



學斯教育
HOKSI EDUCATION

Coordinate Geometry

HKDSE Mathematics Compulsory Part

Hoksi Education

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3 Coordinate Geometry

3.1 Distance, midpoint and slope

For points $A(x_1, y_1)$ and $B(x_2, y_2)$:

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}, \quad M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right),$$

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} \quad (x_1 \neq x_2).$$

Two non-vertical lines are parallel when $m_1 = m_2$, and perpendicular when $m_1 m_2 = -1$.

3.2 Equations of straight lines

Table 3.1: Equations of a straight line

Form	Equation	Use when you know
Slope–intercept	$y = mx + c$	Slope and y -intercept
Point–slope	$y - y_1 = m(x - x_1)$	A point and the slope
General	$Ax + By + C = 0$	Any line, including vertical

Example 3.1 (Perpendicular bisector). Find the equation of the perpendicular bisector of the segment joining $A(1, 2)$ and $B(5, -6)$.

Solution. The midpoint is $M = (3, -2)$ and

$$m_{AB} = \frac{-6 - 2}{5 - 1} = -2,$$

so the perpendicular bisector has slope $\frac{1}{2}$. Using point–slope form,

$$y + 2 = \frac{1}{2}(x - 3) \quad \Rightarrow \quad x - 2y - 7 = 0.$$

3.3 Circles

The circle with centre (a, b) and radius r has equation

$$(x - a)^2 + (y - b)^2 = r^2, \quad (3.1)$$

which expands to the general form

$$x^2 + y^2 + Dx + Ey + F = 0, \quad (3.2)$$

with centre $(-\frac{D}{2}, -\frac{E}{2})$ and radius $\sqrt{\frac{D^2+E^2}{4} - F}$.

Watch out

Equation 3.2 only represents a real circle when $\frac{D^2+E^2}{4} - F > 0$. If the expression is zero the equation describes a single point; if it is negative there are no real points at all.

3.4 Exercises

1. Find the distance between $(-3, 4)$ and $(2, -8)$.
2. Find the centre and radius of $x^2 + y^2 - 6x + 8y - 11 = 0$.
3. The line $2x - 3y + 6 = 0$ passes through $P(a, 4)$. Find a .

Answers

1. 13.
2. Centre $(3, -4)$, radius 6.
3. $a = 3$.

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