Past paper questions
1.3 Coordinate geometry

The questions in this document have been compiled from a number of past papers, as indicated in the table below. Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
6	2015	June	11
7	2015	June	12
7	2015	June	13
5	2013	November	12
5	2016	March	12
7	2013	June	13
7	2014	June	11
1	2014	June	12
6	2014	November	13
4	2014	November	11

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub www.cambridgeinternational.org/support.

6 The line with gradient -2 passing through the point $P(3t, 2t)$ intersects the x-axis at A and the y-axis at B.

   (i) Find the area of triangle AOB in terms of t. [3]

  The line through P perpendicular to AB intersects the x-axis at C.

   (ii) Show that the mid-point of PC lies on the line $y = x$. [4]

7 The point C lies on the perpendicular bisector of the line joining the points A (4, 6) and B (10, 2). C also lies on the line parallel to AB through (3, 11).
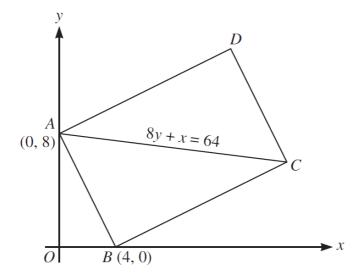
   (i) Find the equation of the perpendicular bisector of AB. [4]

   (ii) Calculate the coordinates of C. [3]

7   The point A has coordinates $(p, 1)$ and the point B has coordinates $(9, 3p + 1)$, where p is a constant.

    (i) For the case where the distance AB is 13 units, find the possible values of p.   [3]

    (ii) For the case in which the line with equation $2x + 3y = 9$ is perpendicular to AB, find the value of p.   [4]
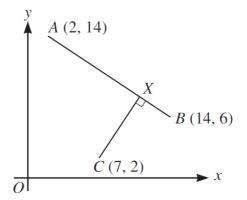
5

The diagram shows a rectangle $ABCD$ in which point A is $(0, 8)$ and point B is $(4, 0)$. The diagonal AC has equation $8y + x = 64$. Find, by calculation, the coordinates of C and D. [7]

5 Two points have coordinates $A\,(5,\,7)$ and $B\,(9,\,-1)$.

   (i) Find the equation of the perpendicular bisector of AB.   [3]

The line through $C\,(1,\,2)$ parallel to AB meets the perpendicular bisector of AB at the point X.

   (ii) Find, by calculation, the distance BX.   [5]

7

The diagram shows three points A (2, 14), B (14, 6) and C (7, 2). The point X lies on AB, and CX is perpendicular to AB. Find, by calculation,

(i) the coordinates of X, [6]

(ii) the ratio $AX : XB$. [2]

7 The coordinates of points A and B are $(a, 2)$ and $(3, b)$ respectively, where a and b are constants. The distance AB is $\sqrt{(125)}$ units and the gradient of the line AB is 2. Find the possible values of a and of b. [6]

1 Find the coordinates of the point at which the perpendicular bisector of the line joining $(2, 7)$ to $(10, 3)$ meets the x-axis. [5]

6 *A* is the point $(a, 2a - 1)$ and *B* is the point $(2a + 4, 3a + 9)$, where *a* is a constant.

   (i) Find, in terms of *a*, the gradient of a line perpendicular to *AB*. [3]

   (ii) Given that the distance *AB* is $\sqrt{(260)}$, find the possible values of *a*. [4]

4 The line $4x + ky = 20$ passes through the points A (8, −4) and B (b, $2b$), where k and b are constants.

   (i) Find the values of k and b. [4]

   (ii) Find the coordinates of the mid-point of AB. [1]

Mark schemes

<u>Mark Scheme Notes</u>

Marks are of the following three types:

M   Method mark, awarded for a valid method applied to the problem. Method marks are
     not lost for numerical errors, algebraic slips or errors in units. However, it is not
     usually sufficient for a candidate just to indicate an intention of using some method or
     just to quote a formula; the formula or idea must be applied to the specific problem in
     hand, e.g. by substituting the relevant quantities into the formula. Correct application
     of a formula without the formula being quoted obviously earns the M mark and in some
     cases an M mark can be implied from a correct answer.

A   Accuracy mark, awarded for a correct answer or intermediate step correctly obtained.
     Accuracy marks cannot be given unless the associated method mark is earned (or
     implied).

B   Mark for a correct result or statement independent of method marks.

