Name	Date started	Target end date

GCE AS / A LEVEL — PURE MATHEMATICS A QUESTION PACK

0973-01 (Legacy C1) · New spec Unit 1 Topic 6 · AS unit, 25% of A-level, 120 marks, 2h 30min paper

REVISE
.wales

MATHEMATICS — PURE A · STRAIGHT LINES

Straight Lines (Coordinate Geometry)

Gradient, parallel / perpendicular lines, distance, midpoint and intersection questions from the legacy WJEC C1 papers (June 2011 – June 2017)

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~2 hours 22 minutes

*Derived from the legacy C1/C2 paper's pace of **~1.25 min/mark** (114 marks over 8 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **single-topic practice question pack**, drilling one narrow new-spec sub-topic. It contains questions from the legacy WJEC C1 and C2 papers (2008 modular spec) that map onto new-spec AS Unit 1 Topic 6 (2.1.3).

Questions are ordered chronologically.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

A calculator is allowed (except where specified by individual questions). The WJEC Formula Booklet may be referred to.

For Examiner's use only

Q	Source	Max	Mark
1	Jun 11 Q1	13	
2	Jan 12 Q1	14	
3	Jan 13 Q1	14	
4	Jan 14 Q1	14	

Q	Source	Max	Mark
5	Jun 14 Q1	14	
6	Jun 15 Q1	16	
7	Jun 16 Q1	14	
8	Jun 17 Q1	15	
Total		114	

Straight Lines (Coordinate Geometry) — what the new spec asks

WJEC GCE AS / A Level Mathematics (from 2017) · Unit 1: Pure Mathematics A · Topic 2.1.3.

Gradient & equation forms 2.1.3

- Gradient: $m = (y_2 - y_1)/(x_2 - x_1)$.
- Point-gradient form: $y - y_1 = m(x - x_1)$.
- Slope-intercept: $y = mx + c$; standard form: $ax + by + c = 0$.

Parallel & perpendicular 2.1.3

- Parallel lines: same gradient $m_1 = m_2$.
- Perpendicular lines: $m_1 m_2 = -1$.
- Vertical line: undefined gradient; its perpendicular is horizontal.

Distance & midpoint 2.1.3

- Distance $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
- Midpoint of A, B: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.
- Perpendicular bisector: line through midpoint with gradient $-1/m_{AB}$.

Intersections & points 2.1.3

- Substitute one line into the other to find the intersection point.
- Foot of perpendicular: solve simultaneously with the perpendicular through the given point.
- Length problems: compute distance after finding the relevant coordinates.

Straight Lines in one page

Quick-reference notes — revisit before each section. Don't use during questions.

Gradient

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

Slope of a horizontal line is 0; vertical line has undefined gradient.

$m > 0$: rising; $m < 0$: falling.

Equations of a line

Point-gradient: $y - y_1 = m(x - x_1)$.

Slope-intercept: $y = mx + c$.

Standard form: $ax + by + c = 0$.

Parallel lines

Lines $y = m_1 x + c_1$ and $y = m_2 x + c_2$ are parallel iff $m_1 = m_2$.

Distinct (non-coincident) iff $c_1 \neq c_2$.

Perpendicular lines

If $m_1 m_2 = -1$, the lines are perpendicular.

Gradient of perpendicular to $y = mx + c$ is $-1/m$.

Vertical / horizontal: each is perpendicular to the other.

Distance & midpoint

Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Midpoint: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.

Perpendicular bisector: through midpoint, gradient $-1/m_{AB}$.

Intersections

Solve the two line equations simultaneously.

Substitute one into the other to eliminate one variable.

Single solution gives the intersection coordinates.

Foot of perpendicular

From P to line L: find the perpendicular through P.

Intersect that perpendicular with L.

Result is the foot of the perpendicular — closest point on L to P.

Collinearity & ratios

A, B, C collinear iff $m_{AB} = m_{BC}$.

$\overrightarrow{AB} = k\overrightarrow{AC}$ implies B on line AC, with ratio k.

Strategy

1. Compute gradient of AB.
2. Find perpendicular gradient if needed.
3. Use point-gradient form for the equation.
4. For intersections: substitute one equation into the other.

SECTION T6

Straight Lines

Questions 1–8 · 114 marks

1. The points A and B have coordinates (3, 11) and (9, –1) respectively.
The line L_1 passes through the point B and is **perpendicular** to AB.

(a) Find the gradient of AB. [2]

(b) Find the equation of L_1 and simplify your answer. [4]

The line L_2 has equation $6x + 7y + 10 = 0$.
The lines L_1 and L_2 intersect at the point C.

