NCEA Level 2 · AS 91256: Lines, Points & the Coordinate Plane

Name: _____ Date: _____

This standard is all about working with points and straight lines on the number plane, distances, midpoints, gradients, equations of lines, and parallel/perpendicular relationships. Work through each section in order; check your working against the answers, and note the 'evidence' hints if you're aiming for Merit or Excellence.

Revision summary

- Distance between $A(x_1,y_1)$ and $B(x_2,y_2)$: $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$.
- Midpoint of AB: $M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.
- Gradient: $m = \frac{y_2-y_1}{x_2-x_1}$ = rise ÷ run.
- Equation of a line: $y = mx + c$, or $y - y_1 = m(x - x_1)$ given a point and gradient.
- Parallel lines have equal gradients ($m_1 = m_2$).
- Perpendicular lines have gradients that multiply to −1 ($m_1 \times m_2 = -1$), so $m_2 = -1/m_1$.
- To find where two lines meet, solve their equations simultaneously.
- Perpendicular bisector of AB: passes through the midpoint of AB with gradient −1/(gradient of AB).

Key skills

1. Find the distance between A(1, 2) and B(7, 10).

2. Find the midpoint of P(−3, 5) and Q(7, −1).

3. Find the gradient of the line through C(2, 3) and D(6, 11).

4. Write the equation of the line with gradient 3 that passes through (2, −1).

Achieved

5. Find the equation of the straight line passing through the points (1, 2) and (4, 11).

6. A line has equation $y = 2x + 5$. Find the equation of the line perpendicular to it that passes through (4, 1).

7. Find the equation of the line parallel to $y = -3x + 2$ that passes through (2, 5).

8. On a walking-track map (units in km), a café is at (2, 3) and a lookout is at (8, 11). How far apart are they in a straight line?

Merit

9. A triangle has vertices A(−2, 1), B(4, 3) and C(2, 9). Show that the triangle has a right angle, and state where it is.

10. Two straight roads are modelled by $y = 2x - 3$ and $x + y = 9$. Find the coordinates of the point where the roads cross.

11. Find the equation of the perpendicular bisector of the line segment joining A(1, 2) and B(5, 8).

Excellence

12. A quadrilateral has vertices A(1, 1), B(5, 3), C(7, 7) and D(3, 5). Prove that ABCD is a rhombus.

13. A stream through a park follows the line $y = 2x$ (the park entrance is the origin). A pōhutukawa tree stands at T(5, 0). Find the shortest distance from the tree to the stream, and the coordinates of the nearest point on the stream. Justify why this is the shortest distance.

14. Two lines are given by $y = (k - 1)x + 3$ and $2x + 4y = 7$, where k is a constant. Find the value of k that makes the lines perpendicular, and explain your reasoning.