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Ch - 3
Exercise 3.5

Q.1 $x - 3y = 3$ ——— (1)

$3x - 9y = 2$ ——— (2)

$\frac{a_1}{a_2} = \frac{1}{3}$; $\frac{b_1}{b_2} = \frac{-3}{-9} = \frac{1}{3}$; $\frac{c_1}{c_2} = \frac{-3}{-2} = \frac{3}{2}$

$\frac{1}{3} = \frac{1}{3} \neq \frac{3}{2}$

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

∴ This pair of eq. has no solution.

Q.3 $3x - 5y = 20$ ——— (1)

$6x - 10y = 40$ ——— (2)

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

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

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

∴ This pair of eq. has infinitely many solutions.

Q.5 $kx + 2y = 5$ ——— (1)

$3x + y = 1$ ——— (2)

$\frac{a_1}{a_2} = \frac{k}{3}$; $\frac{b_1}{b_2} = \frac{2}{1} = 2$; $\frac{c_1}{c_2} = \frac{-5}{-1} = 5$

For unique solution,

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

$\frac{k}{3} \neq 2$

$k \neq 2 \times 3$

$\boxed{k \neq 6}$

Q.7 $4x - 5y = k$ ——— (1)

$2x - 3y = 12$ ——— (2)

$\frac{a_1}{a_2} = \frac{4}{2} = 2$; $\frac{b_1}{b_2} = \frac{-5}{-3} = \frac{5}{3}$; $\frac{c_1}{c_2} = \frac{k}{12}$

$2 \neq \frac{5}{3}$

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

$\therefore$ $\boxed{k \text{ is any real no.}}$

Q.9 $2x + 3y - 5 = 0$ ——— (1)

$6x + ky - 15 = 0$ ——— (2)

$\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3}$; $\frac{b_1}{b_2} = \frac{3}{k}$; $\frac{c_1}{c_2} = \frac{-5}{-15} = \frac{1}{3}$

For infinitely many solutions,

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

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

$k = 3 \times 3$

$\boxed{k = 9}$

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

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

$k = 3 \times 3$

$\boxed{k = 9}$

$\therefore \boxed{k = 9}$

Q.11 $kx - 2y + 6 = 0$ ——— (1)

$4x - 3y + 9 = 0$ ——— (2)

$\frac{a_1}{a_2} = \frac{k}{4}$; $\frac{b_1}{b_2} = \frac{-2}{-3} = \frac{2}{3}$; $\frac{c_1}{c_2} = \frac{6}{9} = \frac{2}{3}$

For infinitely many solutions,

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

$\frac{k}{4} = \frac{2}{3}$

$\boxed{k = \frac{8}{3}}$

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

$\boxed{\frac{2}{3} = \frac{2}{3}}$

$\therefore \boxed{k = \frac{8}{3}}$

Q.13 $2x - 3y = 7$ ——— (1)

$(k+2)x - (2k+1)y = 3(2k-1)$

$(k+2)x - (2k+1)y = (6k-3)$ ——— ②

$\frac{a_1}{a_2} = \frac{2}{(k+2)}$; $\frac{b_1}{b_2} = \frac{-3}{-(2k+1)} = \frac{3}{(2k+1)}$; $\frac{c_1}{c_2} = \frac{-7}{-(6k-3)} = \frac{7}{(6k-3)}$

For infinitely many solutions,

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

$\frac{2}{k+2} = \frac{3}{2k+1}$

$4k+2 = 3k+6$

$4k-3k = 6-2$

$\boxed{k = 4}$

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

$\frac{3}{2k+1} = \frac{7}{6k-3}$

$18k - 9 = 14k + 7$

$18k - 14k = 7 + 9$

$4k = 16$

$k = \frac{16}{4}$

$\boxed{k = 4}$

$\therefore \boxed{k = 4}$

15 $x + (k+1)y = 4$ ——— ①

$2(k+1)x + 9y = 7k + 1$

$(2k+2)x + 9y = 7k + 1$ ——— ②

$\frac{a_1}{a_2} = \frac{1}{2k+2}$; $\frac{b_1}{b_2} = \frac{k+1}{9}$; $\frac{c_1}{c_2} = \frac{-4}{-(7k+1)} = \frac{4}{7k+1}$

