Exercise 3.1

1. Let his present age of Aftab = x
Let present age of his daughter = y

Before 7 years : $x - 7$
$y - 7$

After 3 years = $x + 3$
$y + 3$

ATQ = $x - 7 = 7(y - 7)$
$x - 7 = 7y - 49$
$x - 7y = -49 + 7$
$x - 7y = -42$

$x + 3 = 3(y + 3)$
$x + 3 = 3y + 9$
$x - 3y = 6$

x	0	-42	-35
y	6	0	1

x	6	0	9
y	0	-2	1

2. let bat be = x
let ball be = y

$3x + 6y = 3900$
$x + 3y = 1300$

$\frac{3x}{3} + \frac{6y}{3} = \frac{3900}{3} \quad = \quad x + 2y = 1300$
$x + 3y = 1300$

x	100	300	700
y	600	500	300

x	100	400	700
y	400	300	200

3. let apples be = x
let grapes be = y

$2x + y = 160$
$4x + 2y = 300$

$\frac{4x + 2y = 300}{2 \quad 2 \quad 2}$
$2x + y = 150$

x	80	60	40
y	0	40	80

x	60	40	20
y	30	70	110

2. (i) $5x - 4y + 8 = 0$
$7x + 6y - 9 = 0$

$a_1 = 5 \quad b_1 = -4 \quad c_1 = 8$
$a_2 = 7 \quad b_2 = 6 \quad c_2 = -9$

$\frac{a_1}{a_2} = \frac{5}{7} \quad \frac{b_1}{b_2} = \frac{-4}{6} \quad \frac{c_1}{c_2} = \frac{8}{-9}$

$\frac{5}{7} \neq \frac{-4}{6}$ [unique solution]

(ii) $9x + 3y + 12 = 0$
$18x + 6y + 24 = 0$

$a_1 = 9 \quad b_1 = 3 \quad c_1 = 12$
$a_2 = 18 \quad b_2 = 6 \quad c_2 = 24$

$\frac{9}{18} = \frac{1}{2} \quad \frac{3}{6} = \frac{1}{2} \quad \frac{12}{24} = \frac{1}{2}$

$\frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ [many solution]

(iii) $6x - 3y + 10 = 0$
$2x - y + 9 = 0$

$a_1 = 6 \quad b_1 = -3 \quad c_1 = 10$
$a_2 = 2 \quad b_2 = -1 \quad c_2 = 9$

$\frac{6}{2} = 3 \quad \frac{-3}{-1} = 3$

$3 = 3 \neq \frac{10}{9}$ (parallel line)

3. (i) $3x + 2y = 5$
$2x - 3x = 7$

$a_1 = 3 \quad b_1 = 2 \quad c_1 = 5$
$a_2 = 2 \quad b_2 = -3 \quad c_2 = 7$

$\frac{3}{2} \neq \frac{2}{3}$ (unique solution) (consistent)

(ii) $2x - 3y = 8$
$4x - 6y = 9$

$a_1 = 2 \quad b_1 = -3 \quad c_1 = 8$
$a_2 = 4 \quad b_2 = -6 \quad c_2 = 9$

$2 = 2 \neq \frac{8}{9}$ (no solution.) (inconsistent)

(iii) $\frac{3}{2}x + \frac{5}{3}y = 7$
$9x - 10y = 14$

$a_1 = \frac{3}{2} \quad b_1 = \frac{5}{3} \quad c_1 = 7$
$a_2 = 9 \quad b_2 = -10 \quad c_2 = 14$

$\frac{\frac{3}{2}}{9} \neq \frac{\frac{5}{3}}{-10}$ (unique solution) (consistent)

(iv) $5x - 3y = 11$
$-10x + 6y = -22$

$a_1 = 5 \quad b_1 = -3 \quad c_1 = 11$
$a_2 = -10 \quad b_2 = 6 \quad c_2 = -22$

$\frac{5}{-10} = \frac{-3}{6} = \frac{11}{-22}$ (many solution) (consistent)

(v) $\frac{4}{3}x + 2y = 8$
$2x + 3y = 12$

$a_1 = \frac{4}{3} \quad b_1 = 2 \quad c_1 = 8$
$a_2 = 2 \quad b_2 = 3 \quad c_2 = 12$

