CLASS IX – MATHEMATICS

Chapter Test: Two Variables, One Line

Step-by-Step Solutions and Marking Scheme | M. M.: 40

Ideas used

Solution of ax + by + c = 0 is an ordered pair (x, y) that satisfies it. **Slope** = rise/run = $(y_2 - y_1)/(x_2 - x_1)$; for y = mx + d, m is the slope and d the y-intercept. For ax + by + c = 0 (b ≠ 0), slope = −a/b.

Pair $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$: $a_1/a_2 \neq b_1/b_2$ gives a unique solution (lines intersect); $a_1/a_2 = b_1/b_2 = c_1/c_2$ gives infinitely many (coincident lines); $a_1/a_2 = b_1/b_2 \neq c_1/c_2$ gives no solution (parallel lines).

Section A (1 mark each)

Q	Ans	Reason
1	(A)	4y = 3x − 9 ⇒ 3x − 4y − 9 = 0, so b = **−4** and c = **−9**.
2	(B)	(4, 2): 3(4) + 2(2) = 12 + 4 = 16 (true). The others give 14, 17 and 15.
3	(C)	Put (0, 0): 7(0) − 3(0) = 0, so the line passes through **(0, 0)**. The other points give 7(1) − 3(7) = −14, 7(7) − 3(1) = 46 and 7(3) − 3(1) = 18, none equal to 0.
4	(D)	Slope = (8 − (−1))/(5 − 2) = 9/3 = **3**.
5	(B)	6x + 3y = 5 ⇒ y = −2x + 5/3, so the slope is **−2**.
6	(C)	Put x = 0: −3y = 12 ⇒ y = −4. The point is **(0, −4)**.
7	(C)	For 3x + 2y = 6 and 2x + 3y = 6: $a_1/a_2 = 3/2$ and $b_1/b_2 = 2/3$, which are not equal, so the solution is unique. In (A) and (D) all three ratios are equal (infinitely many) and in (B) $a_1/a_2 = b_1/b_2 = 1/3 \neq 4/7$ (none).
8	(D)	Need 2/6 = k/9 = 5/15. 2/6 = 1/3, so k = 9/3 = **3** (and 5/15 = 1/3 as well).
9	(B)	Adding: 2x = 18, x = 9; then y = 4. So xy = **36**.
10	(A)	x = 3 and y = −2 together give the point **(3, −2)**.
11	(A)	4/2 = −6/−3 = 10/5 = 2, so A is true. R is the rule that explains it. → **(A)**.
12	(D)	A is false: 2x + 3y = 7 has infinitely many solutions, for example (2, 1), (5, −1), (0, 7/3). R is true. → **(D)**.

Section B (2 marks each)

Q.13 (2 marks)

Substitute x = 2, y = −3 in 5x + ky = 22: 5(2) + k(−3) = 22. [1]

Ans. 10 − 3k = 22 ⇒ −3k = 12 ⇒ k = −4. [1] ***(Check: 10 + 12 = 22 (verified))***

Q.14 (2 marks)

(A) 6x − 3y = 9 ⇒ −3y = −6x + 9 ⇒ **y = 2x − 3**. [1]

Ans. Comparing with y = mx + d: slope m = 2 and y-intercept d = −3. [1]

OR (B) Slope = (−5 − 7)/(1 − (−3)) = −12/4 = **−3**. [1]

The slope is negative, so the line goes **downward** from left to right. [1]

Q.15 (2 marks)

$a_1/a_2 = 5/15 = 1/3$ and $b_1/b_2 = -2/-6 = 1/3$, so $a_1/a_2 = b_1/b_2$. [1]

Ans. $c_1/c_2 = -7/-20 = 7/20$, which is not 1/3. So the pair has no solution (the lines are parallel). [1]

Q.16 (2 marks)

(A) From x − y = 2, x = y + 2. Put in 3x + 2y = 21: 3(y + 2) + 2y = 21 ⇒ 5y + 6 = 21 ⇒ **y = 3**. [1]

Ans. x = 3 + 2 = 5. [1] ***(3(5) + 2(3) = 21 (verified))***

OR (B) Subtract the second equation from the first: (3x + y) − (x + y) = 10 − 4 ⇒ 2x = 6 ⇒ **x = 3**. [1]

Ans. y = 4 − 3 = 1. [1]

Section C (3 marks each)

Q.17 (3 marks)

(A) Multiply $4x + 3y = 17$ by 2 and $5x - 2y = 4$ by 3: $8x + 6y = 34$ and $15x - 6y = 12$. [1]

Add: $23x = 46 \Rightarrow \mathbf{x = 2}$. [1]