(c) (i) Show that C has coordinates (3, –4).

(ii) Find the length of BC.

(iii) Find the coordinates of the mid-point of BC.

(iv) Write down the equation of the line AC. [7]

1. The points A, B, C, D have coordinates $(-5, 14)$, $(1, 2)$, $(5, 4)$, $(3, 8)$ respectively.

(a) (i) Show that AB and CD are parallel.

(ii) Find the equation of AB.

(iii) The line L passes through the point D and is perpendicular to AB. Show that L has equation

$$x - 2y + 13 = 0.$$ [8]

(b) The lines L and AB intersect at the point E.

(i) Find the coordinates of E.

(ii) Calculate the length of EF, where F denotes the mid-point of AB. [6]

1. The points A and B have coordinates $(2, -3)$ and $(4, 1)$ respectively.
The line L has equation $x + 2y - 11 = 0$.

(a) Find the equation of AB and simplify your answer. [5]

(b) Show that AB and L are perpendicular. [3]

(c) The lines AB and L intersect at the point C. Show that C has coordinates $(5, 3)$. [2]

(d) Find the lengths of AB and AC. Hence find the value of the constant k such that $AB = kAC$, giving your answer in its simplest form. [4]

1. The points A and B have coordinates (6, –2) and (4, 1), respectively.
The line L_1 passes through the point B and is perpendicular to AB.

(a) (i) Find the gradient of AB.

(ii) Find the equation of L_1. [5]

(b) The line L_2 passes through A and has equation $x - 8y - 22 = 0$.
The lines L_1 and L_2 intersect at the point C.

(i) Show that C has coordinates (–2, –3).

(ii) Find the coordinates of the mid-point of AC.

(iii) Find the area of triangle ABC, simplifying your answer. [9]

1. The points A and B have coordinates $(-2, 10)$ and $(12, 3)$ respectively.

(a) (i) Find the gradient of AB.

(ii) Find the equation of AB. [4]

(b) The line L is perpendicular to AB and intersects the y-axis at the point $C(0, -1)$. The lines AB and L intersect at the point D.

(i) Write down the equation of L.

(ii) Show that D has coordinates $(4, 7)$.

(iii) Find the length of AD and the length of BD. [7]

(c) The line CD is extended to the point E so that D is the mid-point of CE.

(i) Find the coordinates of E.

(ii) **Write down** the geometrical name for the quadrilateral $ACBE$. [3]

1. The points A, B, C have coordinates $(-7, 3)$, $(2, 0)$, $(-3, 5)$, respectively. The line L passes through C and is perpendicular to AB.

(a) (i) Find the gradient of AB.

(ii) Show that the equation of AB is

$$x + 3y - 2 = 0.$$

(iii) Find the equation of L. [7]

(b) The line L intersects AB at the point D. Show that the coordinates of D are $(-4, 2)$. [2]

(c) Show that L is not the perpendicular bisector of AB. [2]

(d) Find the value of $\tan A\hat{B}C$. Give your answer in its simplest form. [5]

1. The points *A*, *B*, *C* have coordinates (–6, –3), (4, 2), (–2, 5), respectively.

(a) (i) Find the gradient of *AB*.

(ii) Find the equation of *AB* and simplify your answer. [5]

(b) Find the lengths of *AB* and *AC*. Hence find the value of the constant k such that *AB* = k*AC*, giving your answer in its simplest form. [4]

(c) The point *D* has coordinates (4, m), where m is a constant.

(i) Write down the equation of *BD*.

(ii) Given that *CD* is perpendicular to *AB*, find the value of m. [5]

$5\sqrt{7} + 4\sqrt{2}$

1. The points *A* and *B* have coordinates (–2, 3) and (4, 5) respectively.
The line L_1 passes through the point *B* and is **perpendicular** to *AB*.

(a) (i) Find the gradient of *AB*.

(ii) Find the equation of L_1. [5]

The line L_2 has equation $x + 2y + 1 = 0$.
The lines L_1 and L_2 intersect at the point *C*.

(b) (i) Show that *C* has coordinates (7, –4).

(ii) Show that the value of cos $B\hat{C}A$ may be expressed in the form $\frac{3}{\sqrt{a}}$, where a is an integer whose value is to be found. [7]

(c) The line *CB* is extended to the point *D* so that *B* is the mid-point of *CD*.

(i) Find the coordinates of *D*.

(ii) **Write down** the geometrical name for the triangle *ACD*. [3]

END OF STRAIGHT LINES PACK

Source: WJEC C1 + C2 (2008 modular spec) · 2011–2017
Curated for WJEC Maths 2017 spec AS Unit 1 — Topic 6 (2.1.3)