Pupils should be taught to:

Generate points and plot graphs of functions

As outcomes, Year 7 pupils should, for example:

Use, read and write, spelling correctly:
coordinates, coordinate pair/point, x-coordinate…
grid, origin, axis, axes, x-axis…
variable, straight-line graph, equation (of a graph)…

Generate and plot pairs of coordinates that satisfy a simple linear relationship. For example:

- y = x + 1
  (0, 1), (1, 2), (2, 3), (3, 4), (4, 5), …
- y = 2x
  (0, 0), (1, 2), (2, 4), (−1, −2), (−2, −4), …
- y = 10 – x
  (0, 10), (1, 9), (2, 8), …

Complete a table of values, e.g. to satisfy the rule y = x + 2:

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

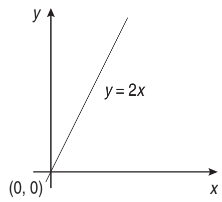
Plot the points on a coordinate grid. Draw a line through the plotted points and extend the line. Then:
- choose an intermediate point, on the line but not one of those plotted;
- read off the coordinate pair for the chosen point and check that it also fits the rule;
- do the same for other points, including some fraction and negative values.

Try this for other graphs.

Recognise that all points on a line will fit the rule.

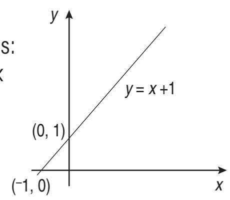
Begin to consider the features of graphs of simple linear functions, where y is given explicitly in terms of x. For example, construct tables of values then use paper or a **graph plotter** to:

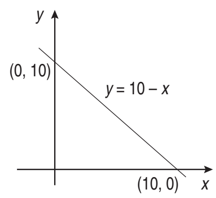
- Plot and interpret graphs such as:
  y = x, y = 2x, y = 3x, y = 4x, y = 5x



Note that graphs of the form y = mx:
- are all straight lines which pass through the origin;
- vary in steepness, depending on the function;
- match the graphs of multiples, but are continuous lines rather than discrete points.

- Plot graphs such as:
  y = x + 1, y = 10 – x





Note the positive or negative slope of the graph and the intercept points with the axes. Make connections with the value of the constant term.

As outcomes, Year 8 pupils should, for example:

Use vocabulary from previous year and extend to:
linear relationship…
intercept, steepness, slope, gradient…

Generate coordinate pairs and plot graphs of simple linear functions, using all four quadrants. For example:

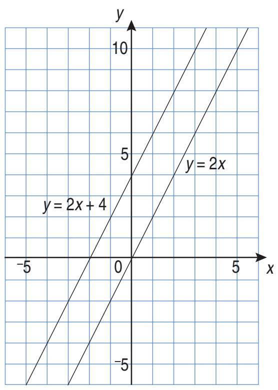
- y = 2x – 3
  (⁻3, ⁻9), (⁻2, ⁻7), (⁻1, ⁻5), (0, ⁻3), (1, ⁻1), (2, 1), …
- y = 5 – 4x
  (⁻2, 13), (⁻1, 9), (0, 5), (1, 1), (2, ⁻3), …

Plot the points. Observe that the points lie in a straight line and draw the line. Read other coordinate pairs from the line (including fractional values) and confirm that they also fit the function.

Recognise that a graph of the form y = mx + c:
- corresponds to a straight line, whereas the graph of a linear sequence consists of set of discrete points lying on an 'imagined straight line';
- represents an infinite set of points, and that:
  - the values of the coordinates of each point satisfy the equation represented by the graph;
  - any coordinate pair which represents a point not on the graph does not satisfy the equation.

Plot the graphs of linear functions in the form y = mx + c, on paper and using ICT, and consider their features. For example:

- Construct tables of values.
  Plot and interpret graphs such as:
  y = 2x, y = 2x + 1, y = 2x + 4, y = 2x – 2, y = 2x – 5



  Describe similarities and differences.
  Notice that:
  - the lines are all parallel to y = 2x;
  - the lines all have the same gradient;
  - the number (constant) tells you where the line cuts the y-axis (the intercept).

As outcomes, Year 9 pupils should, for example:

Use vocabulary from previous years and extend to:
quadratic function, cubic function…

Plot the graphs of linear functions in the form ay + bx + c = 0, on paper and using ICT, and consider their features. For example:

Recognise that linear functions can be rearranged to give y explicitly in terms of x. For example:

- Rearrange y + 2x – 3 = 0 in the form y = 3 – 2x.
  Rearrange y/4 – x = 0 in the form y = 4x.
  Rearrange 2y + 3x = 12 in the form $y = \frac{12 - 3x}{2}$.
- Construct tables of values.
  Plot the graphs on paper and using **ICT**.
  Describe similarities and differences.
- Without drawing the graphs, compare and contrast features of graphs such as:

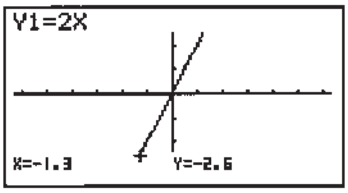
y = 3x	y = 3x + 4	y = x + 4
y = x – 2	y = 3x – 2	y = ⁻3x + 4

Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:

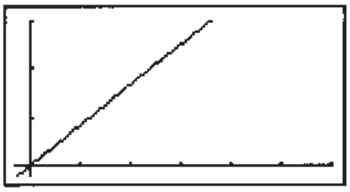
Generate points and plot graphs of functions (continued)

Recognise that equations of the form y = mx correspond to straight-line graphs through the origin.

