 20$

$x = 40 + 20 \Rightarrow x = 60$

$x = 60$ km/hr

$y = 40$ km/hr

(v) let length of rectangle be x units

Breadth of rectangle be y units

Area $= l \times b$

$= xy$

old Area $- 9 = (\text{length} - 5) \times (\text{Breadth} + 3)$

$xy - 9 = (x - 5)(y + 3)$

$xy - 9 = x(y + 3) - 5(y + 3)$

$xy - 9 = xy + 3x - 5y - 15$

$0 = xy + 3x - 5y - 15 - xy + 9$

$3x - 5y - 6 = 0$

$3x - 5y = 6$ ——— (1)

old Area $+ 67 = (\text{length} + 3) \times (\text{Breadth} + 2)$

$xy + 67 = (x + 3)(y + 2)$

$xy + 67 = x(y + 2) + 3(y + 2)$

$xy + 67 = xy + 2x + 3y + 6$

$0 = xy + 2x + 3y + 6 - xy - 67$

$2x + 3y - 61 = 0$

$2x + 3y = 61$ ——— (2)

$3x - 5y - 6 = 0$

$3x = 6 + 5y$

$x = \frac{6 + 5y}{3}$

$2x + 3y = 61$

$2\left(\frac{6 + 5y}{3}\right) + 3y = 61$

$3 \times 2\left(\frac{6 + 5y}{3}\right) + 3 \times 3y = 3 \times 61$

$2(6 + 5y) + 9y = 183$

$\Rightarrow 12 + 10y + 9y = 183 \Rightarrow 19y = 183 - 12 \Rightarrow 19y = 171$

$y = 9$

$3x - 5y = 6$

$3x - 5(9) = 6$

$3x - 45 = 6$

$3x = 6 + 45$

$3x = 51 \Rightarrow x = \frac{51}{3} = 17$

length = 17 units

Breadth = 9 units