Affiliated to CBSE, New Delhi (Affiliation No. 1030642)

GNPS

GOMTI NANDAN PUBLIC SCHOOL

Gandhi Ward, Bina (M.P.) 470113. | 9165 609 333. | info@mygnps.com | www.mygnps.com

CLASS X · MATHEMATICS STANDARD (041) · CBSE BOARD EXAMINATION 2027

CHAPTER 3

Pair of Linear Equations in Two Variables

Answer Booklet · Full worked solutions with CBSE-style step marks

Every question of the Standard booklet | Step marks shown line by line | MCQ keys with working

INSIDE THIS BOOKLET

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HOW TO USE THE ANSWERS

1. Solve the question in your notebook **first**. Open this booklet only to check.
2. The orange number beside each line is the **step mark** an examiner gives for that line, as in the CBSE marking scheme.
3. Give yourself marks line by line. A right final answer without the working can lose step marks.
4. Check every solution by putting it back into both equations.
5. Copy every wrong answer to the My Mistakes page of your booklet.

READ THIS FIRST

Marking Guide

Full worked solutions to every question in the chapter booklet, set out the way a CBSE examiner marks them.

HOW MARKS ARE GIVEN IN PAIR OF LINEAR EQUATIONS IN TWO VARIABLES ANSWERS

1. **1-mark MCQ / assertion–reason:** only the correct option scores. The working here is for your understanding.
2. **Solve a pair (2 marks):** one variable found 1 · the other 1. Show the multiplying and adding / substituting.
3. **Condition on k:** the ratios written with the right condition 1 · value of k 1 (with the third ratio checked for "no solution").
4. **Word problem (3 marks):** two correct equations 1–1½ · solving 1 · answer in words with units ½.
5. **Graph (3–5 marks):** a table of points for each line 1 + 1 · both lines drawn and the meeting point read 1 · vertices / area 1 each.
6. Lines with no number are working that earns no separate mark but must be shown.

PART A · SOLUTIONS

A NCERT Practice – Solutions

Worked solutions with step marks for every question in Part A.

Consistency and graphs

A1. By comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, find whether the lines intersect, are parallel or coincide: **(i)** $3x + 2y - 7 = 0$
$5x - 4y + 1 = 0$ **(ii)** $4x - 6y + 10 = 0$
$6x - 9y + 15 = 0$ **(iii)** $2x + 5y - 8 = 0$
$6x + 15y - 11 = 0$ **[3]**

(i) $\frac{3}{5}$ and $\frac{2}{-4} = -\frac{1}{2}$: not equal → the lines **intersect** — 1

(ii) $\frac{4}{6} = \frac{-6}{-9} = \frac{10}{15} = \frac{2}{3}$ → the lines **coincide** — 1

(iii) $\frac{2}{6} = \frac{5}{15} = \frac{1}{3}$ but $\frac{-8}{-11} = \frac{8}{11}$ → the lines are **parallel** — 1

A2. Check whether each pair is consistent or inconsistent: **(i)** $x + 2y = 5$
$3x + 6y = 15$ **(ii)** $2x - 3y = 8$
$4x - 6y = 9$ **(iii)** $3x - y = 2$
$6x + 2y = 10$ **[3]**

(i) $\frac{1}{3} = \frac{2}{6} = \frac{5}{15}$: coincident lines → **consistent** (infinitely many solutions) — 1

(ii) $\frac{2}{4} = \frac{-3}{-6} = \frac{1}{2}$ but $\frac{8}{9} \neq \frac{1}{2}$: parallel → **inconsistent** — 1

(iii) $\frac{3}{6} = \frac{1}{2}$ and $\frac{-1}{2}$: not equal → unique solution → **consistent** — 1

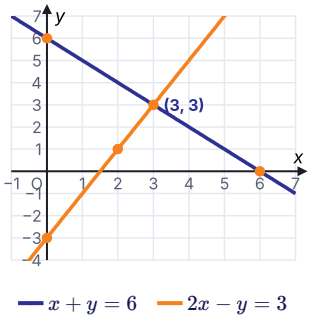
Q	Answer	Working / reason
A3	**(b)** intersecting at $(3, -2)$	$x = 3$ is parallel to the y-axis and $y = -2$ is parallel to the x-axis; they meet at $(3, -2)$.

