

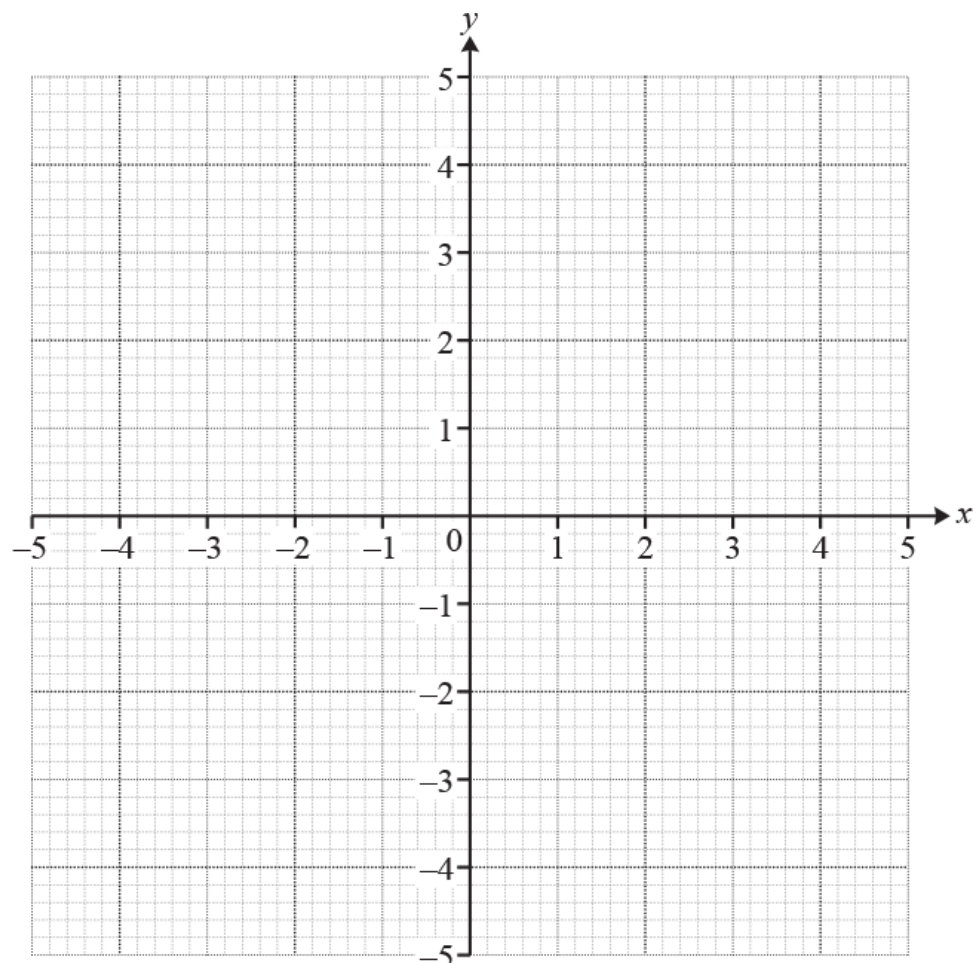
1. Find the coordinates of the point of intersection of the lines $y = 3x - 2$ and $x + 3y = 1$. [4]

2. Find the equation of the line which is perpendicular to the line $y = 2x - 5$ and which passes through the point $(4, 1)$. Give your answer in the form $y = ax + b$. [3]

3. A is the point $(1, 5)$ and B is the point $(6, -1)$. M is the midpoint of AB. Determine whether the line with equation $y = 2x - 5$ passes through M. [3]

4. Find the equation of the straight line through $(1, 5)$ which is perpendicular to the line with equation $2y = x + 3$. [3]

5. A straight line passes through $(0, 1)$ and has gradient -2 . Draw the graph of this line on the grid. [2]



6.

