Chapter 3: Pair of Linear Equations in Two Variables
Complete Board PYQs Question Bank

Exercise Set 3.4 (CBSE Board Questions)

Question 4

Solution:
System: $4x + ky + 8 = 0$ and $x + 2y + 2 = 0$.
For unique solution: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.
$\frac{4}{1} \neq \frac{k}{2} \implies k \neq 8$.

Formula / Hints:
Unique solution condition:
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Question 5

Solution:
System: $2x + 3y = 2$ and $(k+2)x + (2k+1)y = 2(k-1)$.
Infinitely many solutions $\implies \frac{2}{k+2} = \frac{3}{2k+1} = \frac{2}{2(k-1)}$.
From $\frac{2}{k+2} = \frac{3}{2k+1} \implies 2(2k+1) = 3(k+2)$
$4k + 2 = 3k + 6 \implies k = 4$.

Formula / Hints:
Infinitely many solutions condition:
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Question 6

Solution:
System: $x + (k+1)y = 4$ and $(k+1)x + 9y = 5k + 2$.
Infinitely many solutions $\implies \frac{1}{k+1} = \frac{k+1}{9} = \frac{4}{5k+2}$.
$\frac{1}{k+1} = \frac{k+1}{9} \implies (k+1)^2 = 9 \implies k + 1 = \pm 3$.
If $k = 2$, $\frac{4}{5(2)+2} = \frac{4}{12} = \frac{1}{3}$ (Matches).
If $k = -4$, $\frac{4}{5(-4)+2} = \frac{4}{-18} = -\frac{2}{9} \neq -\frac{1}{3}$.
Hence, $k = 2$.

Formula / Hints:
Always check all ratio parts to confirm consistency.

Question 7

Solution:
System: $2x + (k-2)y = k$ and $6x + (2k-1)y = 2k + 5$.
Infinitely many solutions $\implies \frac{2}{6} = \frac{k-2}{2k-1} = \frac{k}{2k+5}$.
$\frac{1}{3} = \frac{k-2}{2k-1} \implies 2k - 1 = 3k - 6 \implies k = 5$.
Check third ratio: $\frac{5}{2(5)+5} = \frac{5}{15} = \frac{1}{3}$ (Matches).
Hence, $k = 5$.

Formula / Hints:
Cross multiply matching subgroups systematically.

Question 8

Solution:
System: $2x + 3y = 7$ and $(k+1)x + (2k-1)y = 4k+1$.
Infinitely many solutions $\implies \frac{2}{k+1} = \frac{3}{2k-1} = \frac{7}{4k+1}$.
$2(2k-1) = 3(k+1) \implies 4k - 2 = 3k + 3 \implies k = 5$.
Check third ratio: $\frac{7}{4(5)+1} = \frac{7}{21} = \frac{1}{3}$ (Matches).
Hence, $k = 5$.

Formula / Hints:
Simplify independent linear groupings.

Question 10

Solution:
System: $kx + 3y = k - 3$ and $12x + ky = 6$.
No solution $\implies \frac{k}{12} = \frac{3}{k} \neq \frac{k-3}{6}$.
$\frac{k}{12} = \frac{3}{k} \implies k^2 = 36 \implies k = \pm 6$.
If $k = 6$, $\frac{6-3}{6} = \frac{3}{6} = \frac{1}{2} = \frac{6}{12}$ (Fails condition).
If $k = -6$, $\frac{-6-3}{6} = -\frac{9}{6} = -\frac{3}{2} \neq -\frac{6}{12}$.
Hence, $k = -6$.

Formula / Hints:
No solution condition:
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Question 11

Solution:
Identical system equations to Question 10.
Condition matching check yields $k = -6$ for no solution.

Formula / Hints:
Duplicate board question tracking index.

Question 13

Solution:
System: $2x + ky = 1$ and $3x - 5y = 7$.
(i) Unique solution: $\frac{2}{3} \neq \frac{k}{-5} \implies k \neq -\frac{10}{3}$.
(ii) No solution: $\frac{2}{3} = \frac{k}{-5} \neq \frac{1}{7} \implies k = -\frac{10}{3}$.
There is no value of k for infinitely many solutions since $\frac{2}{3} \neq \frac{1}{7}$.

Formula / Hints:
Infinitely many solutions require consistency across all constants.

Question 15

Solution:
System: $(2a-1)x + 3y - 5 = 0$ and $3x + (b-1)y - 2 = 0$.
Infinitely many solutions $\implies \frac{2a-1}{3} = \frac{3}{b-1} = \frac{-5}{-2} = \frac{5}{2}$.
$\frac{2a-1}{3} = \frac{5}{2} \implies 4a - 2 = 15 \implies a = \frac{17}{4}$.
$\frac{3}{b-1} = \frac{5}{2} \implies 5b - 5 = 6 \implies b = \frac{11}{5}$.

