MATHS FIELD GUIDE · GRADE 9

One linear equation in two variables

OPENING PROBLEM

What stays constant?

x	−1	0	1
y = 2x + 1	−1	1	3

02 Move between a rule, a table and a line
03 Rules and worked cases
04 From the givens to the answer
05 Decide what the intersection means
06 Check your reasoning
07 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Move between a rule, a table and a line

For y = mx + b, b sets the vertical intercept and m is the change in y per unit change in x.

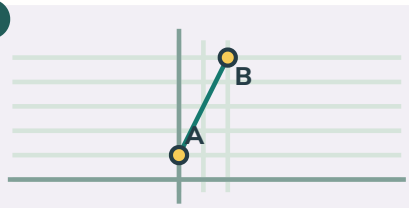
1

x	−1	0	1
y = 2x + 1	−1	1	3

What stays constant?

Each x-step of one raises y by two. The value at zero is one.

2



A (0, 1)
B (2, 5)

Find rise and run between the points.

Rise 4, run 2. Slope = 4/2 = 2.

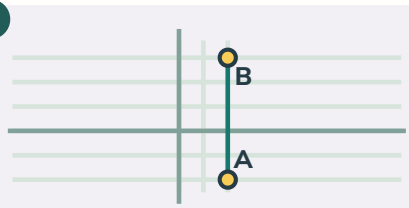
3

$$y = 3x - 2$$
$$\downarrow$$
$$10 = 3x - 2$$
$$\downarrow$$
$$x = 4$$

Which input produces output ten?

Undo subtraction, then divide by three. Check: 3 × 4 − 2 = 10.

4



A (2, -2)
B (2, 3)

Does this vertical line have slope zero?

No. Its run is zero, so rise divided by run is undefined. A horizontal line has slope zero.

y = 4
horizontal, slope zero.

x = 4
vertical, slope undefined.

CHAPTER PROBLEM

In y = 3x − 2, find y when x = 2.

4. y = 6 − 2 = 4.

MATHS REFERENCE · GRADE 9

One linear equation in two variables

Rules, conditions and worked cases

Recognise the case	Mathematical reasoning
Build a solution pair	For $2x + y = 7$, choose $x = 2$ and obtain $y = 3$.
Find intercepts	Set $x = 0$ for $(0,7)$; set $y = 0$ for $(7/2,0)$. Both lie on the same line.
Check membership	At $(3,2)$, $2 \times 3 + 2 = 8$. The point lies off the line $2x + y = 7$.

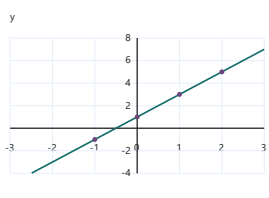
Read the representations

An equation can describe many pairs

A solution of $y = 2x + 1$ is a pair (x, y) that makes the equation true.

Choose an x-value and calculate its matching y-value. For $x = 1$, $y = 3$.

One equation in two variables usually does not select just one pair.



Every plotted pair satisfies $y = 2x + 1$. The line represents all real-valued solutions.

A table supplies points; the equation supplies the line

Choose convenient x-values, compute y, and plot with labelled scales.

Two distinct points determine a line. A third point helps check the calculations and plotting.

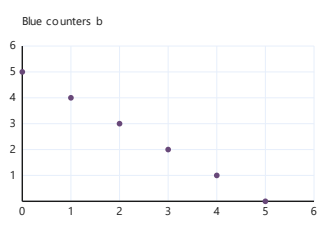
The table gives some solutions; the line contains infinitely many real-valued solution pairs.

The context can restrict the solutions

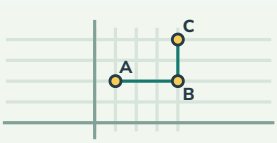
For counts of red and blue counters with $r + b = 5$, both variables must be non-negative integers.

The full real-valued equation is a line, but the counter problem permits just six points.

For continuously measured quantities, intermediate values may be meaningful. Always check the context.



Only (0,5), (1,4), (2,3), (3,2), (4,1), (5,0) are permitted counter counts.



A (1, 2)
B (4, 2)
C (4, 4)

Describe A to C via B.

Go three right, then two up. The total route length is five grid units.

WORKED EXAMPLES

From the givens to the answer

Do you add the coordinates to check any line?

A learner checks (2, 5) in y = 2x + 1 by adding 2 + 5.

1. The check must use the given equation.
2. Substitute x = 2 into the right side: 2 × 2 + 1 = 5.
3. That equals y, so (2, 5) is a solution.

Generate points for x + y = 4

1. Rearrange as y = 4 − x.
2. Using x = 0, 2, 4 gives y = 4, 2, 0.
3. Plot (0,4), (2,2), (4,0). Draw the line when all real inputs are allowed.

