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| **UNIT 6: Real-life and algebraic linear graphs, quadratic and cubic graphs, the equation of a circle, plus rates of change and area under graphs made from straight lines** |

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**SPECIFICATION REFERENCES**

N13 use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

A8 work with coordinates in all four quadrants

A9 plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form *y* = *mx* + *c* to identify parallel **and perpendicular lines**; find the equation of the line through two given points, or through one point with a given gradient

A10 identify and interpret gradients and intercepts of linear functions graphically and algebraically

A11 identify and interpret roots, intercepts, turning points of quadratic functions graphically; …

A12 recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function  with *x* ≠ 0, …

A14 plot and interpret … graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration

A15 **calculate or estimate gradients of graphs and areas under graphs (including quadratic and non-linear graphs) and interpret results in cases such as distance–time graphs, velocity–time graphs … (this does not include calculus)**

A16  **recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point**

A17 solve linear equations in one unknown … (including those with the unknown on both sides of the equation); find approximate solutions using a graph

A18 solve quadratic equations (**including those that require rearrangement**) algebraically by factorising, **by completing the square and by using the quadratic formula**; find approximate solutions using a graph

R1 change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts

R10 solve problems involving direct … proportion, including graphical … representations

R11 use compound units such as speed, … unit pricing, …

R14 … recognise and interpret graphs that illustrate direct and inverse proportion

**PRIOR KNOWLEDGE**

Students can identify coordinates of given points in the first quadrant or all four quadrants.

Students can use Pythagoras’ Theorem and calculate the area of compound shapes.

Students can use and draw conversion graphs for these units.

Students can use function machines and inverse operations.

**KEYWORDS**

Coordinate, axes, 3D, Pythagoras, graph, speed, distance, time, velocity, quadratic, solution, root, function, linear, circle, cubic, approximate, gradient, perpendicular, parallel, equation

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| **6b. Linear graphs and coordinate geometry**  (A9, A10, A12, A17, R10, R14) | **Teaching time**  7-9 hours |

**OBJECTIVES**

By the end of the unit, students should be able to:

* Plot and draw graphs of *y* = *a*, *x* = *a*, *y* = *x* and *y* = –*x*, drawing and recognising lines parallel to axes, plus *y* = *x* and *y* = –*x*;
* Identify and interpret the gradient of a line segment;
* Recognise that equations of the form *y* = *mx* + *c* correspond to straight-line graphs in the coordinate plane;
* Identify and interpret the gradient and *y*-intercept of a linear graph given by equations of the form *y* = *mx* + *c*;
* Find the equation of a straight line from a graph in the form *y* = *mx* + *c*;
* Plot and draw graphs of straight lines of the form *y* = *mx* + *c* with and without a table of values;
* Sketch a graph of a linear function, using the gradient and *y*-intercept (i.e. without a table of values);
* Find the equation of the line through one point with a given gradient;
* Identify and interpret gradient from an equation *ax* + *by* = *c*;
* Find the equation of a straight line from a graph in the form *ax* + *by* = *c*;
* Plot and draw graphs of straight lines in the form *ax* + *by* = *c*;
* Interpret and analyse information presented in a range of linear graphs:
* use gradients to interpret how one variable changes in relation to another;
* find approximate solutions to a linear equation from a graph;
* identify direct proportion from a graph;
* find the equation of a line of best fit (scatter graphs) to model the relationship between quantities;
* Explore the gradients of parallel lines and lines perpendicular to each other;
* Interpret and analyse a straight-line graph and generate equations of lines parallel and perpendicular to the given line;
* Select and use the fact that when *y* = *mx* + *c* is the equation of a straight line, then the gradient of a line parallel to it will have a gradient of *m* and a line perpendicular to this line will have a gradient of .

**POSSIBLE SUCCESS CRITERIA**

Find the equation of the line passing through two coordinates by calculating the gradient first.

Understand that the form *y* = *mx* + *c* or *ax* + *by* = *c* represents a straight line.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Given an equation of a line provide a counter argument as to whether or not another equation of a line is parallel or perpendicular to the first line.

Decide if lines are parallel or perpendicular without drawing them and provide reasons.

**COMMON MISCONCEPTIONS**

Students can find visualisation of a question difficult, especially when dealing with gradients resulting from negative coordinates.

**NOTES**

Encourage students to sketch what information they are given in a question – emphasise that it is a sketch.

Careful annotation should be encouraged – it is good practice to label the axes and check that students understand the scales.