$\frac{\frac{4}{3}}{2} \neq \frac{2}{3}$ (unique solution) (consistent)

~~$x - y + 1 = 0$~~
~~$3x + 2y - 12 = 0$~~

5. let the length be $= x$
let the breadth be $= y$

$x + y = 36$
$x - y = 4$

$x = 4 + y$
$4 + y + y = 36$
$2y = 32$
$y = 16$

$x - 16 = 4$
$x = 20$

So the length is 20m and breath is 16m

1) $x + y = 14$

$x - y = 4$

$y = 14 - x$

$x - (14 - x) = 4$

$x + x - 14 = 4$

$2x = 18$

$x = 9$

$y = 14 - x$

$y = 14 - 9$

$y = 5$

$3x - y = 3$

$9x - 3y = 9$

$3x - 3 = y$

$9x - 3(3x - 3) = 9$

$9x - 9x + 9 = 9$

$y = 3 - 3x$

$9x - 3(3 - 3x) = 9$

$9x - 9 + 9x = 9$

$18x = 18$

$x = 1$

$9 - 3y = 9$

$-3y = 9 - 9$

$y = 0$

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$

$= \frac{3 \times 3x - 2 \times 5y}{6} = -2$

$= \frac{9x - 10y}{6} = -2$

$9x - 10y = -12$

$x = \frac{-12 + 10y}{9}$

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

$= \frac{2 \times x + 3 \times y}{6} = \frac{13}{6}$

$= \frac{2x + 3y}{6} = \frac{13}{6}$

$= 2x + 3y = 13$

$2\left(\frac{-12 + 10y}{9}\right) + 3y = 13$

$\frac{-24 + 20y}{9} + 3y = 13$

$-24 + 20y + 27y = 117$

$47y = 117 + 24$

$47y = 141$

$y = 3$

$2x + 9 = 13$

$2x = 4$

$x = 2$

3. (i) let ones digit be = x
let tens digit be = y

$x - y = 26$ — (i)
$x = 3y$ — (ii)

$x - y = 26$
$(3y) - y = 26$
$2y = 26$
$y = 13$

$x = 3y$
$x = 3 \times 13$
$x = 39$

So, the numbers are 13, 39.

(ii) let the 1st angles be = x
let the 2nd angle be = y

$x + y = 180^\circ$
$x - y = 18$
$x = 18 + y$
$18 + y + y = 180$
$2y = 180 - 18$
$2y = 162$
$y = 81$

$x - y = 18$
$x - 81 = 18$
$x = 99^\circ$

So, the two angles are 81° and 99°.

(iv) Let the fixed charge be = x
Let the charge paid per distance = y

$x + 10y = 105$
$x + 15y = 155$
$x = 105 - 10y$
$105 - 10y + 15y = 155$
$5y = 50$
$y = 10$

$x + 100 = 105$
$x = 5$

So, the fixed charge is ₹5 and charge paid per distance is ₹10.

(v) Let the number of bats be = x
Let the number of balls be = y

$7x + 6y = 3800$
$3x + 5y = 1750$

$x = \frac{8750 - 5y}{3}$

$7\left(\frac{1750 - 5y}{3}\right) + 6y = 3800$

$\frac{12250 - 35y}{3} + 6y = 3800$

$12250 - 35y + 18y = 11400$
$12250 - 17y = 11400$
$12250 - 11400 = 17y$
$850 = 17y$
$50 = y$

$3x + 5y = 1750$
$3x + 250 = 1750$
$3x = 1500$
$x = 500$

So, the cost of 1 bat is ₹500 and 1 ball is ₹50.