A4. Solve graphically: $x + y = 6$ and $2x - y = 3$. **[3]**

$x + y = 6$: points $(0, 6)$, $(6, 0)$, $(2, 4)$ 1

$2x - y = 3$: points $(0, -3)$, $(2, 1)$, $(3, 3)$ 1

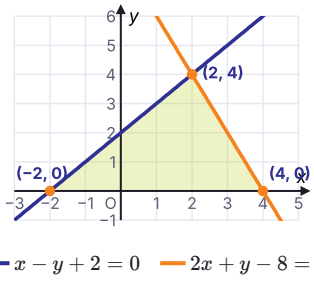
The lines meet at $(3, 3)$: $x = 3$, $y = 3$ 1



A5. Draw the graphs of $x - y + 2 = 0$ and $2x + y - 8 = 0$. Find the vertices of the triangle formed by these lines and the x-axis, and shade it. Also find its area. **[4]**

$x - y + 2 = 0$: $(0, 2)$, $(-2, 0)$, $(2, 4)$; $2x + y - 8 = 0$: $(0, 8)$, $(4, 0)$, $(2, 4)$ 1

Both lines drawn on the same axes; they meet at $(2, 4)$ 1



Vertices: $(2, 4)$, $(-2, 0)$, $(4, 0)$ 1

Area $= \frac{1}{2} \times 6 \times 4 = 12$ sq units 1

Substitution method

A6. Solve by the substitution method: **(i)** $x + y = 11,\ x - y = 3$ **(ii)** $3x - y = 7,\ 2x + 3y = 12$ **(iii)** $\frac{x}{2} + \frac{y}{3} = 4,\ x - y = 3$ **[3]**

(i) $x = y + 3 \rightarrow 2y + 3 = 11 \rightarrow y = 4, x = 7$ 1

(ii) $y = 3x - 7 \rightarrow 2x + 9x - 21 = 12 \rightarrow 11x = 33 \rightarrow x = 3, y = 2$ 1

(iii) $3x + 2y = 24$ (×6) and $x = y + 3 \rightarrow 5y + 9 = 24 \rightarrow y = 3, x = 6$ 1

A7. Solve $3x + 2y = 12$ and $5x - 3y = 1$, and hence find m for which $y = mx + 1$. **[3]**

$y = \dfrac{12 - 3x}{2} \rightarrow 5x - \dfrac{3(12 - 3x)}{2} = 1 \rightarrow 10x - 36 + 9x = 2$ 1

$19x = 38 \rightarrow x = 2, y = 3$ 1

$3 = 2m + 1 \Rightarrow m = 1$ 1

Elimination method

A8. Solve by the elimination method: **(i)** $x + 2y = 9,\ 3x - 2y = 3$ **(ii)** $4x + 3y = 18,\ 3x - 2y = 5$ **[3]**

(i) Add: $4x = 12 \to x = 3$; $3 + 2y = 9 \to y = 3$ — 1

(ii) First ×2: $8x + 6y = 36$; second ×3: $9x - 6y = 15$; add: $17x = 51 \to x = 3$ — 1

$12 + 3y = 18 \to y = 2$ — 1

A9. Use elimination on $2x - y = 5$ and $4x - 2y = 12$. What do you conclude? **[2]**

First ×2: $4x - 2y = 10$. Subtract from the second: $0 = 2$ — 1

This is impossible, so the pair has no solution: the lines are parallel — 1

Word problems

A10. If 1 is added to both the numerator and the denominator of a fraction, it becomes $\frac{4}{5}$. If 5 is subtracted from both, it becomes $\frac{1}{2}$. Find the fraction. **[3]**