Formula / Hints:
Equate ratios individually to find missing variable weights.

Question 17 (i)

Solution:
System: $(2a-1)x - 3y = 5$ and $3x + (b-2)y = 3$.
Infinitely many solutions $\implies \frac{2a-1}{3} = \frac{-3}{b-2} = \frac{5}{3}$.
$\frac{2a-1}{3} = \frac{5}{3} \implies 2a - 1 = 5 \implies a = 3$.
$\frac{-3}{b-2} = \frac{5}{3} \implies 5b - 10 = -9 \implies b = \frac{1}{5}$.

Formula / Hints:
Verify algebraic coefficient distribution rules.

Question 17 (ii)

Solution:
System: $2x - 3y = 7$ and $(a+b)x - (a+b-3)y = 4a+b$.
Infinitely many solutions $\implies \frac{2}{a+b} = \frac{-3}{-(a+b-3)} = \frac{7}{4a+b}$.
$\frac{2}{a+b} = \frac{3}{a+b-3} \implies 2a+2b-6 = 3a+3b \implies a+b = -6$ (1)
$\frac{2}{a+b} = \frac{7}{4a+b} \implies \frac{2}{-6} = \frac{7}{4a+b} \implies 4a+b = -21$ (2)
Subtracting (1) from (2): $3a = -15 \implies a = -5 \implies b = -1$.

Formula / Hints:
Substitute intermediate sum combinations directly.

Question 17 (iv)

Solution:
System: $2x+3y-7 = 0$ and $(a-1)x+(a+1)y = (3a-1)$.
Infinitely many solutions $\implies \frac{2}{a-1} = \frac{3}{a+1} = \frac{-7}{-(3a-1)} = \frac{7}{3a-1}$.
$\frac{2}{a-1} = \frac{3}{a+1} \implies 2a+2 = 3a-3 \implies a = 5$.
Check third ratio: $\frac{7}{3(5)-1} = \frac{7}{14} = \frac{1}{2}$; $\frac{2}{5-1} = \frac{1}{2}$ (Matches).
Hence, $a = 5$.

Formula / Hints:
Cross multiply linear configurations accurately.

Exercise Set 3.5 (CBSE Board Questions)

Question 6

Solution:
Let investments in scheme A and B be x and y.
$0.08x + 0.09y = 1860 \implies 8x + 9y = 186000 \quad (1)$
Interchanged: $0.09x + 0.08y = 1880 \implies 9x + 8y = 188000 \quad (2)$
Adding (1) and (2): $17(x + y) = 374000 \implies x + y = 22000 \quad (3)$
Subtracting (1) from (2): $x - y = 2000 \quad (4)$
Adding (3) and (4): $2x = 24000 \implies x = 12000$.
Then $y = 10000$.

Formula / Hints:
Annual Interest $= P \times R$.
Use addition/subtraction symmetry trick for large coefficients.

Exercise Set 3.6 (CBSE Board Questions)

Question 1

Solution:
Let numbers be x (greater) and y (smaller).
$\frac{1}{2}(x-y)=2 \implies x-y=4 \quad (1)$
$x+2y=13 \quad (2)$
Subtracting (1) from (2): $3y=9 \implies y=3$.
Then $x=3+4=7$. Numbers are 7 and 3.

Formula / Hints:
Map terms logically onto system variables.

Question 3

Solution:
Let tens digit be x, units digit be y. Original $=10x+y$.
Sum of digits: $x+y=15 \quad (1)$
Reversed exceeds original by 9: $(10y+x)-(10x+y)=9 \implies y-x=1 \quad (2)$
Adding (1) and (2): $2y=16 \implies y=8 \implies x=7$.
The number is 78.

Formula / Hints:
Reversed Value $=10\times$ Units $+$ Tens.

Question 5

Solution:
Let original number be $10x+y$. Given $10x+y=4(x+y) \implies 2x=y$.
Add 18: $(10x+y)+18=10y+x \implies 9x-9y=-18 \implies y-x=2$.
Substitute $y=2x \implies 2x-x=2 \implies x=2 \implies y=4$.
The number is 24.

Formula / Hints:
Digit components must look like positive single integers.

Question 7

Solution:
Let original number be $10x+y$.
Given: $10x+y=4(x+y) \implies 2x=y \quad (1)$
Also: $10x+y=2xy$. Substitute (1):
$10x+2x=2x(2x) \implies 12x=4x^2 \implies x=3$ (since $x\neq 0$).
$y=2(3)=6$. The number is 36.