(v) let the numerator be $= x$
let the denominator be $= y$

$$\frac{x+2}{y+2} = \frac{9}{11}$$

$$11(x+2) = 9(y+2)$$
$$11x + 22 = 9y + 18$$
$$11x - 9y = -4$$

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

$$6(x+3) = 5(y+3)$$
$$6x + 18 = 5y + 15$$
$$6x - 5y = -3$$

$$x = \frac{-4+9y}{11}$$

$$6\left(\frac{-4+9y}{11}\right) - 5y = -3$$

$$\frac{-24+54y}{11} - 5y = -3$$

$$-24 + 54y - 55y = -33$$
$$-24 - y = -33$$
$$-24 + 33 = y$$
$$9 = y$$

$$11x - 81 = -4$$
$$11x = 77$$
$$x = 7$$

so, the fraction is $\frac{7}{9}$

(vi) Present age of Jacob $= x$
Present age of his son $= y$

5 years before $= x + 5 = 3(y+5)$
$x + 5 = 3y + 15$
$x - 3y = 10$

5 years before $= x - 5 = 7(y-5)$
$x - 5 = 7y - 35$
$x - 7y = -30$

$x = 10 + 3y$

$10 + 3y - 7y = -30$

$10 - 4y = -30$

$10 + 30 = 4y$

$40 = 4y$

$10 = y$

$x - 30 = 10$

$x = 40$

So, Jacob's age is 40 years and his son's age is 10 years.

$s - t = 3$

$s = 3 + t$

$\frac{s}{3} + \frac{t}{2} = 6$

$\frac{2s + 3t}{6} = 6$

$2s + 3t = 36$

$2(3 + t) + 3t = 36$

$6 + 2t + 3t = 36$

$5t = 30$

$t = 6$

$s - t = 3$

$s - 6 = 3$

$s = 9$

$0.2x + 0.3y = 1.3$

$\frac{2}{10}x + \frac{3}{10}y = \frac{13}{10}$

$2x + 3y = 13$

$x = \frac{13 - 3y}{2}$

$0.4x + 0.5y = 2.3$

$\frac{4}{10}x + \frac{5y}{10} = \frac{23}{10}$

$4x + 5y = 23$

$4\left(\frac{13 - 3y}{2}\right) + 5y = 23$

$\frac{52 - 12y}{2} + 5y = 23$

$52 - 12y + 10y = 46$

$52 - 2y = 46$

$6 = 2y$

$3 = y$

$2x + 9 = 13$

$2x = 4$

$x = 2$

(v) $\sqrt{2}x + \sqrt{3}y = 0$ $\quad \sqrt{3}x - \sqrt{8}y = 0$

$x = \frac{-\sqrt{3}y}{\sqrt{2}}$

$\sqrt{3}\left(\frac{-\sqrt{3}y}{\sqrt{2}}\right) - \sqrt{8}y = 0$

$\frac{-3y}{\sqrt{2}} - \sqrt{8}y = 0$

$\Rightarrow y\left(\frac{-3}{\sqrt{2}} - \sqrt{8}\right) = 0$

$\Rightarrow y = \frac{0}{\frac{-3}{\sqrt{2}} - \sqrt{8}} = 0$

$\sqrt{3}x - \sqrt{8} \times 0 = 0$

$\sqrt{3}x - 0 = 0$

$\sqrt{3}x = 0$

$x = \frac{0}{\sqrt{3}} = 0$

2. $2x + 3y = 11$ $\quad 2x - 4y = -24$

$x = \frac{11 - 3y}{2}$

$2\left(\frac{11-3y}{2}\right) - 4y = -24$

$\frac{22 - 6y}{2} - 4y = -24$

$22 - 6y - 8y = -48$

$22 - 14y = -48$

$70 = 14y$

$5 = y$

$2x - 20 = -24$

$2x = 4$

$x = 2$

$y = mx + 3$

$5 = m \times 2 + 3$

$5 = 2m + 3$

$2 = 2m$

$1 = m$

4 (i) $x+y=5$
$2x+2y=10$

$a_1=1 \quad a_2=1 \quad a_3=5$
$b_1=2 \quad b_2=2 \quad b_3=10$

$\frac{1}{2}=\frac{1}{2}=\frac{5}{10}$ (consistent)

(ii) $x-y=8 \qquad 3x-3y=16$

$a_1=1 \quad a_2=-1 \quad a_3=8$
$b_1=3 \quad b_2=-3 \quad b_3=16$

$\frac{1}{3}=\frac{1}{3}\neq\frac{8}{16}$ (inconsistent)

(iii) $2x+y-6=0 \qquad 4x-2y-4=0$

$a_1=2 \quad a_2=1 \quad a_3=-6$
$b_1=4 \quad b_2=-2 \quad b_3=-4$

$\frac{2}{4}\neq\frac{1}{-2}\neq\frac{-6}{-4}$ (inconsistent)