For infinitely many solutions,

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

$$\frac{1}{2k+2} = \frac{k+1}{9}$$

$$9 = (k+1)(2k+2)$$

$$2k^2 + 2k + 2k + 2 = 9$$

$$2k^2 + 4k + 2 = 9$$

$$2k^2 + 4k - 7 = 0$$

Q.15 $x + (k+1)y = 4$ ——— ①

$(k+1)x + 9y = 5k+2$ ——— ②

$$\frac{a_1}{a_2} = \frac{1}{k+1} \; ; \; \frac{b_1}{b_2} = \frac{k+1}{9} \; ; \; \frac{c_1}{c_2} = \frac{-4}{-(5k+2)} = \frac{4}{5k+2}$$

For infinitely many solutions,

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

$$\frac{1}{k+1} = \frac{k+1}{9}$$

$$9 = (k+1)^2$$

$$k^2 + 1 + 2k = 9$$

$$k^2 + 2k - 8 = 0$$

$$k^2 + 4k - 2k - 8 = 0$$

$$k(k+4) - 2(k+4) = 0$$

$$(k+4)(k-2) = 0$$

$$\boxed{k = -4}, \quad \boxed{k = 2}$$

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

$$\frac{k+1}{9} = \frac{4}{5k+2}$$

$$(k+1)(5k+2) = 36$$

$$5k^2 + 2k + 5k + 2 = 36$$

$$5k^2 + 7k + 2 = 36$$

$$5k^2 + 7k - 34 = 0$$

$$5k^2 + 17k - 10k - 34 = 0$$

$$k(5k+17) - 2(5k+17) = 0$$

$$(5k+17)(k-2) = 0$$

$$\boxed{k = \frac{-17}{5}}, \quad \boxed{k = 2}$$

$$\therefore \boxed{k = 2}$$

Q-16 $kx + 3y = 2k+1$ ——— (1)

$2(k+1)x + 9y = 7k+1$

$(2k+2)x + 9y = 7k+1$ ——— (2)

$$\frac{a_1}{a_2} = \frac{k}{2k+2} \; ; \; \frac{b_1}{b_2} = \frac{3}{9} = \frac{1}{3} \; ; \; \frac{c_1}{c_2} = \frac{-(2k+1)}{-(7k+1)} = \frac{2k+1}{7k+1}$$

For infinitely many solutions,

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

$$\frac{k}{2k+2} = \frac{1}{3}$$

$$3k = 2k+2$$

$$3k - 2k = 2$$

$$\boxed{k = 2}$$

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

$$\frac{1}{3} = \frac{2k+1}{7k+1}$$

$$7k+1 = 6k+3$$

$$7k - 6k = 3 - 1$$

$$\boxed{k = 2}$$

$$\therefore \boxed{k = 2}$$

Q-17 $2x + (k-2)y = k$ ——— (1)

$6x + (2k-1)y = 2k+5$ ——— (2)

$$\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3} \; ; \; \frac{b_1}{b_2} = \frac{k-2}{2k-1} \; ; \; \frac{c_1}{c_2} = \frac{-k}{-(2k+5)} = \frac{k}{2k+5}$$

For infinitely many solutions,

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

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

$$2k - 1 = 3k - 6$$

$$3k - 2k = -6 + 1 \quad 6 - 1$$

$$\boxed{k = +5}$$

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

$$\frac{k-2}{2k-1} = \frac{k}{2k+5}$$

$$(k-2)(2k+5) = (k)(2k-1)$$

$$2k^2 + 5k - 4k - 10 = 2k^2 - k$$

$$k + k = 10$$

$$2k = 10$$

$$\boxed{k = 5}$$

$$\therefore \boxed{k = 5}$$

Q.189 $2x + 3y = k$ ——— ①

$(k-1)x + (k+2)y = 3k$ ——— ②

$$\frac{a_1}{a_2} = \frac{2}{k-1} ; \frac{b_1}{b_2} = \frac{3}{k+2} ; \frac{c_1}{c_2} = \frac{-k}{-3k} = \frac{k}{3k} = \frac{1}{3}$$