Let the fraction be $\frac{x}{y}$. $\frac{x+1}{y+1} = \frac{4}{5} \Rightarrow 5x - 4y = -1$ — 1

$\frac{x-5}{y-5} = \frac{1}{2} \Rightarrow 2x - y = 5$ — ½

$y = 2x - 5 \to 5x - 8x + 20 = -1 \to x = 7, y = 9$ — 1

Fraction $= \frac{7}{9}$ — ½

A11. Six years ago, a mother was four times as old as her daughter. Six years from now, she will be twice as old as her daughter. Find their present ages. **[3]**

Let the ages be x (mother) and y (daughter). $x - 6 = 4(y - 6) \Rightarrow x - 4y = -18$ — 1

$x + 6 = 2(y + 6) \Rightarrow x - 2y = 6$ — ½

Subtract: $2y = 24 \to y = 12, x = 30$ — 1

Mother 30 years, daughter 12 years — ½

A12. The sum of the digits of a two-digit number is 12. The number formed by reversing the digits is 18 more than the original number. Find the number. **[3]**

Let tens digit $= x$, units digit $= y$: $x + y = 12$ — ½

$10y + x = 10x + y + 18 \Rightarrow y - x = 2$ — 1

Add: $2y = 14 \to y = 7, x = 5$ — 1

The number is 57 — ½

A13. A taxi charges a fixed amount plus a charge for every km. The fare for 10 km is ₹180 and for 15 km is ₹255. Find the fixed charge and the charge per km. How much is the fare for 25 km? **[3]**

Let fixed charge $=$ ₹x, rate $=$ ₹y per km: $x + 10y = 180,\ x + 15y = 255$ — 1

Subtract: $5y = 75 \to y = 15, x = 30$ — 1

Fare for 25 km $= 30 + 25 \times 15 =$ ₹405 — 1

A14. The area of a rectangle increases by 50 square units if its length is increased by 5 units and its breadth by 2 units. The area decreases by 10 square units if the length is decreased by 4 units and the breadth is increased by 1 unit. Find the length and breadth. **[3]**

Let length $= x$, breadth $= y$. $(x+5)(y+2) = xy + 50 \Rightarrow 2x + 5y = 40$ — 1

$(x-4)(y+1) = xy - 10 \Rightarrow x - 4y = -6$ — ½

$x = 4y - 6 \to 8y - 12 + 5y = 40 \to y = 4,\ x = 10$ — 1

Length 10 units, breadth 4 units — ½

B

PART B · SOLUTIONS

Exemplar Practice – Solutions

Worked solutions with step marks for every question in Part B.

Multiple choice

Q	Answer	Working / reason
B1	**(b)** $\frac{15}{4}$	$\frac{3}{2} = \frac{2k}{5} \Rightarrow k = \frac{15}{4}$; and $\frac{c_1}{c_2} = \frac{-2}{1}$ is different, so they are parallel.
B2	**(d)** intersecting or coincident	Consistent means at least one solution: one (intersecting) or infinitely many (coincident).
B3	**(c)** k ≠ 10	Unique: $\frac{1}{5} \neq \frac{2}{k} \Rightarrow k \neq 10$.
B4	**(d)** no solution	Both lines are parallel to the x-axis and never meet.
B5	**(c)** 3 and 1	Add: $2x = 6 \to x = 3,\ y = 1$.
B6	**(c)** 12	$x + y = 30,\ 5x + 10y = 210 \Rightarrow x + 2y = 42 \to y = 12$.
B7	**(a)** (36, 12)	$F = 3S,\ 3S + 12 = 2(S + 12) \Rightarrow S = 12,\ F = 36$.

