

1.3 Connect coordinate calculations with lines and quadratic graphs

Name: _____ Class: _____ Date: _____

Total: 24 marks

KEY WORDS gradient 斜率 • midpoint 中点 • vertex 顶点

Objective

Connect coordinate calculations with lines and quadratic graphs. Original GAC004-aligned practice, not an official assessment. Show the method as well as the result. All applied scenarios are invented classroom problems.

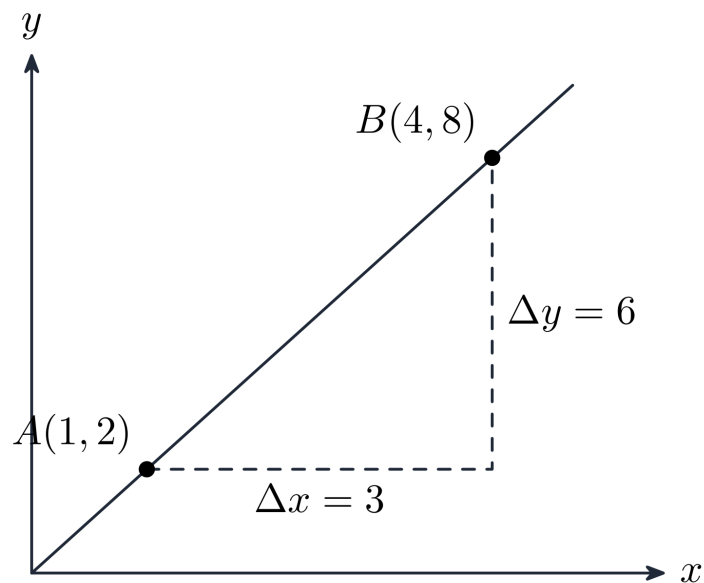
1 Key knowledge and worked examples

■ Key knowledge: coordinates make geometric relationships testable

For a nonvertical straight line, **gradient** 斜率 is change in y divided by change in x . In $y = mx + c$, m is the gradient and c is the y -intercept. A vertical line $x = k$ has undefined gradient. Nonvertical parallel lines have equal gradients. Two nonvertical perpendicular lines have gradients whose product is negative 1; horizontal and vertical lines are also perpendicular.

The **midpoint** 中点 averages each coordinate. Distance uses Pythagoras with the coordinate differences. A quadratic graph has a **vertex** 顶点 at its turning point. Its real roots are x -coordinates where it meets the x -axis; a repeated root touches rather than crosses. Solving two graph equations finds their intersections.

■ Worked example: a rising line through two given points



Known: $A = (1, 2)$ and $B = (4, 8)$. Use gradient because the line is nonvertical.

$$m = \frac{y_B - y_A}{x_B - x_A} = \frac{8 - 2}{4 - 1} = 2$$

The line equation is $y = mx + c$. Substitute A to find the intercept.

$$c = y_A - mx_A = 2 - 2(1) = 0$$

Thus $y = 2x$. The diagram's horizontal change is 3 and vertical change is 6.

2 Practice

2.1 Find the gradient of the line through (2, 1) and (6, 9).

[2]

2.2 Find the midpoint of $(-2, 5)$ and $(4, -1)$. [2]

2.3 Find the equation of the line with gradient 3 through $(2, 7)$. Give its y-intercept. [3]

2.4 For $y = (x - 2)^2 - 9$, sketch the graph, labelling the vertex and both x-intercepts. Show how you find the intercepts. [3]

3 Exam-style questions

3.1 Let $A = (1, 2)$ and $B = (7, 10)$. Find (a) the distance AB , (b) its midpoint, and (c) the equation of the perpendicular bisector of AB . [6]