Formula / Hints:
System configuration combining nonlinear algebraic relations.

Question 8

Solution:
Let digits be x and $y \implies xy = 20$. Original number $= 10x + y$.
Add 9: $(10x + y) + 9 = 10y + x \implies 9y - 9x = 9 \implies y - x = 1 \implies y = x + 1$.
$x(x+1) = 20 \implies x^2 + x - 20 = 0 \implies (x+5)(x-4) = 0 \implies x = 4$.
$y = 4 + 1 = 5$. The number is 45.

Formula / Hints:
Isolate integer pairs across quadratic boundaries.

Exercise Set 3.7 (CBSE Board Questions)

Question 4

Solution:
Let fraction be $\frac{x}{y}$. Given $x + y = 12 \implies y = 12 - x$.
Denominator increased by 3: $\frac{x}{y+3} = \frac{1}{2} \implies 2x = y + 3$.
Substitute definition: $2x = (12 - x) + 3 \implies 3x = 15 \implies x = 5$.
$y = 12 - 5 = 7$. Original fraction $= \frac{5}{7}$.

Formula / Hints:
Fraction $= \frac{\text{Numerator } (x)}{\text{Denominator } (y)}$.

Question 6

Solution:
Let fraction be $\frac{x}{y}$.
Subtract 2 from numerator: $\frac{x-2}{y} = \frac{1}{3} \implies 3x - y = 6$ (1)
Subtract 1 from denominator: $\frac{x}{y-1} = \frac{1}{2} \implies 2x - y = -1$ (2)
Subtracting (2) from (1): $x = 7$.
Substitute $x = 7$: $2(7) - y = -1 \implies y = 15$. Fraction $= \frac{7}{15}$.

Formula / Hints:
Model direct rational constraints via cross multiplication.

Question 7

Solution:
Let fraction be $\frac{x}{y}$. Given $x + y = 2x + 4 \implies y - x = 4 \implies y = x + 4$.
Increased by 3: $\frac{x+3}{y+3} = \frac{2}{3} \implies 3x + 9 = 2y + 6 \implies 2y - 3x = 3$.
Substitute $y = x+4$: $2(x+4) - 3x = 3 \implies 2x + 8 - 3x = 3 \implies x = 5$.
$y = 5 + 4 = 9$. Fraction $= \frac{5}{9}$.

Formula / Hints:
Isolate independent system coordinates carefully.

Question 9

Solution:
Let fraction be $\frac{x}{y}$. Given $x + y = 2y - 3 \implies x - y = -3 \implies y = x + 3$.
Decreased by 1: $\frac{x-1}{y-1} = \frac{1}{2} \implies 2x - 2 = y - 1 \implies 2x - y = 1$.
Substitute $y = x + 3$: $2x - (x + 3) = 1 \implies x = 4$.
$y = 4 + 3 = 7$. Fraction $= \frac{4}{7}$.

Formula / Hints:
Convert words into distinct balanced equalities.

Exercise Set 3.8 (CBSE Board Questions)

Question 5

Solution:
Let father's age be x, sum of children's ages be y.
Present: $x = 3y \quad (1)$
After 5 years: $(x+5) = 2(y+10) \implies x-2y = 15 \quad (2)$
Substitute (1) into (2): $3y - 2y = 15 \implies y = 15$.
Father's age $x = 3(15) = 45$ years.

Hints:
After 5 years, each of the two children grows by 5, so their sum increases by $5 \times 2 = 10$.

Question 6

Solution:
Let father's age be x, son's age be y.
2 years ago: $(x-2) = 5(y-2) \implies x - 5y = -8 \quad (1)$
2 years later: $(x+2) = 3(y+2) + 8 \implies x - 3y = 12 \quad (2)$
Subtracting (1) from (2): $2y = 20 \implies y = 10$.
Then $x = 3(10) + 12 = 42$. Father is 42, Son is 10.

Formula / Hints:
Shift individual chronological metrics prior to mapping.

Question 10

Solution:
Let Rashmi's age be x, Nazma's age be y.
3 years ago: $(x-3) = 3(y-3) \implies x - 3y = -6 \quad (1)$
10 years later: $(x+10) = 2(y+10) \implies x - 2y = 10 \quad (2)$
Subtracting (1) from (2): $y = 16$.
Then $x = 2(16) + 10 = 42$. Rashmi is 42, Nazma is 16.

Formula / Hints:
Linear age translation template.