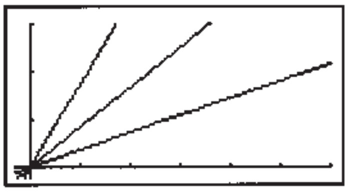
- Use a **graphical calculator** to plot a straight-line graph through the origin, trace along it, and read off the coordinates. Describe the relationship between the values for x and the values for y.



- Draw the graph of y = x.



Draw the graph of a line that is steeper.
Draw the graph of a line that is less steep.



Recognise that equations of the form y = c, where c is constant, correspond to straight-line graphs parallel to the x-axis, and that equations of the form x = c correspond to straight-line graphs parallel to the y-axis.

As outcomes, Year 8 pupils should, for example:

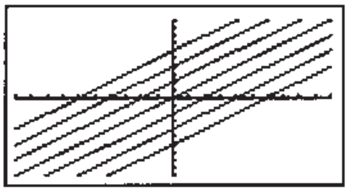
Recognise that equations of the form y = mx + c correspond to straight-line graphs.

Use a **graphical calculator** to investigate the family of straight lines y = mx + c.

- Draw the graphs of:

  y = x + 1   y = x + 2   y = x + 3
  y = x – 1   y = x – 2   y = x – 3

  Describe what the value of m represents.
  Describe what the value of c represents.



- Use a **graphical calculator** and knowledge of the graph of y = mx + c to explore drawing lines through:

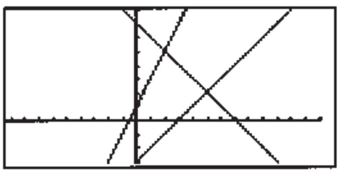
  (0, 5)
  (⁻7, ⁻7)
  (2, 6)
  (⁻7, 0) and (0, 7)
  (⁻3, 0) and (0, 6)
  (0, ⁻8) and (8, 0)

Know and explain the reasons for these properties of functions of the form y = mx + c:

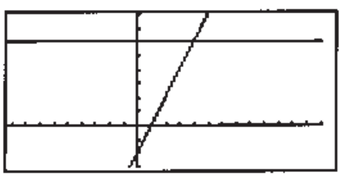
- they are all straight lines;
- for a given value of c, all lines pass through the point (0, c) on the y-axis;
- all lines with the same given value of m are parallel.

Use knowledge of these properties to find the equations of straight-line graphs.
For example, use a **graphical calculator** to:

- Find the equations of these straight-line graphs.



- Find some more straight lines that pass through the point (4, 6).



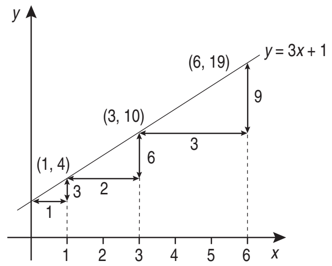
As outcomes, Year 9 pupils should, for example:

Given values for m and c, find the gradient of lines given by equations of the form y = mx + c.

Compare changes in y with corresponding changes in x, and relate the changes to a graph of the function. For example:

- y = 3x + 1

x	0	1	2	3	4	5
y	1	4	7	10	13	16
Difference		3	3	3	3	3



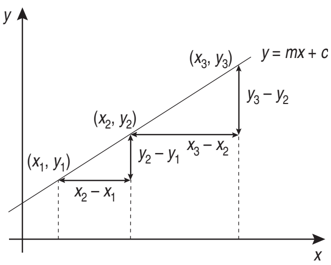
$$\frac{\text{change in y}}{\text{change in x}} = \frac{4-1}{1-0} = \frac{10-4}{3-1} = \frac{19-10}{6-3} = 3$$

Recognise that:

- the change in y is proportional to the change in x;
- the constant of proportionality is 3;
- triangles in the diagram are mathematically similar, i.e. enlargements of a basic triangle.

Know that for any linear function, the change in y is proportional to the corresponding change in x. For example, if A (x_1, y_1), B (x_2, y_2) and C (x_3, y_3) are any three points on the line y = mx + c, then

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_3 - y_2}{x_3 - x_2} = m$$



Know that for the straight line y = mx + c:

- $m = \dfrac{\text{change in y}}{\text{change in x}}$;
- m is called the gradient of the line and is a measure of the steepness of the line;
- if y decreases as x increases, m will be negative;
- lines parallel to the x-axis, e.g. y = 3, have gradient 0, and for lines parallel to the y-axis, e.g. x = 7, it is not possible to specify a gradient.

Link to properties of linear sequences (pages 148–9), proportionality (pages 78–81), enlargements (pages 212–15), and trigonometry (pages 242–7).