(iv) $2x-2y-2=0$

$a_1=2 \quad a_2=-2 \quad a_3=-2$
$b_1=4 \quad b_2=-4 \quad b_3=-5$

$\frac{2}{4}=\frac{-2}{-4}\neq\frac{-2}{-5}$ (inconsistent)

(i) $x+y=5$

$2x-3y=4$

let us multiply 2 with equation I and 1 with

$2(x+y=5) = 2x+2y=10$

$1(2x-3y=4) = 2x-3y=4$

$5y = 6$

$y = \frac{6}{5}$

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

$x = 5-\frac{6}{5} = \frac{25-6}{5} = \frac{19}{5}$

(ii) $3x+4y=10$ $\quad 2x-2y=2$

Equation I x 2 and Equation II x 3

$1(3x+4y=10) = 3x+4y=10$

$2(2x-2y=2) = 4x-4y=4$

$7x = 14$

$x = 2$

$3x+4y=10$

$3\times2+4y=10$

$4y=10-6$

$4y=4$

$y=1$

) $3x-5y-4=0$

$9x-2y-7=0$

Equation I $\times 2$ and Equation II $\times 5$

$2(3x-5y-4) = 6x-10y=8$

$5(9x-2y-7) = 45x-10y=35$

$-39x = -27$

$x = \frac{-27}{-39} = \frac{9}{13}$

$3\times\frac{9}{13} - 5y = 4$

$\frac{27}{13} - 5y = 4$

$\frac{27-52}{13} = 5y$

$\frac{-25}{13} = 5y$

$y = \frac{-25}{13} \times \frac{1}{5} = \frac{-5}{13}$

) $\frac{x}{2} + \frac{2y}{3} = -1$ $\qquad$ $\frac{x}{1} - \frac{y}{3} = 3$

$\frac{3x+4y}{6} = -1$ $\qquad$ $\frac{3x-y}{3} = 3$

$3x+4y=-6$ $\qquad$ $3x-y=9$

$3x+4y=-6$

$3x-y=9$

$5y=15$

$y=-3$

$3x-12=-6$

$3x=6$

$x=2$

2. (i) let the numerator be $= x$
let the denominator be $= y$

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

$$x+1 = y-1$$

$$x-y = -2$$

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

$$2x = y+1$$

$$2x-y = 1$$

Equation I $\times 2$ and Equation II $\times 1$

$$2x-2y = -4$$
$$2x-y = 1$$
$$-y = -5$$
$$y = 5$$

$$x-y = -2$$
$$x-5 = -2$$
$$x = 3$$

So the Fraction is $\frac{3}{5}$.

(ii) let Muni's age be $= x$
let Sonu's age be $= y$

$$x-5 = 3(y-5)$$
$$x-5 = 3y-15$$
$$x-3y = -10$$

$$x+10 = 2(y+10)$$
$$x+10 = 2y+20$$
$$x-2y = 10$$

$$x - 3y = -10$$
$$x - 2y = 10$$
$$-y = -20$$
$$y = 20$$

$$x - 60 = -10$$
$$x = 50$$

So, Ravi's age is 50 years and Sonu's age is 20 years.

) Let the ones digit = x
Let the tens digit = y
Original number = $10y + x$

$$x + y = 9$$
$$9(10y + x) = 2(10x + y)$$
$$9(10y + x) = 2(10x + 9y)$$
$$90y + 9x = 20x + 2y$$
$$88y = 11x$$
$$x = \frac{88}{11}y \qquad x = 8y$$

$$x + y = 9$$
$$8y + y = 9$$
$$9y = 9$$
$$y = 1$$
$$x + 1 = 9$$
$$x = 8$$

So number is 18.

(iv) Total cash = 2000

let ₹50 notes be = x

let ₹100 notes be = y

$x + y = 25$ — (i)

$50x + 100y = 2000$

$x + 2y = 40$

$x + 2y = 40$

$x + y = 25$

$y = 15$

$x + 15 = 15$

$x = 10$

So, she got ~~2000~~ 10 ₹50s and 15 ₹100s.

v) let the fixed charge = x

let the additional charge = y

$x + 4y = 27$

$x + 2y = 21$

$x + 12 = 27$

$x = 15$

$x + 4y = 27$

$x + 2y = 21$

$2y = 6$

$y = 3$

So, fixed charge is ₹15 and additional charge is

Ex 8.6

1. (i) $\frac{1}{2x} + \frac{1}{3y} = 2$ $\quad\quad$ $\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$