Short answer with reasons

B8. Do the equations $4x + 3y - 1 = 5$ and $12x + 9y = 15$ represent a pair of coincident lines? Justify. **[2]**

First equation: $4x + 3y = 6$. Ratios: $\frac{4}{12} = \frac{3}{9} = \frac{1}{3}$ but $\frac{6}{15} = \frac{2}{5}$ — 1

The third ratio is different, so the lines are parallel, not coincident — 1

B9. True or false: "For every real c, the pair $x - 2y = 8$ and $5x - 10y = c$ has a unique solution." Justify. **[2]**

$\frac{1}{5} = \frac{-2}{-10} = \frac{1}{5}$, so $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ for every c — 1

False. The pair has no solution if $c \neq 40$ and infinitely many if $c = 40$; never a unique one — 1

B10. Given the equation $3x - 4y + 7 = 0$, write another linear equation in two variables so that the pair forms (i) intersecting lines (ii) parallel lines (iii) coincident lines. **[3]**

(i) $4x + 3y - 1 = 0$: $\frac{3}{4} \neq \frac{-4}{3}$ (any answer with $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$) — 1

(ii) $6x - 8y + 5 = 0$: $\frac{3}{6} = \frac{-4}{-8} \neq \frac{7}{5}$ — 1

(iii) $6x - 8y + 14 = 0$: all ratios $= \frac{1}{2}$ — 1

B11. For what values of a and b does the pair $2x + 3y = 7$ and $(a + b)x + (2a - b)y = 21$ have infinitely many solutions? **[3]**

$\frac{2}{a+b} = \frac{3}{2a-b} = \frac{7}{21} = \frac{1}{3}$ — 1

$a + b = 6$ and $2a - b = 9$ — 1

Add: $3a = 15 \to a = 5, b = 1$ — 1

B12. Find k for which $kx - 4y = 3$ and $6x - 12y = 9$ have infinitely many solutions. **[2]**

$\frac{k}{6} = \frac{-4}{-12} = \frac{3}{9} = \frac{1}{3}$ — 1

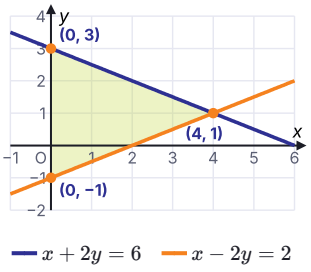
$k = 2$ — 1

Long answer

B13. Draw the graphs of $x + 2y = 6$ and $x - 2y = 2$. Find the vertices of the triangle formed by these lines and the y-axis, and its area. **[4]**

$x + 2y = 6$: $(0, 3), (6, 0), (2, 2)$; $x - 2y = 2$: $(0, -1), (2, 0), (4, 1)$ — 1

Both lines drawn; they meet at $(4, 1)$ — 1



Vertices: $(4, 1), (0, 3), (0, -1)$ — 1

Base on the y-axis $= 4$, height $= 4$: area $= \frac{1}{2} \times 4 \times 4 = 8$ sq units — 1

B14. A boat goes 24 km downstream in 2 hours and comes back upstream in 3 hours. Find the speed of the boat in still water and the speed of the stream. **[3]**

Let the speeds be u (boat) and v (stream) km/h. Downstream: $u + v = \frac{24}{2} = 12$ — 1

Upstream: $u - v = \frac{24}{3} = 8$ — ½

Add: $2u = 20 \to u = 10, v = 2$ — 1

Boat 10 km/h, stream 2 km/h — ½

B15. Find two numbers whose sum is 75 and whose difference is 15. Show that the pair of equations you form is consistent. **[2]**

$x + y = 75$, $x - y = 15$; $\frac{1}{1} \neq \frac{1}{-1}$, so a unique solution: consistent — 1

$2x = 90 \to x = 45, y = 30$ — 1

C

PART C · SOLUTIONS

Board Pattern Practice – Solutions

Worked solutions with step marks for every question in Part C.