- When a part of a question has two or more "method" steps, the M marks are generally
  independent unless the scheme specifically says otherwise; and similarly when there are
  several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a
  particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme.
  When two or more steps are run together by the candidate, the earlier marks are implied and
  full credit is given.

- The symbol $\sqrt{}$ implies that the A or B mark indicated is allowed for work correctly following
  on from previously incorrect results. Otherwise, A or B marks are given for correct work
  only. A and B marks are not given for fortuitously "correct" answers or results obtained from
  incorrect working.

- Note: B2 or A2 means that the candidate can earn 2 or 0.
           B2/1/0 means that the candidate can earn anything from 0 to 2.

  The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether
  a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless
  otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working
  following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the
  scheme specifically indicates otherwise.

- For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f.,
  or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated
  above, an A or B mark is not given if a correct numerical answer arises fortuitously from
  incorrect working. For Mechanics questions, allow A or B marks for correct answers which
  arise from taking g equal to 9.8 or 9.81 instead of 10.

The following abbreviations may be used in a mark scheme or used on the scripts:

AEF   Any Equivalent Form (of answer is equally acceptable)

AG   Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)

BOD   Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)

CAO   Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)

CWO   Correct Working Only – often written by a 'fortuitous' answer

ISW   Ignore Subsequent Working

MR   Misread

PA   Premature Approximation (resulting in basically correct work that is insufficiently accurate)

SOS   See Other Solution (the candidate makes a better attempt at the same question)

SR   Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

MR –1   A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through $\sqrt{}$" marks. MR is not applied when the candidate misreads his own figures – this is regarded as an error in accuracy. An MR –2 penalty may be applied in particular cases if agreed at the coordination meeting.

PA –1   This is deducted from A or B marks in the case of premature approximation. The PA – 1 penalty is usually discussed at the meeting.

May/June 2015 Paper 11

6	(i)	$y - 2t = -2(x - 3t)(y + 2x = 8t)$ Set x to $0 \rightarrow B(0, 8t)$ Set y to $0 \rightarrow A(4t, 0)$ $\rightarrow$ Area $= 16t^2$	M1 M1 A1 [3]	Unsimplified or equivalent forms Attempt at both A and B, then using cao
	(ii)	$m = \dfrac{1}{2}$ $\rightarrow y - 2t = \dfrac{1}{2}(x - 3t)(2y = x + t)$ Set y to $0 \rightarrow C(-t, 0)$ Midpoint of CP is (t, t) This lies on the line $y = x$.	B1 M1 A1 A1 [4]	cao Unsimplified or equivalent forms co correctly shown.

May/June 2015 Paper 12

7		$A(4, 6)$, $B(10, 2)$.		
	(i)	$M = (7, 4)$ m of $AB = -\dfrac{2}{3}$ m of perpendicular $= \dfrac{3}{2}$ $\rightarrow y - 4 = \dfrac{3}{2}(x - 7)$	B1 B1 M1 A1 [4]	co co Use of $m_1 m_2 = -1$ & their midpoint in the equation of a line. co
	(ii)	Eqn of line parallel to AB through $(3, 11)$ $\rightarrow y - 11 = -\dfrac{2}{3}(x - 3)$ Sim eqns $\rightarrow C(9, 7)$	 M1 DM1A1 [3]	 Needs to use m of AB Must be using their correct lines. Co

May/June 2015 Paper 13

7	(i)	$(9 - p)^2 + (3p)^2 = 169$ $10p^2 - 18p - 88 (= 0)$ oe $p = 4$ **or** $-11/5$ oe	**M1** **A1** **A1** [3]	Or $\sqrt{\ } = 13$ 3-term quad

October/November 2013 Paper 12

5	$A(0, 8)$ $B(4, 0)$ $8y + x = 33$ m of $AB = -2$ m of $BC = \frac{1}{2}$ Eqn $BC \rightarrow y - 0 = \frac{1}{2}(x - 4)$ Sim eqns $\rightarrow C(16, 6)$ Vector step method $\rightarrow D(12, 14)$ (or AD $y = \frac{1}{2}x + 8$, CD $y = -2x + 38$) (or $M = (8, 7) \rightarrow D = (12, 14)$)	 B1 M1 M1 M1 A1 M1 A1 [7]	 Use of $m_1 m_2 = -1$ for BC or AD Correct method for equation of BC Sim Eqns for BC, AC. M1 valid method.