Let $\frac{1}{x} = a$ $\quad$ $\frac{1}{y} = b$

$\frac{a}{2} + \frac{b}{3} = 2$ $\quad\quad$ $\frac{a}{3} + \frac{b}{2} = \frac{13}{6}$

$\frac{3a+2b}{6} = 2$ $\quad\quad$ $\frac{2a+3b}{6} = \frac{13}{6}$

$3a+2b=12$ $\quad\quad$ $2a+3b=13$

Multiply Equ. I x 2 and Equ. II x 3

$(3a+2b=12) \times 2 = 6a+4b=24$

$(2a+3b=13) \times 3 = 6a+9b=39$

$(-)\ (-)\ (-)$

$-5b = -15$

$b = 3$

$2a+3b=13$

$2a+3\times3=13$

$2a+9=13$

$2a=4$

$a=2$

$\frac{1}{x} = a = 2$ $\quad\quad$ $\frac{1}{y} = b = 3$

$x = \frac{1}{2}$ $\quad\quad$ $y = \frac{1}{3}$

(ii) $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ $\quad$ $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

let $\frac{1}{\sqrt{x}} = a$ $\quad$ $\frac{1}{\sqrt{y}} = b$

$2a + 3b = 2$ $\quad$ $4a - 9b = -1$

Multiply Eqn I × 2 and Eqn II × 1

$(2a + 3b = 2) \times 2 = 4a + 6b = 4$

$(4a - 9b = -1) \times 1 = 4a - 9b = -1$

$(-) \quad (+) \quad (+)$

$15b = 5$

$b = \frac{1}{3}$

$2a + 3b = 2$

$2a + 1 = 2$

$2a = \frac{1}{2}$

$\frac{1}{\sqrt{x}} = a = \frac{1}{2}$ $\quad$ $\frac{1}{\sqrt{y}} = b = \frac{1}{3}$

$\sqrt{x} = 2$ $\quad$ $\sqrt{y} = 3$

$(\sqrt{x})^2 = (2)^2$ $\quad$ $(\sqrt{y})^2 = (3)^2$

$x = 4$ $\quad$ $y = 9$

(iii) $\frac{4}{x} + 3y = 14$ $\quad$ $\frac{3}{x} - 4y = 23$

let $\frac{1}{x} = a$ $\quad$ $y = b$

$4a + 3b = 14$ $\quad$ $3a - 4b = 23$

Multiply Eq I × 3 and Eq II × 4

$(4a+3b=14)\times 3 = 12a+9b=42$

$(3a-4b=23)\times 4 = 12a-16b=92$

$25b=-50$

$b=-2$

$4a-6=14$

$4a=20$

$a=5$

$\frac{1}{x}=a=5$ $\quad y=b=-2$

$x=\frac{1}{5}$ $\quad y=-2$

ii) $\frac{5}{x-1}+\frac{1}{y-2}=2 \quad \frac{6}{x-1}-\frac{3}{y-2}=1$

let $\frac{1}{x-1}=a \quad \frac{1}{y-2}=b$

$5a+b=2 \quad 6a-3b=1$

$(5a+b=2)\times 3 = 15a+3b=6$

$(6a-3b=1)\times 1 = 6a-3b=1$

$21a=7$

$a=\frac{1}{3}$

$6a-3b=1$

$2-3b=1$

$1=3b$

$\frac{1}{3}=b$

$\frac{1}{x-1}=a=\frac{1}{3} \quad \frac{1}{y-2}=b=\frac{1}{3}$

$x-1=3$

$x=4$

$y-2=3$

$y=5$

(v) $\frac{7x-2y}{xy}=5$ $\frac{8x+7y}{xy}=15$

$\frac{7x}{xy}-\frac{2y}{xy}=\frac{5xy}{xy}$ $\frac{8x+7y}{xy}=\frac{15xy}{xy}$

$\frac{7}{y}-\frac{2}{x}=5$ $\frac{8}{y}+\frac{7}{x}=15$

let $\frac{1}{y}=a$ $\frac{1}{x}=b$

$7a-2b=5$ $8a+7b=15$

$(7a-2b=5)\times 7 = 49a-14b=35$

$(8a+7b=15)\times 2 = 16a+14b=30$

$65a = 65$

$a = \frac{1}{1}$

$7-2b=5$

$2=2b$

$1=b$

$\frac{1}{y}=a=1$ $\frac{1}{x}=b=1$

$y=1$ $x=1$

(vi) $6x + 3y = 6xy$ $\quad 2x + 4y = 5xy$

$\frac{6x}{xy} + \frac{3y}{xy} = \frac{6xy}{xy}$ $\quad \frac{2x}{xy} + \frac{4y}{xy} = \frac{5xy}{xy}$