Check a proposed pair on 3x + y = 10

1. For (2, 4), substitute into the left side: 3 × 2 + 4 = 10.
2. The equation is true, so the pair is a solution.
3. For (2, 5), the left side is 11. That pair is not a solution.

Check another case

Example 1

Which pair satisfies 2x + y = 12?

(4,4) · (4,8) · (6,6) · (0,0)

(4,4)

2 × 4 + 4 = 12.

Example 2

Explain the difference between a table of four solutions and the entire solution line.

The table lists four selected pairs.

When all real inputs are allowed, infinitely many pairs satisfy the linear equation.

The line represents that entire set, including points between listed pairs.



P (2, 5)
Q (5, 2)

Are the points the same if the coordinates swap?

No. Each has its horizontal and vertical distances exchanged.

ILLUSTRATED PROBLEM SHEET

Decide what the intersection means

Each equation selects a line. A shared point satisfies both equations.

1

x	0	1	2
y = x + 1	1	2	3
y = 5 − x	5	4	3

Where do the lines meet?

At (2, 3). Both output rows give 3 in the same column.

2

$$y = x + 1$$
$$\downarrow$$
$$x + y = 5$$
$$\downarrow$$
$$x + (x + 1) = 5$$

Substitute to recover the same pair.

2x = 4, so x = 2. Then y = 3.

3

$$x + y = 5$$
$$\downarrow$$
$$-x + y = 1$$
$$\downarrow$$
$$2y = 6$$

Why add the equations?

The x terms cancel. y = 3, then x = 2.

4

Line A	Line B	Solutions
y = 2x + 1	y = 2x + 4	none
y = 2x + 1	2y = 4x + 2	infinite

What changes when the slopes match?

Different intercepts give parallel lines. Matching intercepts give the very same line.

Same slope, different intercepts
no solution.

Different slopes
exactly one solution.

CHAPTER PROBLEM

For y = 4x + 3, find y when x = −1.

-1. y = −4 + 3 = −1.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

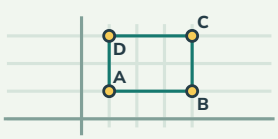
Check your reasoning

Try the problem	Solution and reasoning
01 Can a rule give two different outputs for the very same input and still be a function?	No. Each allowed input has one output.
02 Which pair satisfies x + y = 7? A) (2,4) B) (3,4) C) (7,7) D) (0,0)	(3,4) 3 + 4 = 7.
03 A notebook and pen cost ₹40. Two notebooks plus that pen cost ₹65. Find each price.	Subtract the totals: notebook ₹25. The pen is ₹15. Check both purchases.
04 For 2x + y = 9, find y when x = 3.	3 6 + y = 9 gives y = 3.
05 Which pair lies on y = x − 2? A) (4,2) B) (2,4) C) (0,2) D) (3,3)	(4,2) 2 = 4 − 2.
06 In the counter problem r + b = 8, how many blue counters are there when r = 5?	3 b = 8 − 5 = 3.

Which answers fit a ticket counter?

Adult tickets cost ₹30 and child tickets ₹20. For a ₹120 total, 3a + 2c = 12 after dividing by ten. Whole-number solutions are (0,6), (2,3) and (4,0).

The line also contains (1,4.5). A half ticket is impossible in this context. Domain restrictions change which points count.



A (1, 1)
B (4, 1)
C (4, 3)
D (1, 3)

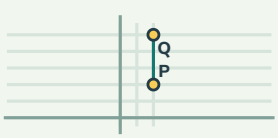
How can you recognise this rectangle?

Opposite sides have the same lengths. Horizontal and vertical neighbours meet at right angles.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
07 How many real-valued solution pairs does $x + y = 6$ have? A) One B) Two C) Six D) Infinitely many	Infinitely many Each real x gives a corresponding real $y = 6 - x$.
08 If $(x, 4)$ satisfies $3x + y = 19$, find x.	5 $3x + 4 = 19$ gives $x = 5$.
09 Why should a graph of adult and child ticket counts use separate points rather than every point on a line?	Ticket counts must be non-negative integers. Fractional or negative ticket counts are not permitted. Only the integer solution pairs that fit the situation should be shown.
10 Explain why a third plotted point is useful even though two points determine a line.	It checks another substitution in the equation. For a linear equation all three distinct correctly plotted points must be collinear. A point off the line signals a calculation, scale or plotting error.
11 For $y = 5 - 2x$, find y when $x = 4$.	-3 $5 - 8 = -3$.



P (2, 2)
Q (2, 5)

Must both coordinates change when a point moves?

No. A vertical move keeps x fixed and adds three to y.

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