Number of solutions · consistency

Q	Answer	Working / reason
C1	**(c)** infinitely many solutions	$\frac{2}{4}=\frac{3}{6}=\frac{5}{10}=\frac{1}{2}$: coincident lines.
C2	**(b)** parallel	$\frac{1}{3}=\frac{-2}{-6}=\frac{1}{3}$ but $\frac{3}{7}\neq\frac{1}{3}$.
C3	**(d)** x – y = 2	$3-1=2$ ✓ and $\frac{2}{1}\neq\frac{1}{-1}$. (a) coincides, (b) is parallel, (c) is not satisfied by $(3,1)$.
C4	**(b)** k ≠ 6	$\frac{k}{3}\neq\frac{2}{1}\Rightarrow k\neq 6$.
C5	**(d)** 6	$\frac{1}{3}=\frac{2}{k}\Rightarrow k=6$; and $\frac{4}{9}\neq\frac{1}{3}$ ✓
C6	**(c)** inconsistent	The lines are parallel (same steepness, never meet): no solution, so inconsistent.
C7	**(a)** 0	Both lines are parallel to the y-axis, so they never meet.
C8	**(a)**	All ratios are $\frac{1}{2}$, so there are infinitely many solutions and the pair is consistent. R explains A.
C9	**(d)**	A is false (the lines coincide: infinitely many solutions). R is true.

C10. Find the value of p for which $px+4y=8$ and $3x+6y=12$ have infinitely many solutions. [2]

$\frac{p}{3}=\frac{4}{6}=\frac{8}{12}=\frac{2}{3}$ — 1

$p=2$ — 1

C11. For what value of k do $2x+ky=1$ and $3x-5y=7$ have (i) a unique solution (ii) no solution? [2]

(i) $\frac{2}{3}\neq\frac{k}{-5}\Rightarrow k\neq-\frac{10}{3}$ — 1

(ii) $k=-\frac{10}{3}$, and then $\frac{1}{7}\neq\frac{2}{3}$ ✓, so no solution — 1

Values from a given solution

Q	Answer	Working / reason
C12	**(b)** –2	$6-k=8\Rightarrow k=-2$

C13. If $x=3$, $y=2$ is the solution of $ax+by=13$ and $bx-ay=0$, find a and b. [2]

$3a+2b=13$ and $3b-2a=0\Rightarrow b=\frac{2a}{3}$ — 1

$3a+\frac{4a}{3}=13\Rightarrow 13a=39\rightarrow a=3, b=2$ — 1

Solve the pair algebraically

C14. Solve: $5x - 3y = 9$ and $3x + 2y = 13$. **[2]**

First ×2: $10x - 6y = 18$; second ×3: $9x + 6y = 39$; add: $19x = 57 \rightarrow x = 3$ — 1

$15 - 3y = 9 \rightarrow y = 2$ — 1

C15. Solve: $\frac{x}{3} + \frac{y}{4} = 4$ and $\frac{x}{2} - \frac{y}{4} = 1$. **[2]**

Add: $\frac{x}{3} + \frac{x}{2} = 5 \Rightarrow \frac{5x}{6} = 5 \rightarrow x = 6$ — 1

$2 + \frac{y}{4} = 4 \rightarrow y = 8$ — 1

C16. Solve: $47x + 31y = 63$ and $31x + 47y = 15$. **[3]**

Add: $78x + 78y = 78 \rightarrow x + y = 1$ — 1

Subtract: $16x - 16y = 48 \rightarrow x - y = 3$ — 1

$x = 2, y = -1$ — 1

Graphical method

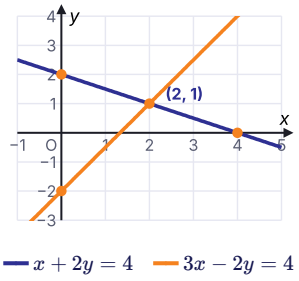
Q	Answer	Working / reason
C17	**(b)** $(2, 3)$	The lines meet at the point 2 along and 3 up: $(2, 3)$.