$\frac{6}{y} + \frac{3}{x} = 6$ $\quad \frac{2}{y} + \frac{4}{x} = 5$

let $\frac{1}{y} = a$ $\quad \frac{1}{x} = b$

$6a + 3b = 6$ $\quad 2a + 4b = 5$

$(6a + 3b = 6) \times 1 = 6a + 3b = 6$

$(2a + 4b = 5) \times 3 = 6a + 12b = 15$

$(-) \quad (-) \quad (-)$

$-9b = -9$

$b = 1$

$6a + 3 = 6$

$6a = 3$

$a = \frac{1}{2}$

$\frac{1}{x} = b = 1$ $\quad \frac{1}{y} = a = \frac{1}{2}$

$x = 1$ $\quad y = 2$

(vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4$ $\quad \frac{15}{x+y} - \frac{5}{x-y} = -2$

let $\frac{1}{x+y} = a$ $\quad \frac{1}{x-y} = b$

$10a + 2b = 4$ $\qquad$ $15a - 5b = -2$

$(10a + 2b = 4) \times 5 = 50a + 10b = 20$

$(15a - 5b = -2) \times 2 = 30a - 10b = -4$

$80a \qquad 16$

$a = \frac{1}{5}$

$2 + 2b = 4$

$2b = 2$

$b = 1$

$\frac{1}{x+y} = a = \frac{1}{5}$ $\qquad$ $\frac{1}{x-y} = b = 1$

$x + y = 5$ $\qquad$ $x - y = 1$

$x + y = 5$

$x - y = 1$

$2x = 6$

$x = 3$

$x + y = 5$

$3 + y = 5$

$y = 2$

$x = 3 \qquad y = 2$

(viii) $\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4}$ $\quad \frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = -\frac{1}{8}$

Let $\frac{1}{3x+y} = a$ $\quad \frac{1}{3x-y} = b$

$a+b = \frac{3}{4}$ $\quad \frac{a}{2} - \frac{b}{2} = \frac{-1}{8}$

$\frac{a-b}{2} = \frac{-1}{8}$

$a-b = \frac{-1}{4}$

$a+b = \frac{3}{4}$

$a-b = \frac{-1}{4}$

$2a = \frac{1}{2}$

$\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$

$a = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\frac{1}{4} + b = \frac{3}{4}$

$b = \frac{1}{2}$

$\frac{1}{3x+y} = a = \frac{1}{4}$ $\quad \frac{1}{3x-y} = b = \frac{1}{2}$

$3x+y = 4$ $\quad 3x-y = 2$

$3x+y = 4$

$3x-y = 3$

$6x = 6$

$x = 1$

$3x+y = 4$

$3+y = 4$

$y = 1$

1. (i) $x - 3y - 3 = 0$
$3x - 9y - 2 = 0$

$a_1 = 1 \quad b_1 = -3 \quad c_1 = -3$
$a_2 = 3 \quad b_2 = -9 \quad c_2 = -2$

$$\frac{x}{6-27} = \frac{y}{-9+2} \neq \frac{1}{-9+9}$$

[no solution]

(ii) $2x+y=5$ $\quad a_1=2 \quad b_1=1 \quad c_1=-5$

$3x+2y=8$ $\quad a_2=3 \quad b_2=2 \quad c_2=-8$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ [unique solution]

$$\frac{x}{-8+10} = \frac{y}{+16+15} = \frac{1}{4-3}$$

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

$y=-1$

$x=2$

(iii) $3x-5y=20$ $\quad a_1=3 \quad b_1=-5 \quad c_1=-20$

$6x-10y=40$ $\quad a_2=6 \quad b_2=-10 \quad c_2=-40$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (infinitely many solutions)