Exercise Set 3.9 (CBSE Board Questions)

Question 1

Solution:
Let speeds of the two people be x km/hr and y km/hr ($x > y$).
Towards each other: $2(x + y) = 16 \implies x + y = 8 \quad (1)$
Same direction: $8(x - y) = 16 \implies x - y = 2 \quad (2)$
Adding (1) and (2): $2x = 10 \implies x = 5$ km/hr.
Then $y = 3$ km/hr.

Formula / Hints:
Relative speed same direction $= x - y$.
Relative speed opposite direction $= x + y$.

Question 2

Solution:
Let upstream speed be $\frac{1}{u}$ and downstream speed be $\frac{1}{v}$.
Let boat speed be x, stream speed be y.
$30u + 44v = 10 \quad (1)$
$40u + 55v = 13 \quad (2)$
Solving system: $u = \frac{1}{5} \implies x - y = 5$. $v = \frac{1}{11} \implies x + y = 11$.
Adding equations: $2x = 16 \implies x = 8$ km/hr, $y = 3$ km/hr.

Formula / Hints:
Time $= \frac{\text{Distance}}{\text{Speed}}$.
Upstream $= x - y$, Downstream $= x + y$.

Question 4

Solution:
Let train speed be x, car speed be y. Total distance $= 600$ km.
Case 1: $\frac{400}{x} + \frac{200}{y} = 6.5 \quad (1)$
Case 2: $\frac{200}{x} + \frac{400}{y} = 7 \quad (2)$
Multiply (2) by 2 and subtract (1): $\frac{600}{y} = 14 - 6.5 = 7.5 \implies y = 80$ km/hr.
Substitute $y = 80$ in (1): $\frac{400}{x} + 2.5 = 6.5 \implies \frac{400}{x} = 4 \implies x = 100$ km/hr.

Formula / Hints:
Isolate reciprocal fractions using common scaling factor matches.

Question 7

Solution:
Let train speed be x, taxi speed be y.
Case 1: $\frac{300}{x} + \frac{200}{y} = 5.5 \quad (1)$
Case 2: $\frac{260}{x} + \frac{240}{y} = 5.6 \quad (2)$
Let $\frac{1}{x} = u, \frac{1}{y} = v \implies 300u + 200v = 5.5, 260u + 240v = 5.6$.
Solving system yields $u = \frac{1}{100} \implies x = 100$ km/hr.
$v = \frac{1}{80} \implies y = 80$ km/hr.

Formula / Hints:
Rational equations transformation framework.

Question 8

Solution:
Let speed of car A be x km/hr, car B be y km/hr. Distance = 100 km.
Same direction: $5(x-y) = 100 \implies x - y = 20 \quad (1)$
Towards each other: $1(x+y) = 100 \implies x + y = 100 \quad (2)$
Adding equations: $2x = 120 \implies x = 60$ km/hr.
Then $y = 40$ km/hr.

Formula / Hints:
Distance = Relative Speed × Time.

Question 9

Solution:
Let scheduled speed be x km/hr, scheduled time be y hours. Dist $= xy$.
Case 1: $(x+10)(y-2) = xy \implies -2x + 10y = 20 \implies -x + 5y = 10 \quad (1)$
Case 2: $(x-10)(y+3) = xy \implies 3x - 10y = 30 \quad (2)$
Multiply (1) by 2 and add (2): $x = 50$ km/hr.
Substitute $x = 50$ in (1): $-50 + 5y = 10 \implies 5y = 60 \implies y = 12$ hours.
Distance $= 50 \times 12 = 600$ km.

Formula / Hints:
Expanding non-linear variable products yields standard linear rows.

Exercise Set 3.10 (CBSE Board Questions)

Question 1

Solution:
Let students per row be x, number of rows be y. Total $= xy$.
Case 1: $(x+3)(y-1) = xy \implies -x+3y = 3 \quad (1)$
Case 2: $(x-3)(y+2) = xy \implies 2x-3y = 6 \quad (2)$
Adding (1) and (2): $x = 9$.
Substitute $x = 9$: $-9+3y = 3 \implies 3y = 12 \implies y = 4$.
Total students $= 9 \times 4 = 36$.

Formula / Hints:
Total Quantity = Items per row $\times$ Rows.

Question 2

Solution:
Let length be x, breadth be y. Perimeter $= 2(x+y) = 70 \implies x+y = 35$.
Given: $x = 2y+5 \implies x-2y = 5$.
Subtracting the two equations: $3y = 30 \implies y = 10$ cm.
Then $x = 35-10 = 25$ cm.

Formula / Hints:
Perimeter of rectangle $= 2(l+b)$.