For infinitely many solutions,

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

$$\frac{2}{k-1} = \frac{3}{k+2}$$

$$2k + 4 = 3k - 3$$

$$3k - 2k = 4 + 3$$

$$\boxed{k = 7}$$

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

$$\frac{3}{k+2} = \frac{k}{3k}$$

$$9k = k^2 + 2k$$

$$9 = k + 2$$

$$k = 9 - 2$$

$$\boxed{k = 7}$$

$$\therefore \boxed{k = 7}$$

Q.18 $2x + 3y = 7$ ——— (1)

$(k+1)x + (2k-1)y = 4k+1$ ——— (2)

$$\frac{a_1}{a_2} = \frac{2}{k+1} \; ; \; \frac{b_1}{b_2} = \frac{3}{2k-1} \; ; \; \frac{c_1}{c_2} = \frac{-7}{-(4k+1)} = \frac{7}{4k+1}$$

For infinitely many solutions,

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

$$\frac{2}{k+1} = \frac{3}{2k-1}$$

$$4k - 2 = 3k + 3$$

$$4k - 3k = 3 + 2$$

$$\boxed{k = 5}$$

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

$$\frac{3}{2k-1} = \frac{7}{4k+1}$$

$$12k + 3 = 14k - 7$$

$$14k - 12k = 7 + 3$$

$$2k = 10$$

$$\boxed{k = 5}$$

$$\therefore \boxed{k = 5}$$

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Q.20 $kx - 5y = 2$ ——— (1)
$6x + 2y = 7$ ——— (2)

$\frac{a_1}{a_2} = \frac{k}{6}$; $\frac{b_1}{b_2} = \frac{-5}{2}$; $\frac{c_1}{c_2} = \frac{-2}{-7} = \frac{2}{7}$

For no solution,

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

$\frac{k}{6} = \frac{-5}{2}$

$k = \frac{-5 \times 6}{2}^{3}$

$\boxed{k = -15}$

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

$\frac{-5}{2} \neq \frac{2}{7}$ $\quad \frac{k}{6} \neq \frac{2}{7}$

$\boxed{k \neq \frac{12}{7}}$

$\therefore \boxed{k = -15}$

Q.22 $3x - 4y + 7 = 0$ ——— (1)
$kx + 3y - 5 = 0$ ——— (2)

$\frac{a_1}{a_2} = \frac{3}{k}$; $\frac{b_1}{b_2} = \frac{-4}{3}$; $\frac{c_1}{c_2} = \frac{7}{-5} = \frac{-7}{5}$

For no solution,

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

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$\frac{3}{k} = \frac{-4}{3}$

$k = \frac{3 \times 3}{-4}$

$\boxed{k = \frac{-9}{4}}$

$\frac{3}{k} \neq \frac{-7}{5}$

$k \neq \frac{3 \times 5}{-7}$

$\boxed{k \neq \frac{-15}{7}}$

$\therefore \boxed{k = \frac{-9}{4}}$

Q.25 $kx + 3y = k - 3$ ——— (1)

$12x + ky = 6$ ——— (2)

$\frac{a_1}{a_2} = \frac{k}{12}$; $\frac{b_1}{b_2} = \frac{3}{k}$; $\frac{c_1}{c_2} = \frac{-(k-3)}{-6} = \frac{k-3}{6}$

For no solution,

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

$\frac{k}{12} = \frac{3}{k}$

$k^2 = 12 \times 3$

$k = \sqrt{36}$

$\boxed{k = 6}$, $\boxed{k = -6}$

$\frac{a_1}{a_2} \neq \frac{c_1}{c_2}$

$\frac{k}{12} \neq \frac{k-3}{6}$

$6k \neq 12k - 36$

$6k \neq 36$

$k \neq \frac{36}{6}$

$\boxed{k \neq 6}$

$\therefore \boxed{k = -6}$

Q.27 $\alpha x + 3y = \alpha - 3$ ——— ①

$12x + \alpha y = \alpha$ ——— ②

~~For no solution,~~

$$\frac{a_1}{a_2} = \frac{\alpha}{12} \; ; \; \frac{b_1}{b_2} = \frac{3}{\alpha} \; ; \; \frac{c_1}{c_2} = \frac{-(\alpha-3)}{-\alpha} = \frac{\alpha-3}{\alpha}$$

