MATHS FORENSICS
CASE FILE WORKSHEET · GCSE

MF-CF-ALG-SLINE
GCSE HIGHER · ABOUT 50 MINUTES

CASE FILE SERIES · GRAPHS

STRAIGHT-LINE GRAPHS

y = mx + c tells you everything about a line. Secure gradient and intercept, extend to equations through two points and parallel lines, then master perpendicular lines and bisectors.

SECURING · GRADES 4–5 | EXTENDING · GRADES 6–7 | MASTERY · GRADES 8–9

Name _____ Class _____ Date _____

CASE BRIEFING

WHAT YOU NEED TO KNOW

Every straight line can be written as $y = mx + c$. **m** is the gradient: how far it goes up for every 1 across. **c** is the y-intercept: where it crosses the y-axis.

Gradient = $\frac{\text{change in } y}{\text{change in } x}$. **Parallel** lines have the same gradient. **Perpendicular** gradients multiply to −1: flip the fraction and change the sign.

1. Rearrange to $y = \ldots$ first if the equation isn't in that form.
2. Find the gradient: from the equation, or change in y over change in x.
3. Substitute a point the line passes through to find c.
4. Write the final equation and check one point in it.

WORKED EXAMPLE **Find the equation of the line through (2, 5) and (6, 13).**

SOLUTION

1 Gradient = $\frac{13 - 5}{6 - 2} = \frac{8}{4} = 2$.

2 So $y = 2x + c$.

3 Substitute (2, 5): $5 = 2 \times 2 + c$, so $c = 1$.

4 Check with (6, 13): $2 \times 6 + 1 = 13$ ✓

✓ **$y = 2x + 1$**

KNOWLEDGE CHECK

Use your investigative skills to solve each case. Show full working: the method marks are where most students lose out.

Securing
Gradient, y-intercept, and points on a line.
Secured ☐

Extending
Equations through two points, parallel lines, axes and midpoints, and tampered evidence.
Secured ☐

Mastery
Perpendicular lines, bisectors and unknown coordinates.
Secured ☐

SECURING

The method, step by step. Show every line.

1 Write down the gradient and the y-intercept of $y = 3x - 5$. [2]

Gradient ____ Intercept _____

2 Find the gradient of the line through (1, 2) and (4, 11). [2]

Answer _____

3 Write down the equation of the line with gradient 2 that crosses the y-axis at (0, 7). [2]

Equation _____

4 Does the point (4, 5) lie on the line $y = 2x - 2$? Show how you decide. [2]

Yes / No _____

5 Find the gradient of the line $2y - 6x = 8$. [2]

Answer _____

FORENSIC TIP The gradient is the number in front of x only once y is on its own. It isn't 6 or −6.

6 Work out the values of $y = 2x - 1$ when $x = -1, 0, 1, 2$ and 3. [2]

y values _____

7 A line has gradient 3 and passes through (2, 7). Where does it cross the y-axis? [2]

(___ , ___) _____

EXTENDING

A step is hidden, or there's a context to unpick. One piece of tampered evidence.

8 Find the equation of the line through (1, 7) and (4, 1). [3]

Equation _____

9 Find the equation of the line parallel to $y = 4x - 1$ that passes through (2, 3). [2]

Equation _____

10 Find where the line $3x + 4y = 24$ crosses each axis. [2]

Points _____

11 Find the midpoint of the line segment from (−2, 5) to (6, −1). [2]

(___ , ___) _____

12 Kai found the gradient of the line through (1, 7) and (5, −1). Find his mistake and give the correct gradient. [2]

TAMPERED EVIDENCE · FIND THE MISTAKE

$(5 - 1) \div (-1 - 7) = 4 \div -8 = -½$

Gradient _____

13 Find the length of the line segment from (1, 2) to (7, 10). [2]

Length _____

14 Find the equation of the line parallel to $2x + 3y = 12$ that passes through $(0, -1)$. [3]

Equation _____

MASTERY No hints. Plan before you calculate.