(iv) $x-3y-7=0$ $\quad a_1=1 \quad b_1=-3 \quad c_1=-7$

$3x-3y-15=0$ $\quad a_2=3 \quad b_2=-3 \quad c_2=-15$

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

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

$6y=6$ $\qquad 6x=-24$

$y=1$ $\qquad x=-4$

(iv) $\frac{5}{x-1} + \frac{1}{y-2} = 2$ $\quad \frac{6}{x-1} - \frac{3}{y-2} = 1$

let $\frac{1}{x-1} = a$ $\quad \frac{1}{y-2} = b$

$5a + b = 2$ $\quad 6a - 3b = 1$

$(5a+b=2) \times 3 = 15a + 3b = 6$

$(6a-3b=1) \times 1 = 6a - 3b = 1$

$21a = 7$

$a = \frac{1}{3}$

$6a - 3b = 1$

$6 \times \frac{1}{3} - 3b = 1$

$2 - 3b = 1$

$1 = 3b$

$\frac{1}{3} = b$

$\frac{1}{x-1} = a = \frac{1}{3}$ $\quad \frac{1}{y-2} = b = \frac{1}{3}$

$x - 1 = 3$ $\quad y - 2 = 3$

$x = 4$ $\quad y = 5$

(v) $\frac{7x-2y}{xy} = 15$ $\quad\quad$ $\frac{8x+7y}{xy} = 15$

$7x-2y = 15xy$ $\quad\quad$ $8x+7y = 15xy$

$\frac{7x}{xy} - \frac{2y}{xy} = \frac{15xy}{xy}$ $\quad\quad$ $\frac{8x}{xy} + \frac{7y}{xy} = \frac{15xy}{xy}$

$\frac{7}{y} - \frac{2}{x} = 15$ $\quad\quad$ $\frac{8}{y} + \frac{7}{x} = 15$

let $\frac{1}{y} = a$ $\quad$ $\frac{1}{x} = b$

$7a-2b=5$ $\quad\quad$ $8a+7b=15$

$(7a-2b=5) \times 7 = 49a-14b=35$

$(8a+7b=15) \times 2 = 16a+14b=30$

$65a = 65$

$a = 1$

$7a-2b=5$

$7-2b=5$

$2=2b$

$1=b$

$\frac{1}{y} = a = 1$ $\quad\quad$ $\frac{1}{x} = b = 1$

$y = 1$ $\quad\quad$ $x = 1$

(vi) $6x + 3y = 6xy$ $\quad 2x + 4y = 5xy$

$\frac{6x}{xy} + \frac{3y}{xy} = \frac{6xy}{xy}$ $\quad \frac{2x}{xy} + \frac{4y}{xy} = \frac{5xy}{xy}$

$\frac{6}{y} + \frac{3}{x} = 6$ $\quad \frac{2}{y} + \frac{4}{x} = 5$

let $\frac{1}{y} = a$ $\quad \frac{1}{x} = b$

$6a + 3b = 6$ $\quad 2a + 4b = 5$

$(6a + 3b = 6) \times 1 = 6a + 3b = 6$

$(2a + 4b = 5) \times 3 = 6a + 12b = 15$

$(-) \quad (-) \quad (-)$

$-9b = -9$

$b = 1$

$6a + 3 = 6$

$6a = 3$

$a = \frac{1}{2}$

$2a + 4b = 5$

$1 + 4b = 5$

$4b = 4$

$b = 1$

$\frac{1}{y} = a = \frac{1}{2}$ $\quad \frac{1}{x} = b = 1$

$y = 2$ $\quad x = 1$

(vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4$ $\quad \frac{15}{x+y} - \frac{5}{x-y} = -2$

let $\frac{1}{x+y} = a$ $\quad \frac{1}{x-y} = b$

$10a + 2b = 4$ $\quad 15a - 5b = -2$

$(10a + 2b = 4) \times 5 = 50a + 10b = 20$

$(15a - 5b = -2) \times 2 = 30a - 10b = -4$

$80a = 16$

$a = \frac{1}{5}$

$10a + 2b = 4$

$2 + 2b = 4$

$2b = 2$

$b = 1$

$\frac{1}{x+y} = a = \frac{1}{5}$ $\quad \frac{1}{x-y} = b = 1$

$x + y = 5$ $\quad x - y = 1$

$x + y = 5$

$x - y = 1$

$2x = 6$

$x = 3$

$x + y = 5$

$3 + y = 5$

$y = 2$

HW

Upstream = $(x-y)$ km/hour

2.a) Downstream = $(x+y)$ km/hour

Distance covered = 20 km (d), 4 km (d)

time covered = 2 hours (d), 2 hours (d)