C18. Solve graphically: $x + 2y = 4$ and $3x - 2y = 4$. **[3]**

$x + 2y = 4$: $(0, 2)$, $(4, 0)$, $(2, 1)$ — 1

$3x - 2y = 4$: $(0, -2)$, $(2, 1)$, $(4, 4)$ — 1

The lines meet at $(2, 1)$: $x = 2, y = 1$ — 1



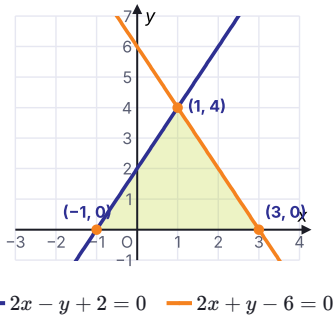
$x + 2y = 4$ $3x - 2y = 4$

C19. Draw the graphs of $2x - y + 2 = 0$ and $2x + y - 6 = 0$. Find the coordinates of the vertices of the triangle formed by these lines and the x-axis, and find its area. **[5]**

$2x - y + 2 = 0$: $(0, 2)$, $(-1, 0)$, $(1, 4)$ — 1

$2x + y - 6 = 0$: $(0, 6)$, $(3, 0)$, $(1, 4)$ — 1

Both lines drawn; they meet at $(1, 4)$ — 1



Vertices: $(1, 4)$, $(-1, 0)$, $(3, 0)$ — 1

Area $= \frac{1}{2} \times 4 \times 4 = 8$ sq units — 1

Word problems

C20. Five years ago, a father was seven times as old as his son Ravi. Five years from now, he will be three times as old as Ravi. Find their present ages. **[3]**

Let father $= x$, Ravi $= y$ years. $x - 5 = 7(y - 5) \Rightarrow x - 7y = -30$ — 1

$x + 5 = 3(y + 5) \Rightarrow x - 3y = 10$ — ½

Subtract: $4y = 40 \rightarrow y = 10$, $x = 40$ — 1

Father 40 years, Ravi 10 years — ½

C21. A two-digit number is 4 times the sum of its digits. If 18 is added to the number, its digits are reversed. Find the number. **[3]**

Let tens digit x, units y: $10x + y = 4(x + y) \Rightarrow y = 2x$ — 1

$10x + y + 18 = 10y + x \Rightarrow y - x = 2$ — 1

$2x - x = 2 \rightarrow x = 2$, $y = 4$; the number is 24 — 1

Q	Answer	Working / reason
C22	**(a)** $\frac{5}{9}$	$x + y = 14$ and $2x = y + 1 \rightarrow 3x = 15 \rightarrow \frac{5}{9}$

C23. Two angles are supplementary. The larger is 30° more than twice the smaller. Find the angles. **[2]**

Let them be x (smaller) and y: $x + y = 180$, $y = 2x + 30$ — 1

$3x = 150 \rightarrow x = 50^\circ$, $y = 130^\circ$ — 1

C24. A school bought 3 chairs and 2 tables for ₹4,700, and 5 chairs and 3 tables for ₹7,400. Find the cost of one chair and one table. [3]

Let a chair cost ₹x and a table ₹y: $3x + 2y = 4700$, $5x + 3y = 7400$ 1

First ×3: $9x + 6y = 14100$; second ×2: $10x + 6y = 14800$; subtract: $x = 700$ 1

$2y = 4700 - 2100 \rightarrow y = 1300$. Chair ₹700, table ₹1,300 1

C25. Two cars start at the same time from towns P and Q, 180 km apart. If they move towards each other, they meet after 2 hours. If they move in the same direction (the faster car behind), they meet after 9 hours. Find their speeds. [3]

Let the speeds be x and y km/h ($x > y$). Towards each other: $2x + 2y = 180 \Rightarrow x + y = 90$ 1

Same direction: $9x - 9y = 180 \Rightarrow x - y = 20$ 1

$x = 55$, $y = 35$: 55 km/h and 35 km/h 1

C26. Meera invested one amount at 6% and another at 10% simple interest per year, and got ₹2,100 as interest in one year. If she had invested the two amounts the other way round, she would have got ₹200 less. Find the two amounts. [5]

Let ₹x be at 6% and ₹y at 10%. $\frac{6x}{100} + \frac{10y}{100} = 2100 \Rightarrow 3x + 5y = 105000$ 1