5	(i)	Mid-point of $AB = (7, 3)$ soi	**B1**		
		Grad. of $AB = -2 \rightarrow$ grad of perp. bisector = 1/2 soi	**M1**		Use of $m_1m_2 = -1$
		Eqn of perp. bisector is $y - 3 = \dfrac{1}{2}(x - 7)$	**A1**	**[3]**	
	(ii)	Eqn of CX is $y - 2 = -2(x - 1)$	**M1**		Using their original gradient and (1,2)
		$\dfrac{1}{2}x - \dfrac{1}{2} = -2x + 4$	**DM1**		Solve simultaneously dependent on both previous M's
		$x = 9/5,\ y = 2/5$	**A1**		
		$BX^2 = 7.2^2 + 1.4^2$ soi	**M1**		
		$BX = 7.33$	**A1**	**[5]**	

May/June 2013 Paper 13

7		$A\,(2, 14)$, $B\,(14, 6)$ and $C\,(7, 2)$.			
	(i)	m of $AB = -\frac{2}{3}$	B1		
		m of perpendicular $= \frac{3}{2}$	M1		For use of $m_1m_2 = -1$
		eqn of AB $y - 14 = -\frac{2}{3}(x - 2)$	M1		Allow M1 for unsimplified eqn
		eqn of CX $y - 2 = \frac{3}{2}(x - 7)$	M1		Allow M1 for unsimplified eqn
		Sim Eqns $\rightarrow X\,(11, 8)$	M1 A1	[6]	For solution of sim eqns.
	(ii)	$AX : XB = 14 - 8 : 8 - 6 = 3 : 1$	M1 A1		Vector steps or Pythagoras.
		Or $\sqrt{(9^2 + 6^2)} : \sqrt{(3^2 + 2^2)} = 3 : 1$		[2]	

May/June 2014 Paper 11

7	$(a - 3)^2 + (2 - b)^2 = 125$ oe	**B1**		
	$\dfrac{2 - b}{a - 3} = 2$ oe	**B1**		
	$(a - 3)^2 + (2a - 6)^2 = 125$ (sub for a or b)	**M1**		Or $1/4(2 - b)^2 + (2 - b)^2 = 125$
	$(5)(a + 2)(a - 8)\,(= 0)$ Attempt factorise/solve	**M1**		Or $(5)(b - 12)(b + 8)\,(= 0)$
	$a = -2$ or 8, $b = 12$ or -8	**A1A1**		Answers (no working) after 2 correct eqns
			[6]	score SCB1B1 for each correct pair (a, b)

May/June 2014 Paper 12

1	$(2, 7)$ to $(10, 3)$		
	Mid-point $(6, 5)$	B1	co
	Gradient $= -\frac{1}{2}$	B1	co
	Perp gradient $= 2$	B1	co
	Eqn $y - 5 = 2(x - 6)$	M1	Must be correct form of Perp
	Sets y to 0, $\rightarrow (3\frac{1}{2}, 0)$	A1	co $x = 3\frac{1}{2}$ only is ok.
		[5]	

October/November 2014 Paper 13

6	(i)	$m = \dfrac{3a+9-(2a-1)}{2a+4-a} = \dfrac{a+10}{a+4}$ oe e.g. $\dfrac{-a-10}{-a-4}$	M1A1	cao Allow omission of brackets for M1
		Gradient of perpendicular $= \dfrac{-(a+4)}{a+10}$ oe but not $\dfrac{-1}{\left(\dfrac{a+10}{a+4}\right)}$	A1$\checkmark$ [3]	Do not ISW. Max penalty for erroneous cancellation 1 mark
	(ii)	$(\sqrt{})[(a+4)^2+(a+10)^2] = (\sqrt{})260$	M1	Allow *their* $(a+4)$, $(a+10)$ from (i). Allow $(-a-4)^2$ etc. Allow omission of brackets
		$(\sqrt{})[(a+4)^2+(a+10)^2]$ cao	A1	
		$(2)(a^2+14a-72)(=0)$	A1	
		$a = 4$ or -18 cao	A1 [4]	

October/November 2014 Paper 11

4	(i)	$32-4k=20 \Rightarrow k=3$	M1A1	Sub $(8, -4)$ [alt: $(2b+4)/(b-8)=-4/k$
		$4b+3\times2b=20$	M1	Sub $(b, 2b)$, $4b+2bk=20$
		$b=2$	A1 [4]	M1 both M1 solving A1, A1]
	(ii)	Mid-point $= (5, 0)$	B1$\checkmark$ [1]	Ft on *their* b