$y = \frac{17}{17}$?

$3x - 5y = 6$

$3x - 5(9) = 6$

$3x - 45 = 6$

$3x = 6 + 45$

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

length = 17 units

Breadth = 9 units

Ex-3.6

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

$\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$

let $\frac{1}{x} = u$ & $\frac{1}{y} = v$

$\frac{1}{2}u + \frac{1}{3}v = 2 \Rightarrow 3u + 2v = 12$

$\frac{1}{3}u + \frac{1}{2}v = \frac{13}{6} \Rightarrow \frac{2u+3v}{6} = \frac{13}{6}$

$\Rightarrow 2u + 3v = 13$

$3u + 2v = 12$

$3u = 12 - 2v \Rightarrow u = \frac{12-2v}{3}$

$2u + 3v = 13$

$\Rightarrow 2\left(\frac{12-2v}{3}\right) + 3v = 13$

$\Rightarrow 24 - 4v + 9v = 39$

$\Rightarrow -4v + 9v = 39 - 24$

$\Rightarrow 5v = 15 \Rightarrow v = \frac{15}{5} = 3$

$3u + 2v = 12$

$3u + 2(3) = 12 \Rightarrow 3u + 6 = 12 \Rightarrow 3u = 12 - 6 \Rightarrow 3u = 6$

$\Rightarrow u = \frac{6}{3} = 2$

$u = \frac{1}{x}$ | $v = \frac{1}{y}$

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

$\Rightarrow x = \frac{1}{2}$ | $\Rightarrow y = \frac{1}{3}$

(ii) $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$

$\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

let $\frac{1}{\sqrt{x}} = u$ & $\frac{1}{\sqrt{y}} = v$

$2u + 3v = 2$

$4u - 9v = -1$

$2u + 3v = 2$

$\Rightarrow 2u = 2 - 3v$

$\Rightarrow u = \frac{2-3v}{2}$

$2\left(\frac{2-3v}{2}\right) - 9v = -1 \Rightarrow 4 - 6v - 9v = -1$

$\Rightarrow -6v - 9v = -1 - 4 \Rightarrow -15v = -5$

$\Rightarrow v = \frac{-5}{-15} = \frac{1}{3}$

$2u + 3v = 2$

$2u + 3\left(\frac{1}{3}\right) = 2 \Rightarrow 2u + 1 = 2 \Rightarrow 2u = 2 - 1$

$\Rightarrow 2u = 1 \Rightarrow u = \frac{1}{2}$

$u = \frac{1}{\sqrt{x}}$

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

$\Rightarrow \sqrt{x} = 2$

$(\sqrt{x})^2 = (2)^2$

$x = 4$

$v = \frac{1}{\sqrt{y}}$

$\frac{1}{3} = \frac{1}{\sqrt{y}} \Rightarrow \sqrt{y} = 3$

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

$y = 9$

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

$\frac{3}{x} - 4y = 23$

let $\frac{1}{x} = u$

$4u + 3y = 14$

$3u - 4y = 23$

$4u = 14 - 3y$

$\Rightarrow u = \frac{14-3y}{4}$

$3\left(\frac{14-3y}{4}\right) - 4y = 23$

$\Rightarrow 42 - 9y - 16y = 92$

$\Rightarrow -9y - 16y = 92 - 42$

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

$4u + 3y = 14$

$\Rightarrow 4u + 3(-2) = 14 \Rightarrow 4u - 6 = 14 \Rightarrow 4u = 14 + 6$

$\Rightarrow 4u = 20 \Rightarrow u = \frac{20}{4} = 5$

$u = \frac{1}{x} \Rightarrow 5 = \frac{1}{x} \Rightarrow x = \frac{1}{5}$

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

$\frac{6}{x-1} + \frac{3}{y-2} = 1$ $\quad \frac{1}{y-2} = v$

$5u + v = 2$

$6u - 3v = 1$

$5u + v = 2$

$v = 2 - 5u$

$6u - 3(2 - 5u) = 1$

$\Rightarrow 6u - 6 + 15u = 1 \Rightarrow 6u + 15u = 1 + 6 \Rightarrow 21u = 7$

$\Rightarrow u = \frac{7}{21} = \frac{1}{3}$

$5u + v = 2$

$\Rightarrow 5\left(\frac{1}{3}\right) + v = 2 \Rightarrow \frac{5}{3} + v = 2 \Rightarrow v = \frac{2-5}{3}$