Swapped: $\frac{10x}{100} + \frac{6y}{100} = 1900 \Rightarrow 5x + 3y = 95000$ 1

Add: $8x + 8y = 200000 \Rightarrow x + y = 25000$ 1

Subtract: $2y - 2x = 10000 \Rightarrow y - x = 5000$ 1

$y = 15000$, $x = 10000$: ₹10,000 at 6% and ₹15,000 at 10% 1

D

PART D · SOLUTIONS

Case-Based Questions – Solutions

Worked solutions with step marks for every question in Part D.

D1. Case Study · Canteen Sales [4]

(i) Write the pair of linear equations for this situation. [1]

$40x + 30y = 1950$ and $30x + 50y = 2150$ (i.e. $4x + 3y = 195$, $3x + 5y = 215$) 1

(ii) Is this pair consistent? Give a reason using the ratios. [1]

$\frac{40}{30} \neq \frac{30}{50}$: unique solution, so consistent 1

(iii) Find the price of a sandwich and of a glass of juice. [2]

$4x + 3y = 195$ ×3 and $3x + 5y = 215$ ×4: $12x + 9y = 585$, $12x + 20y = 860 \rightarrow 11y = 275$, $y = 25$ 1

$4x = 195 - 75 \rightarrow x = 30$. Sandwich ₹30, juice ₹25 1

OR

(iii) On Wednesday the canteen sold 50 sandwiches and 40 glasses of juice. How much did it collect? [2]

From the pair: sandwich ₹30, juice ₹25 1

$50 \times 30 + 40 \times 25 = 1500 + 1000 = ₹2,500$ 1

D2. Case Study · Town Map [4]

(i) Do the highway and the canal cross? Give a reason using the ratios. **[1]**

$\frac{1}{1} \neq \frac{2}{-1}$: the lines intersect, so yes — 1

(ii) At which point does the highway meet the railway line? **[1]**

Put $y = 0$: $x = 8 \rightarrow (8, 0)$ — 1

(iii) Find the coordinates of the bridge. **[2]**

$x = y + 2 \rightarrow y + 2 + 2y = 8 \rightarrow y = 2$ — 1

$x = 4$: the bridge is at $(4, 2)$ — 1

OR

(iii) The highway, the canal and the railway line enclose a triangular plot. Find its area. **[2]**

Vertices: bridge $(4, 2)$, highway–railway $(8, 0)$, canal–railway $(2, 0)$ — 1

Area $= \frac{1}{2} \times 6 \times 2 = 6$ sq km — 1

D3. Case Study · School Trip [4]

(i) Write the pair of equations, taking x students per bus and y per van. **[1]**

$2x + 3y = 150$ and $3x + 2y = 175$ — 1

(ii) By subtracting the equations, find how many more students a bus carries than a van. **[1]**

Subtract: $x - y = 25$: a bus carries 25 more — 1

(iii) Find the number of students a bus and a van can carry. **[2]**

Add: $5x + 5y = 325 \Rightarrow x + y = 65$ — 1

With $x - y = 25$: $x = 45$, $y = 20$ — 1

OR

(iii) For 245 students the school books 5 buses. How many vans are needed for the rest? **[2]**

A bus carries 45 (from the pair): 5 buses carry 225 — 1

$245 - 225 = 20$ students left $\rightarrow$ 1 van — 1

D4. Case Study · River Ferry [4]

(i) Write the speed of the ferry downstream and upstream in terms of u and v. **[1]**

Downstream $u + v$; upstream $u - v$ — 1

(ii) Form the two equations. **[1]**

$u + v = \frac{36}{2} = 18$ and $u - v = \frac{30}{3} = 10$ — 1

(iii) Find u and v. **[2]**

Add: $2u = 28 \rightarrow u = 14$ — 1

$v = 4$: ferry 14 km/h, stream 4 km/h — 1

OR

(iii) A tourist takes the ferry 90 km downstream and back. How long does the round trip take? **[2]**

Downstream speed 18 km/h, upstream 10 km/h ½

$\frac{90}{18} + \frac{90}{10} = 5 + 9$ 1

$= 14$ hours ½

E Challenge Questions – Solutions

PART E · SOLUTIONS

Worked solutions with step marks for every question in Part E.