$\frac{\text{Distance}}{\text{speed}} = \text{time}$

$\frac{20}{x+y} = 2$

$2(x+y) = 20$

$2x+2y = 20$

$x+y = 10$

$\frac{\text{Distance}}{\text{speed}} = \text{time}$

$\frac{4}{x-y} = 2$

$2(x-y) = 4$

$2x-2y = 4$

$x-y = 2$

$x+y = 10$

$x-y = 2$

$2x = 12$

$x = 6$

$6-y = 2$

$4 = y$

So, speed of still water is 6 km/hr and speed of current is 4 km/hr.

2.(b) Total distance covered = 300 km

Distance travelled by train = 60 km

hours by train = 4 hours

Distance travelled by bus = 300 km − 60 = 240 km

hours by bus = $\frac{25}{6}$ hours

$\frac{60}{x} + \frac{240}{y} = 4$

$\frac{60y+240x}{xy} = 4$

$60y+240x = 4xy$

$\frac{100}{x} + \frac{200}{y} = \frac{25}{6}$

$\frac{100y+200x}{xy} = \frac{25}{6}$

$600y+1200x = 25xy$

$$6000y + 2400x = 40xy$$
$$6000y + 1200x = 25xy$$
$$1200x = 15xy$$
$$80 = y$$

~~$4800 + 240x = 4x$~~

$$\frac{60}{x} + \frac{240}{80} = 4$$

$$\frac{60}{x} + 3 = 4$$

$$\frac{60}{x} = 1$$

$$x = 60$$

So, distance travelled by train is 80 km and distance travelled by bus is 80 km/hr

$\frac{15}{8}$
144

(11) let time taken 1 woman = x
let time taken 1 man = y

$$\frac{2}{x} + \frac{5}{y} = \frac{1}{4}$$

$$2a + 5b = \frac{1}{4}$$

$$\frac{8a + 20b = 1}{4}$$

$$2a + 5b = 1$$

$$\frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

$$3a + 6b = \frac{1}{3}$$

$$9a + 18b = 1$$

$$a + 2b = 1$$

$$2a + 5b$$
$$2a + 4b$$
$$b =$$

$$a = \frac{1 - 18b}{9}$$

$$\frac{8 - 144b + 20}{9} = 1$$

$$-144b + 12 = 9$$

$$-144b = 3$$

$$b = \frac{1}{36}$$

1(vii) $\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4}$ $\quad \frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = -\frac{1}{8}$

Let $\frac{1}{3x+y} = a$ $\quad \frac{1}{3x-y} = b$

$a + b = \frac{3}{4}$

$4a + 4b = 3$

$\frac{a}{2} - \frac{b}{2} = \frac{-1}{8}$

$\frac{a-b}{2} = \frac{-1}{8}$

$a - b = \frac{-1}{4}$

$4a - 4b = -1$

$4a + 4b = 3$
$4a - 4b = -1$
$8a = 2$
$a = \frac{1}{4}$

$1 + 4b = 3$
$4b = 2$
$b = \frac{1}{2}$

$\frac{1}{3x+y} = a = \frac{1}{4}$ $\quad \frac{1}{3x-y} = b = \frac{1}{2}$

$3x + y = 4$ $\quad 3x - y = 2$

$3x + y = 4$
$3x - y = 2$
$6x = 6$
$x = 1$

$3x - y = 2$
$3 - y = 2$
$1 = y$

(ii) $\frac{6}{x} + \frac{15}{y} = \frac{3}{4}$

$\frac{6}{x} + \frac{12}{y} = \frac{2}{3}$

$\frac{3}{y} = \frac{1}{12}$

$y = 36$

Let time taken 1 women $= x$

Let time taken 1 men $= y$

$\frac{6}{x} + \frac{12}{30} = \frac{2}{3}$

$\frac{6}{x} + \frac{1}{3} = \frac{2}{3}$

$\frac{6}{x} = \frac{1}{3}$

$x = 18$