$\Rightarrow v = \frac{6-5}{3} \Rightarrow v = \frac{1}{3}$

$v = \frac{1}{x-1}$

$\Rightarrow \frac{1}{3} = \frac{1}{x-1} \Rightarrow x - 1 = 3 \Rightarrow x = 3 + 1 \Rightarrow x = 4$

$v = \frac{1}{y-2} \Rightarrow \frac{1}{3} = \frac{1}{y-2} \Rightarrow y - 2 = 3$

$\Rightarrow y = 3 + 2 \Rightarrow y = 5$

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

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

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

$\frac{1}{x} = u$ & $\frac{1}{y} = v$

$-2u + 7v = 5$

$7u + 8v = 15$

$7v = 5 + 2u$

$\Rightarrow v = \frac{5+2u}{7}$

$7v + 8\left(\frac{5+2v}{7}\right) = 15$

$\Rightarrow 49v + 40 + 16v = 105$

$\Rightarrow 49v + 16v = 105 - 40 \Rightarrow 65v = 65 \Rightarrow v = \frac{65}{65} = 1$

$-2(1) + 7v = 5$

$-2 + 7v = 5 \Rightarrow 7v = 5 + 2 \Rightarrow 7v = 7 \Rightarrow v = \frac{7}{7} = 1$

$v = \frac{1}{x} \Rightarrow 1 = \frac{1}{x} \Rightarrow x = 1$

$v = \frac{1}{y} \Rightarrow 1 = \frac{1}{y} \Rightarrow y = 1$

(v) $6x + 3y = 6xy$

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

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

$\frac{1}{x} = u$ & $\frac{1}{y} = v$

$6v + 3u = 6$

$2v + 4u = 5$

$6v = 6 - 3u$

$\Rightarrow v = \frac{6-3u}{6}$

$2\left(\frac{6-3u}{6}\right) + 4u = 5 \Rightarrow 6 - 3u + 12u = 15$

$\Rightarrow -3u + 12u = 15 - 6 \Rightarrow 9u = 9 \Rightarrow u = \frac{9}{9} = 1$

$6v + 3u = 6$

$\Rightarrow 6v + 3(1) = 6$

$\Rightarrow 6v + 3 = 6 \Rightarrow 6v = 6 - 3 \Rightarrow 6v = 3 \Rightarrow v = \frac{3}{6} = \frac{1}{2}$

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

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

$v = \frac{1}{y}$

$\Rightarrow y = 2$

(vi) $\frac{10}{x+y} + \frac{2}{x-y} = 4$ $\quad \frac{1}{x+y} = u$

$\frac{15}{x+y} - \frac{5}{x-y} = -2$ $\quad \frac{1}{x-y} = v$

$10u + 2v = 4$

$15u - 5v = -2$

$10u = 4 - 2v$

$u = \frac{4-2v}{10}$

$3\left(\frac{4-2v}{10}\right) - 5v = -2$

$\Rightarrow 12 - 6v - 10v = -4 \Rightarrow -6v - 10v = -4 - 12$

$\Rightarrow -16v = -16 \Rightarrow v = \frac{-16}{-16} = 1$

$10u + 2(1) = 4$

$\Rightarrow 10u + 2 = 4$

$\Rightarrow 10u = 4 - 2 \Rightarrow 10u = 2 \Rightarrow u = \frac{2}{10} = \frac{1}{5}$

$u = \frac{1}{x+y} \Rightarrow \frac{1}{5} = \frac{1}{x+y} \Rightarrow x + y = 5$

$v = \frac{1}{x-y} \Rightarrow 1 = \frac{1}{x-y} \Rightarrow x - y = 1$

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

$x+y = 5$
$\Rightarrow 3+y = 5 \Rightarrow y = 5-3 \Rightarrow y = 2$

iii) $\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4}$ $\quad \frac{1}{3x+y} = u$

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

$u+v = \frac{3}{4}$
$4(u+v) = 3$
$4u+4v = 3$

$\frac{1}{2}u - \frac{1}{2}v = \frac{-1}{8}$
$\frac{u-v}{2} = \frac{-1}{8}$
$\frac{4(u-v)}{2} = -1$
$4(u-v) = -1 \Rightarrow 4u-4v = -1$