E1. For what values of a and b does the pair $3x + 4y = 12$ and $(a+b)x + 2(a-b)y = 5a - 1$ have infinitely many solutions? **[3]**

$\frac{3}{a+b} = \frac{4}{2(a-b)} \to 6a - 6b = 4a + 4b \to a = 5b$ 1

$\frac{3}{a+b} = \frac{12}{5a-1} \to 15a - 3 = 12a + 12b \to a - 4b = 1$ 1

$5b - 4b = 1 \to b = 1$, $a = 5$ (check: ratios $\frac{3}{6} = \frac{4}{8} = \frac{12}{24}$) 1

E2. Solve for x and y: $px + qy = p + q$ and $qx - py = q - p$. **[3]**

First $\times p$: $p^2x + pqy = p^2 + pq$; second $\times q$: $q^2x - pqy = q^2 - pq$ 1

Add: $(p^2 + q^2)x = p^2 + q^2 \to x = 1$ 1

Then $p + qy = p + q \to y = 1$ 1

E3. Find k so that the three lines $2x + y = 7$, $x - y = 2$ and $kx + y = 9$ pass through one point. **[3]**

Solve the first two: add $\to 3x = 9 \to x = 3$, $y = 1$ 1

The third line must pass through $(3, 1)$: $3k + 1 = 9$ 1

$k = \frac{8}{3}$ 1

E4. If Riya gives ₹100 to Sam, Sam will have twice as much as Riya has left. If instead Sam gives ₹50 to Riya, they will have equal amounts. How much does each have? **[3]**

Let Riya have ₹x and Sam ₹y. $y + 100 = 2(x - 100) \Rightarrow 2x - y = 300$ 1

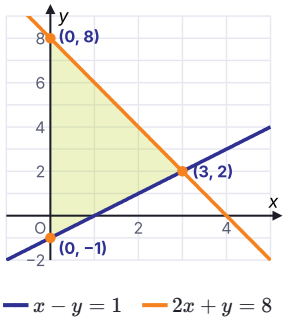
$x + 50 = y - 50 \Rightarrow y - x = 100$ 1

Add: $x = 400$, $y = 500$. Riya ₹400, Sam ₹500 1

E5. Draw the graphs of $x - y = 1$ and $2x + y = 8$. Shade the triangle formed by these lines and the y-axis, and find its vertices and area. **[4]**

$x - y = 1$: $(0, -1)$, $(1, 0)$, $(3, 2)$; $\quad 2x + y = 8$: $(0, 8)$, $(4, 0)$, $(3, 2)$ — 1

Lines drawn; they meet at $(3, 2)$ — 1



Vertices: $(3, 2)$, $(0, 8)$, $(0, -1)$ — 1

Base on the y-axis $= 9$, height $= 3$: area $= \frac{1}{2} \times 9 \times 3 = 13.5$ sq units — 1

E6. In a cyclic quadrilateral $ABCD$, $\angle A = (2x + 4)^\circ$, $\angle B = (y + 3)^\circ$, $\angle C = (2y + 10)^\circ$ and $\angle D = (4x - 5)^\circ$. Find the four angles. **[3]**

Opposite angles of a cyclic quadrilateral add up to 180°. $A + C$: $2x + 2y + 14 = 180 \Rightarrow x + y = 83$ — 1

$B + D$: $4x + y - 2 = 180 \Rightarrow 4x + y = 182$; subtract: $3x = 99 \rightarrow x = 33$, $y = 50$ — 1

$\angle A = 70^\circ$, $\angle B = 53^\circ$, $\angle C = 110^\circ$, $\angle D = 127^\circ$ — 1