Core concept 4.2: Graphical Representations

This document is part of a set that forms the subject knowledge content audit for Key Stage 3 maths. The audit is based on the NCETM Secondary Professional Development materials and there is one document for each of the 17 core concepts. Each document contains audit questions with check boxes you can select to show how confident you are (1 = not at all confident, 2 = not very confident, 3 = fairly confident, 4 = very confident), exemplifications and explanations, and further support links. At the end of each document there is space to type reflections, targets and notes. The document can then be saved for your records.

4.2.1 Connect coordinates, equations and graphs

How confident are you that you understand how coordinates, in all four quadrants, can be generated according to mathematical rules and that a graphical representation shows the points that satisfy that relationship?

1 ☐ 2 ☐ 3 ☐ 4 ☐

A key piece of understanding here is that, if a set of coordinates lies on the same straight line, then there is a consistent relationship between the *x*- and *y*-values that can be expressed algebraically as the equation of the line.

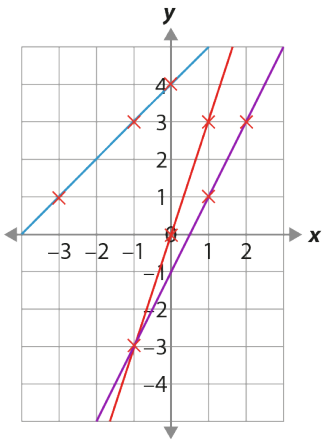
These more probing explorations will support students in reaching two important awarenesses:

- the line represents the infinity of points satisfying the rule and therefore 'captures' or represents that rule in the same way the algebraic equation does
- the line divides the plane into points that fit the rule and points that do not.

Some students may find it challenging to express the relationship between the *x*- and *y*-values algebraically.

Prompt students to describe the relationship in words by considering how the *x*-value is being operated on in order for it to match the *y*-value. This will help them identify the relationship before formally expressing it in algebraic form. For example:

'Consider the graph below. Look at the three coordinates marked on each line and use them to identify the equation of each line.'



After identifying three coordinates on a line (so (−3, 1), (−1, 3) and (0, 4) in the case of the blue line) the students can be encouraged to describe a rule that relates the *x*-value to the *y*-value (add 4). This can then be built upon to write an algebraic rule ($y = x + 4$).

Further support links

- NCETM Secondary Professional Development materials: 4.2 Graphical representations, pages 10–17

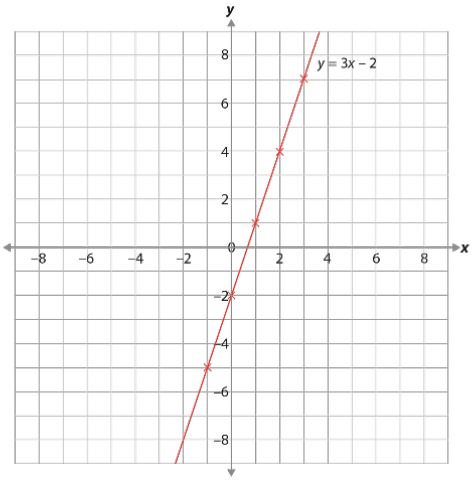
4.2.2 Explore linear relationships

How confident are you that you can explain the relationship between a mathematical rule expressed as $y = mx + c$ and its resulting graphical representation by referring to the rate of change and the y-intercept?

1 ☐ 2 ☐ 3 ☐ 4 ☐

Students will have begun to explore simple algebraic relationships and number patterns in Key Stage 2. This is taken further in Key Stage 3, where students will write the relationship between the *x*- and *y*-values in a set of coordinates using algebra and recognise when it is a linear relationship.

Students should also be given opportunities to explore the connections between the equation of a line, its gradient and its *y*-intercept. By looking at the features of particular graphs, the corresponding set of points and the equation of the line, certain key features can be identified and discussed. For example, students could be presented with a graph, such as this:



x	...	–1	0	1	2	3	...
y	...	–5	–2	1	4	7	...

Ask questions such as:

- *'How quickly is the graph rising (or falling)?'*
- *'As x increases by one each time, how is y increasing (or decreasing)?'*
- *'How does this relate to its equation?'*
- *'What does the '– 2' in the equation signify? Can you explain why this is so?'*

This will support students to become aware that the two significant features of any straight line which enable it to be drawn uniquely – the rate at which *x* changes with respect to *y* (the gradient) and where the line is positioned in the plane (the intercept) – can be inferred by looking at the equation of the line.

When students are confident transitioning between a graph and its corresponding equation written in the standard form $y = mx + c$, they should be encouraged to do the same when the equation is written in a different form, such as $ax + by = c$.

Further support links

- NCETM Secondary Professional Development materials: 4.2 Graphical representations, pages 19–24

4.2.3 Model and interpret a range of situations graphically

How confident are you that you can read and interpret information from a range of graphs such as quadratics, real life graphs and the intersection of two linear graphs?

1 ☐ 2 ☐ 3 ☐ 4 ☐

Students should explore graphs in given contexts, such as distance–time graphs, and be able to match graphs with specific scenarios. They should also not only develop algebraic and graphical fluency when understanding linear functions, but also experience simple quadratic functions. Students should build on what they have learnt when plotting straight line graphs and apply this knowledge to quadratic functions. This is a key skill that is developed further in both Key Stages 4 and 5, so it is important that students are given time to develop secure foundations for this future work.

Students should begin to explore the idea of two linear graphs intersecting and recognise that the point of intersection is the solution to a pair of simultaneous equations. This will help prepare students for future learning in Key Stage 4 when solving two linear simultaneous equations algebraically. In order to gain a deep understanding of this concept, students must also experience scenarios where there is no point of intersection and be able to explain why this is so by making reference to the gradients.

Further support links

- NCETM Secondary Professional Development materials: 4.2 Graphical representations, pages 30–33

Notes