For no solution,

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

$$\frac{\alpha}{12} = \frac{3}{\alpha}$$

$$\alpha^2 = 12 \times 3$$

$$\alpha = \sqrt{36}$$

$$\boxed{\alpha = 6}, \boxed{\alpha = -6}$$

$$\frac{a_1}{a_2} \neq \frac{c_1}{c_2}$$

$$\frac{\alpha}{12} \neq \frac{\alpha-3}{\alpha}$$

$$\alpha^2 \neq 12\alpha - 36$$

$$\alpha^2 - 12\alpha + 36 \neq 0$$

$$\alpha^2 - 6\alpha - 6\alpha + 36 \neq 0$$

$$\alpha(\alpha-6) - 6(\alpha-6) \neq 0$$

$$(\alpha-6)(\alpha-6) \neq 0$$

$$\boxed{\alpha \neq 6}$$

$$\therefore \boxed{\alpha = -6}$$

Q.28 $kx + 2y = 5$ ——— ①

$3x + y = 1$ ——— ②

$$\frac{a_1}{a_2} = \frac{k}{3} \; ; \; \frac{b_1}{b_2} = \frac{2}{1} = 2 \; ; \; \frac{c_1}{c_2} = \frac{-5}{-1} = 5$$

(i) For unique solution,

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

$$\frac{k}{3} \neq 2$$

$$\boxed{k \neq 6}$$

(ii) For no solution,

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

$$\frac{k}{3} = 2$$

$$\boxed{k = 6}$$

$$\frac{a_1}{a_2} \neq \frac{c_1}{c_2}$$

$$\frac{k}{3} \neq 5$$

$$\boxed{k \neq 15}$$

$$\therefore \boxed{k = 6}$$

4.29 (i) $6x + 3y = c - 3$ ——— ①

$12x + 2y = c$ ——— ②

$$\frac{a_1}{a_2} = \frac{6}{12} = \frac{1}{2} \; ; \; \frac{b_1}{b_2} = \frac{3}{c} \; ; \; \frac{c_1}{c_2} = \frac{-(c-3)}{-c} = \frac{c-3}{c}$$

For infinitely many solutions,

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

$$\frac{1}{2} = \frac{3}{c}$$

$$\boxed{c = 6}$$

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

$$\frac{3}{c} = \frac{c-3}{8c}$$

$$3c = c^2 - 3c$$

$$c^2 = 6c$$

$$c \times c = 6 \times c \Rightarrow \boxed{c = 6}$$

$$\therefore \boxed{c = 6}$$

(ii) $cx + 3y + (3-c) = 0$ ——— (1)

$12x + cy - c = 0$ ——— (2)

$\frac{a_1}{a_2} = \frac{c}{12}$; $\frac{b_1}{b_2} = \frac{3}{c}$; $\frac{c_1}{c_2} = \frac{3-c}{-c} = \frac{-(3-c)}{c}$

For infinitely many solutions,

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

$\frac{c}{12} = \frac{3}{c}$

$c^2 = 12 \times 3$

$c = \sqrt{36}$

$\boxed{c = 6}$, $\boxed{c = -6}$

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

$\frac{3}{c} = \frac{-3+c}{c}$

$3c = -3c + c^2$

$c^2 = 6c$

$c \times c = 6 \times c$

$\boxed{c = 6}$

$\therefore \boxed{c = 6}$

Q.30 $2x + ky = 1$ ——— (1)

$3x - 5y = 7$ ——— (2)

$\frac{a_1}{a_2} = \frac{2}{3}$; $\frac{b_1}{b_2} = \frac{k}{-5} = \frac{-k}{5}$; $\frac{c_1}{c_2} = \frac{-1}{-7} = \frac{1}{7}$

(i) For unique solution,

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

$\frac{2}{3} \neq \frac{k}{-5}$

$\boxed{k \neq \frac{-10}{3}}$

(ii) For no solution,

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

$\frac{2}{3} = \frac{k}{-5}$ | $\frac{-k}{5} \neq \frac{1}{7}$

$\boxed{k = \frac{-10}{3}}$ | $\boxed{k \neq \frac{-5}{7}}$

$\therefore \boxed{k = \frac{-10}{3}}$

(iii) For infinitely many solutions,

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

$\frac{2}{3} = \frac{k}{-5}$ | $\frac{-k}{5} = \frac{1}{7}$

$\boxed{k = \frac{-10}{3}}$ | $\boxed{k = \frac{-5}{7}}$

∴ This pair of eq. has no infinitely many solutions.