15 Find the equation of the line perpendicular to $y = \frac{1}{2}x + 3$ that passes through (4, 1). [3]

Equation _____

16 A is (1, 2) and B is (7, 10). Find the equation of the perpendicular bisector of AB. [4]

Equation _____

FORENSIC TIP A perpendicular bisector goes through the **midpoint**, at right angles. You need both facts.

17 Show that the lines $2y = 3x + 4$ and $3y + 2x = 6$ are perpendicular. [2]

18 A line has gradient -3 and passes through $(k, 7)$ and $(3, k)$. Find k. [3]

k = _____

19 Find the area of the triangle enclosed by the line $y = 2x + 4$ and the two axes. [3]

Area _____

20 Find the coordinates of the point where the lines $y = 3x - 2$ and $x + 2y = 17$ meet. [3]

(___ , ___) _____

21 A(1, 1) and B(5, 3) are two corners of the square ABCD, with the letters going anticlockwise. Find the coordinates of C and D. [4]

C ___ D _____

FORENSIC TIP Sketch it. Every side of a square is the same step, turned through 90°. Check with gradients: AB is ½ and BC is −2.

KNOWLEDGE CHECK: SOLUTIONS

Check your method as well as your answer. In the exam, an answer with no working usually earns the final mark at most.

Q1 SECURING

✓ **Gradient 3, y-intercept −5**

Q2 SECURING

9 ÷ 3.

✓ **3**

Q3 SECURING

✓ **$y = 2x + 7$**

Q4 SECURING

✓ **No: when x = 4, y = 6, not 5.**

Q5 SECURING

Rearrange: $y = 3x + 4$.

✓ **3**

Q6 SECURING

Each step of 1 in x adds 2 to y: the gradient.

✓ **−3, −1, 1, 3, 5**

Q7 SECURING

7 = 3 × 2 + c, so c = 1.

✓ **(0, 1)**

Q8 EXTENDING

Gradient −6 ÷ 3 = −2; 7 = −2 + c.

✓ **$y = -2x + 9$**

Q9 EXTENDING

Same gradient 4; 3 = 8 + c.

✓ **$y = 4x - 5$**

Q10 EXTENDING

Put y = 0, then x = 0.

✓ **(8, 0) and (0, 6)**

Q11 EXTENDING

Average the x values, then the y values.

✓ **(2, 2)**

Q12 EXTENDING

He mixed the order: change in y on top, in the same order as x. (−1 − 7) ÷ (5 − 1).

✓ **−2**

Q13 EXTENDING

Across 6, up 8: √(36 + 64).

✓ **10 units**

Q14 EXTENDING

Rearrange: $y = -\frac{2}{3}x + 4$, so the gradient is $-\frac{2}{3}$.

✓ **$y = -\frac{2}{3}x - 1$**

Mastery solutions are in the Lab. Grades 8 and 9 are won on method, so a bare answer won't tell you much. Photograph or write your Mastery working in **Forensic Marking** and get it marked mark by mark, with the full solution and the mistake behind every lost mark. Your first marked question is free.

lab.mathsforensics.com/written/?sheet=CF-ALG-SLINE

Mark your evidence

Level	Marks	My score	Secured? (every mark)
Securing	14		☐
Extending	16		☐
Mastery	22		☐

R · Reading
Misread or missed part of the question

M · Method
Didn't know how to do it

A · Accuracy
Knew how, slipped in the working

Write R, M or A next to every mark you lost. Mostly R or A? The fix is technique, not more practice of the topic.

CASE CLOSED: STRAIGHT-LINE GRAPHS

In this case file you've learned to:

- Read the gradient and intercept from y = mx + c, rearranging first if needed.
- Find the gradient between two points, keeping the order consistent.
- Find the equation of a line from two points, or a point and a parallel line.
- Use perpendicular gradients and midpoints to find a bisector.
- Find where a line meets the axes, and use it in area problems.

Because every case comes down to one principle: numbers don't lie.

YOUR NEXT ASSIGNMENT

Practise every GCSE topic in the Lab

New numbers every time, feedback that names the mistake behind each wrong answer, and handwritten working marked like an examiner. Start free.

https://www.mathsforensics.com/the-lab