Question 6

Solution:
Let fixed charge be x, rate per km be y.
For 12 km: $x+12y = 89 \quad (1)$
For 20 km: $x+20y = 145 \quad (2)$
Subtracting (1) from (2): $8y = 56 \implies y = 7$.
Substitute $y = 7$: $x+12(7) = 89 \implies x+84 = 89 \implies x = 5$.
For 30 km: Cost $= 5+30(7) = 5+210 = 215$.

Formula / Hints:
Total Fare = Fixed base + Distance $\times$ Rate.

Question 7

Solution:
Let fixed charge be x, cost of food per day be y.
Student A (20 days): $x+20y = 1000 \quad (1)$
Student B (26 days): $x+26y = 1180 \quad (2)$
Subtracting (1) from (2): $6y = 180 \implies y = 30$.
Substitute $y = 30$: $x+20(30) = 1000 \implies x = 400$.
Fixed charge is 400, daily food rate is 30.

Formula / Hints:
Linear system tracking framework.

Question 8

Solution:
Let angles be x and y ($x > y$). Supplementary $\implies x + y = 180$.
Exceeds by 18: $x - y = 18$.
Adding equations: $2x = 198 \implies x = 99°$.
Then $y = 180 - 99 = 81°$.

Formula / Hints:
Supplementary angles sum up to exactly 180°.

Question 9

Solution:
Let number of 50 notes be x, 100 notes be y.
Total notes: $x + y = 25 \quad (1)$
Total value: $50x + 100y = 2000 \implies x + 2y = 40 \quad (2)$
Subtracting (1) from (2): $y = 15$.
Then $x = 25 - 15 = 10$.
She received 10 notes of 50 and 15 notes of 100.

Formula / Hints:
Total Value $= \sum(\text{Note Face Value}) \times \text{Count}$.

Question 11

Solution:
Let angles be x and y. $x + y = 180$, $x - y = 50$.
Adding equations: $2x = 230 \implies x = 115°$.
Then $y = 180 - 115 = 65°$.

Formula / Hints:
Supplementary system layout step.

Question 12

Solution:
Let red balls be x, blue balls be y.
$0.10x + 0.20y = 24 \implies x + 2y = 240 \quad (1)$
$3x - y = 20 \implies y = 3x - 20 \quad (2)$
Substitute (2) into (1): $x + 2(3x - 20) = 240 \implies 7x - 40 = 240$
$7x = 280 \implies x = 40 \implies y = 3(40) - 20 = 100$.
There are 40 red balls and 100 blue balls.

Formula / Hints:
Convert percentages into standard whole metrics.

Question 18

Solution:
Let correct answers be x, wrong answers be y.
Case 1: $3x - y = 40 \quad (1)$
Case 2: $4x - 2y = 50 \implies 2x - y = 25 \quad (2)$
Subtracting (2) from (1): $x = 15$.
Substitute $x = 15$: $2(15) - y = 25 \implies y = 5$.
Total questions $= x + y = 15 + 5 = 20$.

Formula / Hints:
Score $= \text{Gains} \times \text{Right} - \text{Deductions} \times \text{Wrong}$.

Question 19

Solution:
Let acute angles be x and y. Acute angles in right triangle sum to $90^\circ \implies x + y = 90$.
Ratio 2:3 $\implies \frac{x}{y} = \frac{2}{3} \implies 3x - 2y = 0$.
Multiply first equation by 2 and add second: $5x = 180 \implies x = 36^\circ$.
Then $y = 90 - 36 = 54^\circ$.

Formula / Hints:
The sum of all interior angles of a triangle equals 180°.

Question 20

Solution:
Let base be x cm. Equal sides are $\frac{5}{6}x$ cm.
Perimeter: $\frac{5}{6}x + \frac{5}{6}x + x = 32 \implies \frac{16}{6}x = 32 \implies x = 12$ cm.
Equal sides $= \frac{5}{6}(12) = 10$ cm.
Altitude $h = \sqrt{10^2 - 6^2} = 8$ cm.
Area $= \frac{1}{2} \times \text{base} \times \text{altitude} = \frac{1}{2} \times 12 \times 8 = 48$ cm^2.

Formula / Hints:
Altitude splits an isosceles triangle base exactly in half.

Very Short Answer Type Questions (CBSE Board Selections)

Question 1

Solution:
System: $x + y - 4 = 0$ and $2x + ky - 3 = 0$.
No solution $\implies \frac{1}{2} = \frac{1}{k} \neq \frac{-4}{-3}$.
$\frac{1}{2} = \frac{1}{k} \implies k = 2$.

Formula / Hints:
No solution requirement condition: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.