Q-31 $2x + 2y + 7 = 0$ ——— ①

$2x + ky + 14 = 0$ ——— ②

$\frac{a_1}{a_2} = \frac{1}{2}$; $\frac{b_1}{b_2} = \frac{2}{k}$; $\frac{c_1}{c_2} = \frac{7}{14} = \frac{1}{2}$

For coincident lines (infinitely many solutions),

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

$\frac{1}{2} = \frac{2}{k}$ | $\frac{2}{k} = \frac{1}{2}$

$\boxed{k = 4}$ | $\boxed{k = 4}$

$\therefore \boxed{k = 4}$

Q. 32 $ax + by = c$ ——— (1)

$lx + my = n$ ——— (2)

$\frac{a_1}{a_2} = \frac{a}{l}$; $\frac{b_1}{b_2} = \frac{b}{m}$; $\frac{c_1}{c_2} = \frac{-c}{-n} = \frac{c}{n}$

For unique solution,

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

$\frac{a}{l} \neq \frac{b}{m}$

$\boxed{am \neq bl}$

Q. 33 $(2a-1)x + 3y - 5 = 0$ ——— (1)

$3x + (b-1)y - 2 = 0$ ——— (2)

$\frac{a_1}{a_2} = \frac{2a-1}{3}$; $\frac{b_1}{b_2} = \frac{3}{b-1}$; $\frac{c_1}{c_2} = \frac{-5}{-2} = \frac{5}{2}$

For infinitely many solutions,

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

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

$$(2a-1)(b-1) = 9$$

$$2ab - 2a - b + 1 = 9$$

$$2a\left(\frac{11}{5}\right) - 2a - \frac{11}{5} + 1 = 9$$

$$\frac{22a}{5} - 2a - \frac{11}{5} + 1 = 9$$

$$22a - 10a - 11 + 5 = 45$$

$$12a = 45 + 6$$

$$a = \frac{51}{12} \quad 17 \quad 4$$

$$\boxed{a = \frac{17}{4}}$$

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

$$\frac{3}{b-1} = \frac{5}{2}$$

$$5b - 5 = 6$$

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

$$\boxed{b = \frac{11}{5}}$$

Q-34

$$2x - 3y = 7 \quad \text{---(1)}$$

$$(a+b)x - (a+b-3)y = 4a+b \quad \text{---(2)}$$

$$\frac{a_1}{a_2} = \frac{2}{a+b} \; ; \; \frac{b_1}{b_2} = \frac{-3}{-(a+b-3)} = \frac{3}{a+b-3} \; ; \; \frac{c_1}{c_2} = \frac{-7}{-(4a+b)} = \frac{7}{4a+b}$$

For infinitely many solutions,

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

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

$$2a + 2b - 6 = 3a + 3b$$

$$3a - 2a + 3b - 2b = -6$$

$$a + b = -6 \quad \text{---(1)}$$

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

$$\frac{3}{a+b-3} = \frac{7}{4a+b}$$

$$12a + 3b = 7a + 7b - 21$$

$$12a - 7a + 3b - 7b = -21$$

$$5a - 4b = -21 \longrightarrow (4)$$

Multiply (3) by 4

$$4a + 4b = -24 \longrightarrow (5)$$

Add (4) & (5)

$$5a - 4b = -21$$
$$(+)\ 4a + 4b = -24$$
$$9a = -45$$
$$\boxed{a = -5}$$

Putting value of a in (3),

$$a + b = -6$$
$$b = -6 + 5$$
$$\boxed{b = -1}$$

Q.35 $2x + 3y = 9 \longrightarrow (1)$

$$(p+q)x + (2p-q)y = 3(p+q+1) \longrightarrow (2)$$

$$\frac{a_1}{a_2} = \frac{2}{p+q}\ ;\ \frac{b_1}{b_2} = \frac{3}{2p-q}\ ;\ \frac{c_1}{c_2} = \frac{-9}{-(3p+3q+3)} = \frac{9}{3p+3q+3}$$