Ans. $4(2) + 3y = 17 \Rightarrow 3y = 9 \Rightarrow y = 3$. [1] *(5(2) − 2(3) = 4 (verified))*

OR (B) From $2x - y = 4$, $y = 2x - 4$. [1]

Put in $5x + 3y = 21$: $5x + 3(2x - 4) = 21 \Rightarrow 11x = 33 \Rightarrow \mathbf{x = 3}$. [1]

Ans. $y = 2(3) - 4 = 2$. [1]

Q.18 (3 marks)

(A) Let the fixed charge be ₹x and the charge per km ₹y. Then $x + 6y = 115$ and $x + 10y = 175$. [1]

Subtract: $4y = 60 \Rightarrow y = 15$; then $x = 115 - 90 = 25$. So fixed charge **₹25** and **₹15 per km**. [1]

Ans. Fare for 14 km = 25 + 14 × 15 = ₹235. [1]

OR (B) Let the tens digit be x and the units digit y. Then $x + y = 11$. [½]

$(10x + y) - (10y + x) = 27 \Rightarrow 9(x - y) = 27 \Rightarrow x - y = 3$. [1]

Add: $2x = 14 \Rightarrow x = 7$, then $y = 4$. [1]

Ans. The number is 74. [½] *(74 − 47 = 27 (verified))*

Section D (5 marks each)

Q.19 (5 marks)

(A) Line 1: $x + y = 5$. Table: (0, 5), (5, 0), (2, 3). [1]

Line 2: $2x - y = 1$, i.e. $y = 2x - 1$. Table: (0, −1), (1, 1), (2, 3). [1]

Plot the points of line 1 and join them to get a straight line; plot the points of line 2 and join them. [2]

The lines meet at the common point **(2, 3)**, which lies on both lines. [½]

Ans. The solution is x = 2, y = 3 (unique solution). [½] *(2 + 3 = 5 and 2(2) − 3 = 1 (verified))*

OR (B) Here $a_1/a_2 = 2/4 = 1/2$ and $b_1/b_2 = 3/k$, $c_1/c_2 = 7/m$.

(i) **Infinitely many solutions:** $1/2 = 3/k = 7/m \Rightarrow \mathbf{k = 6, m = 14}$. [2]

(ii) **No solution:** $1/2 = 3/k \neq 7/m \Rightarrow k = 6$ and $m \neq 14$, e.g. **k = 6, m = 15**. [2]

(iii) **Unique solution:** $1/2 \neq 3/k$, i.e. $k \neq 6$, e.g. **k = 5** (for any m). [1]

Q.20 (5 marks)

(A) Let the mother's present age be x years and the son's y years. Five years ago: $x - 5 = 7(y - 5) \Rightarrow x - 7y = -30$. [1]

Five years from now: $x + 5 = 3(y + 5) \Rightarrow x - 3y = 10$. [1]

Subtract: $(x - 3y) - (x - 7y) = 10 - (-30) \Rightarrow 4y = 40 \Rightarrow \mathbf{y = 10}$. [1]

$x = 3(10) + 10 = \mathbf{40}$. [1]

Ans. Mrs Rao is 40 years and her son is 10 years old. Check: 5 years ago 35 = 7 × 5 (true); 5 years later 45 = 3 × 15 (true). [1]

OR (B) (i) $2(l + w) = 52$ gives $\mathbf{l + w = 26}$ and $\mathbf{l - w = 6}$. [2]

(ii) Add: $2l = 32 \Rightarrow \mathbf{l = 16\ m}$; then $w = 26 - 16 = \mathbf{10\ m}$. [2]

(iii) Area = 16 × 10 = **160 m²**. [1]

Section E (4 marks)

Q.21 (4 marks)

(i) Plan A: **y = 5x + 300**. Plan B: **y = 10x + 100**. **[1]**

(ii) Equal cost: 5x + 300 = 10x + 100 ⇒ 5x = 200 ⇒ x = **40 hours**; cost = 5(40) + 300 = **₹500** (the lines meet at (40, 500)). **[1]**

(iii) (A) For 25 hours: Plan A = 5(25) + 300 = ₹425; Plan B = 10(25) + 100 = ₹350. **Plan B** is cheaper by **₹75**. [1]

For more than 40 hours the Plan B line is above the Plan A line, so **Plan A is cheaper for more than 40 hours**. [1]

OR (iii) (B) Plan A: slope = **5**, y-intercept = **300**. Plan B: slope = **10**, y-intercept = **100**. [1]

The slope is the extra cost for each extra hour used (₹5 per hour for A, ₹10 per hour for B); the intercept is the fixed fee. [1]

— End of Solutions —