$4u+4v = 3$
$4u-4v = -1$
$(4u+4v)+(4u-4v) = 3+(-1)$
$\Rightarrow 8u = 2 \quad \Rightarrow u = \frac{2}{8} = \frac{1}{4}$

$4u+4v = 3$
$\Rightarrow 4\left(\frac{1}{4}\right)+4v = 3$
$\Rightarrow 1+4v = 3 \Rightarrow 4v = 3-1 \Rightarrow 4v = 2 \Rightarrow v = \frac{2}{4} = \frac{1}{2}$

$u = \frac{1}{4}$ & $v = \frac{1}{2}$

$u = \frac{1}{3x+y} \Rightarrow \frac{1}{4} = \frac{1}{3x+y} \Rightarrow 3x+y = 4$

$v = \frac{1}{3x-y} + \frac{1}{2} = \frac{1}{3x-y} \Rightarrow 3x-y = 2$

$(3x+y)(3x-y) = 4+2$
$\Rightarrow 6x = 6 \Rightarrow x = \frac{6}{6} = 1$

$3x+y = 4$
$\Rightarrow 3(1)+y = 4$
$\Rightarrow 3+y = 4 \Rightarrow y = 4-3 \Rightarrow y = 1$

2 (i) Speed of Rishi rowing in water be x km/hr
Speed of current be y km/hr
Downward speed $= x+y$ km/hr
Upward speed $= x-y$ km/hr
Time = Distance / Speed

$\frac{20}{x+y} = 2$
$\Rightarrow x+y = 10$ ——— (1)

upstream
$\frac{4}{x-y} = 2$
$\Rightarrow x-y = 2$ ——— (2)

$x+y = 10 \quad x = 10-y$
$x-y = 2$
$(10-y)-y = 2$
$\Rightarrow -2y = 2-10$
$\Rightarrow -2y = -8 \Rightarrow y = \frac{8}{2} = 4$

$x+y = 10$
$\Rightarrow x+4 = 10$
$\Rightarrow x = 10-4 \Rightarrow x = 6$

(ii) A women's one day work $= \frac{1}{x}$

A man's one day work $= \frac{1}{y}$

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

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

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

$2a + 5b = 1$

$\Rightarrow 6a + 20b = 1$ ——— (3)

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

$\Rightarrow 9a + 18b = 1$ ——— (4)

Multiply eq (3) with 9 & eq (4) by 8

$72a + 180b = 9$

$72a + 144b = 8$

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

$9a + 18\left(\frac{1}{36}\right) = 1$

$\Rightarrow 9a + 2 = 1 \Rightarrow 9a = 1 - \frac{1}{2} \Rightarrow a = \frac{1}{18}$

(iii) Total distance = 300 km

Time = $\frac{\text{distance}}{\text{speed}}$

let the speed of train be x km/hr

& bus be y km/hr

$\frac{60}{x} + \frac{240}{y} = 4$ ——— (1)

$\frac{100}{x} + \frac{200}{y} = 4\frac{10}{60} = 25$ ——— (2)

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

$60a + 240b = 4 \Rightarrow 600a + 1200b = 25$ ——— (2)

$100a + 200b = \frac{25}{6}$

Multiply eq (1) by 10

$600a + 2400b = 40$

$600a + 1200b = 25$

$1200b = 15$

$b = \frac{15}{1200} = \frac{1}{80}$

Placing $\frac{1}{80}$ in eq (1)

$\Rightarrow 600a + 1200b = 25$

$\Rightarrow 600a + 1200 \times \frac{1}{80} = 25$

$\Rightarrow 600a + 15 = 25 \Rightarrow 600a = 10 \Rightarrow a = \frac{10}{600}$

$\Rightarrow a = 60$

$\frac{1}{x} = a \quad x = 60$ km, $y = 80$ km

Extra Question

1. If the sum of zeroes of the quadratic p $3x^2 - kx + 6$ is 3, then find the value k.

A $3x^2 - kx + 6$

$a = 3, \ b = -k, \ c = 6$

Sum of zero $= \frac{-b}{a}$

$\Rightarrow 3 = -(-k)$

$\Rightarrow 3 \times 3 = k \Rightarrow k = 9$

2. If α & β are the