For infinitely many solutions,

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

$$\frac{2}{p+q} = \frac{3}{2p-q}$$

$$4p - 2q = 3p + 3q$$

$$4p - 3p - 2q - 3q = 0$$

$$p - 5q = 0 \quad \text{---} \quad (3)$$

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

$$\frac{3}{2p-q} = \frac{9}{3p+3q+3}$$

$$9p + 9q + 9 = 18p - 9q$$

$$9q + 9q + 9 = 18p - 9p$$

$$-9p + 18q = -9$$

$$9p - 18q = 9 \quad \text{---} \quad (4)$$

$$p - 2q = 1$$

Subtract (4) from (3)

$$p - 5q = 0$$

$$(-)\ p - 2q = 1$$

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

$$-3q = -1$$

$$\boxed{q = \frac{1}{3}}$$

Putting value of q in (4)

$$p - 2q = 1$$

$$p - 2\left(\frac{1}{3}\right) = 1$$

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

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

$$\boxed{p = \frac{5}{3}}$$

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

$$\frac{3}{a+b-3} = \frac{7}{4a+b}$$

$$12a + 3b = 7a + 7b - 21$$

$$12a - 7a + 3b - 7b = -21$$

$$5a - 4b = -21 \longrightarrow (4)$$

Multiply (3) by 4

$$4a + 4b = -24 \longrightarrow (5)$$

Add (4) & (5)

$$5a - 4b = -21$$
$$(+)\ 4a + 4b = -24$$
$$9a = -45$$
$$\boxed{a = -5}$$

Putting value of a in (3),

$$a + b = -6$$
$$b = -6 + 5$$
$$\boxed{b = -1}$$

Q.35 $2x + 3y = 9 \longrightarrow (1)$

$(p+q)x + (2p-q)y = 3(p+q+1) \longrightarrow (2)$

$$\frac{a_1}{a_2} = \frac{2}{p+q}\ ;\ \frac{b_1}{b_2} = \frac{3}{2p-q}\ ;\ \frac{c_1}{c_2} = \frac{-9}{-(3p+3q+3)} = \frac{9}{3p+3q+3}$$

For infinitely many solutions,

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

$$\frac{2}{p+q} = \frac{3}{2p-q}$$

$$4p - 2q = 3p + 3q$$

$$4p - 3p - 2q - 3q = 0$$

$$p - 5q = 0 \quad \text{---} \quad (3)$$

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

$$\frac{3}{2p-q} = \frac{9}{3p+3q+3}$$

$$9p + 9q + 9 = 18p - 9q$$

$$9q + 9q + 9 = 18p - 9p$$

$$-9p + 18q = -9$$

$$9p - 18q = 9 \quad \text{---} \quad (4)$$

$$p - 2q = 1$$

Subtract (4) from (3)

$$p - 5q = 0$$

$$(-)\ p - 2q = 1$$

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

$$-3q = -1$$

$$\boxed{q = \frac{1}{3}}$$

Putting value of q in (4)

$$p - 2q = 1$$

$$p - 2\left(\frac{1}{3}\right) = 1$$

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

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

$$\boxed{p = \frac{5}{3}}$$

Q. 36 (ii) $2x - (2a+5)y = 5$ ——— ①

$(2b+1)x - 9y = 15$ ——— ②

$\frac{a_1}{a_2} = \frac{2}{2b+1}$; $\frac{b_1}{b_2} = \frac{-(2a+5)}{-9} = \frac{2a+5}{9}$; $\frac{c_1}{c_2} = \frac{-5}{-15} = \frac{1}{3}$

For infinitely many solutions,

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

$\frac{2}{2b+1} = \frac{2a+5}{9}$

$18 = (2a+5)(2b+1)$

$18 = 4ab + 2a + 10b + 5$

$4ab + 2a + 10b = 13$

$4(-1)b + 2(-1) + 10b = 13$

$-4b - 2 + 10b = 13$

$6b = 15$

$b = \frac{15}{6}$

$\boxed{b = \frac{5}{2}}$

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

$\frac{2a+5}{9} = \frac{1}{3}$

$6a + 15 = 9$

$6a = -6$

$\boxed{a = -1}$

(iv) $3x + 4y = 12$ ——— ①

$(a+b)x + (2a-2b)y = 5a - 1$ ——— ②

$\frac{a_1}{a_2} = \frac{3}{a+b}$; $\frac{b_1}{b_2} = \frac{4}{2a-2b} = \frac{2}{a-b}$; $\frac{c_1}{c_2} = \frac{-12}{-(5a-1)} = \frac{12}{5a-1}$

For infinitely many solutions,

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

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

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

$3a - 2a - 3b - 2b = 0$

$a - 5b = 0$ ——— (3)

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

$\frac{2}{a-b} = \frac{12}{5a-1}$

$10a - 2 = 12a - 12b$

$10a - 12a - 2 = -12b$

$-2a - 2 = -12b$

$-2a + 12b = 2$

$2a - 12b = -2$

$a - 6b = -1$ ——— (4)

Subtract (4) from (3),

$a - 5b = 0$

$a - 6b = -1$

(-) (+) (+)

$\boxed{b = 1}$

Putting value of b in (3)

$a - 5b = 0$

$a - 5(1) = 0$

$\boxed{a = 5}$

(Ans) $2x + 3y - 7 = 0$ ——— (1)

$(a-1)x + (a+1)y = (3a-1)$ ——— (2)

$\frac{a_1}{a_2} = \frac{2}{a-1}$, $\frac{b_1}{b_2} = \frac{3}{a+1}$; $\frac{c_1}{c_2} = \frac{-7}{-(3a-1)} = \frac{7}{3a-1}$

For infinitely many solutions,

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

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

$2a + 2 = 3a - 3$

$2a - 3a = -3 - 2$

$-a = -5$

$\boxed{a = 5}$

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

$\frac{3}{a+1} = \frac{7}{3a-1}$

$9a - 3 = 7a + 7$

$9a - 7a = 7 + 3$

$2a = 10$

$\boxed{a = 5}$

$\therefore \boxed{a = 5}$

(viii) $x + 2y = 1$ ——— ①

$(a-b)x + (a+b)y = a+b-2$ ——— ②

$\frac{a_1}{a_2} = \frac{1}{a-b}$; $\frac{b_1}{b_2} = \frac{2}{a+b}$; $\frac{c_1}{c_2} = \frac{-1}{-(a+b-2)} = \frac{1}{a+b-2}$

For infinitely many solutions,

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

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

$a + b = 2a - 2b$

$a - 2a + b - 2b = 0$

$-a - b = 0$

$a + b = 0$

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

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

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

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

$a + b = 4$

$a + 1 = 4$

$a = 4 - 1$

$\boxed{a = 3}$

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

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

$a + b - 2 = a - b$

$2b = 2$

$\boxed{b = 1}$

Q.37 $\lambda x + y = \lambda^2$ ——— (1)

$x + \lambda y = 1$ ——— (2)

$\frac{a_1}{a_2} = \lambda$; $\frac{b_1}{b_2} = \frac{1}{\lambda}$; $\frac{c_1}{c_2} = \lambda^2$

(i) No solution

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

$\lambda = \frac{1}{\lambda}$

$\lambda^2 = 1$

$\lambda = \sqrt{1}$

$\boxed{\lambda = 1}$, $\boxed{\lambda = -1}$

$\frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\frac{1}{\lambda} \neq \lambda^2$

$\lambda^3 \neq 1$

$\lambda \neq \sqrt[3]{1}$

$\boxed{\lambda \neq 1}$

$\therefore \boxed{\lambda = -1}$

(ii) Infinitely many solutions,

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

$\lambda = \frac{1}{\lambda}$

$\lambda^2 = 1$

$\lambda = \sqrt{1}$

$\boxed{\lambda = 1}$, $\boxed{\lambda = -1}$

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

$\frac{1}{\lambda} = \lambda^2$

$\lambda^3 = 1$

$\lambda = \sqrt[3]{1}$

$\boxed{\lambda = 1}$

$\therefore \boxed{\lambda = 1}$

(iii) Unique solution

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

$$\lambda \neq \frac{1}{\lambda}$$

$$\lambda^2 \neq 1$$

$$\lambda \neq \sqrt{1}$$

$$\boxed{\lambda \neq \pm 1}$$

∴ The value of λ is any real no. except ± 1.