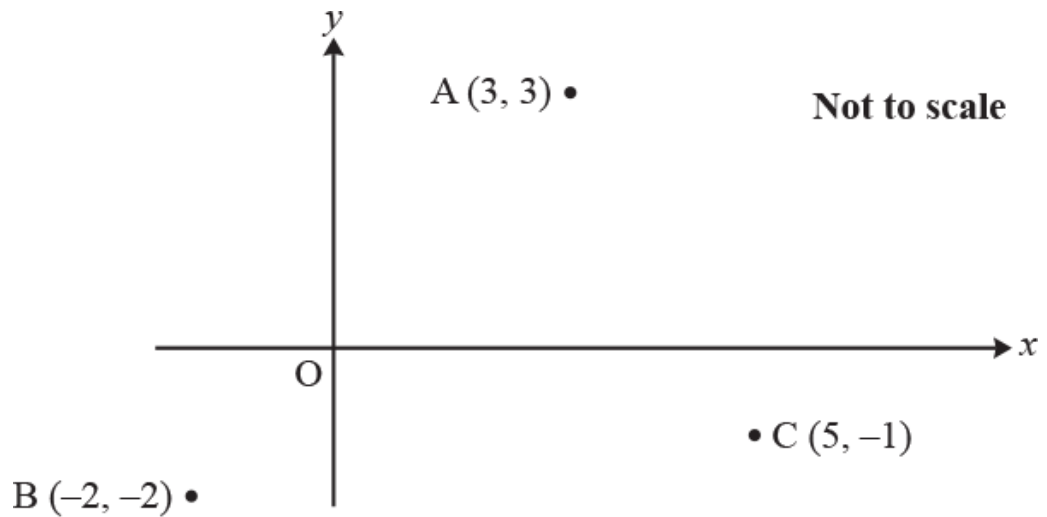


Fig. 10

Fig. 10 shows the points A (3, 3), B (-2, -2) and C (5, -1).

(i) Show that $AB = BC$. [2]

Find the equation of the line through B which is perpendicular to AC. Give your answer
(ii) in the form $y = mx + c$. [4]

(iii) Find the coordinates of point D such that ABCD is a rhombus. [2]

(iv) Determine, showing all your working, whether the point E (8, 3.8) lies inside or outside the rhombus ABCD. [4]

7. Fig. 4 shows rectangle ABCD. The point A lies on the y -axis and D is the point $(2, 1)$. The equation of BC is $y = 3x + 5$.

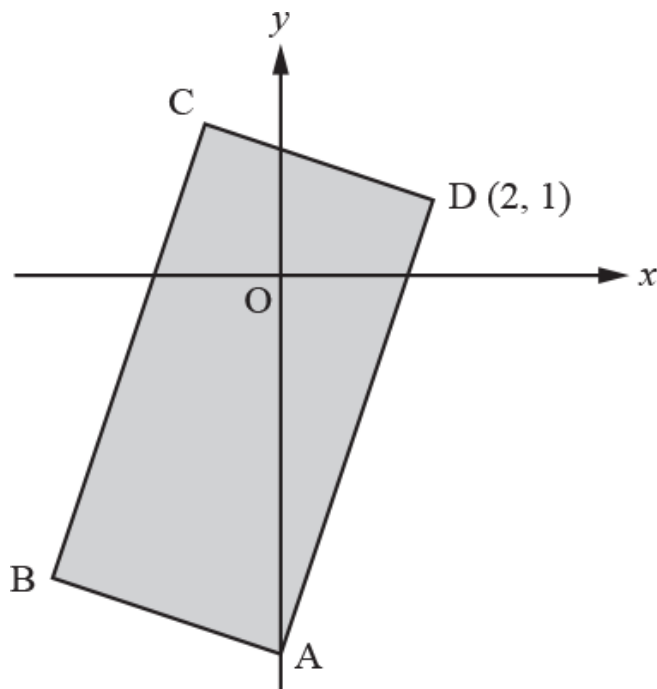


Fig. 4

- (a) Determine the coordinates of A. [3]
- (b) Determine the area of ABCD. [7]

END OF QUESTION paper

Mark scheme

Question		Answer/Indicative content	Marks	Part marks and guidance	
1		substitution to eliminate one variable	M1	or multiplication to make one pair of coefficients the same; condone one error in either method	independent of first M1
		simplification to $ax = b$ or $ax - b = 0$ form, or equivalent for y	M1	or appropriate subtraction / addition; condone one error in either method	
		(0.7, 0.1) oe or $x = 0.7, y = 0.1$ oe isw	A2	A1 each Examiner's Comments In the main, this question was completed well. Some candidates found the arithmetic challenging, especially if rearranging $x + 3y = 1$ to substitute in for y , with the resulting need to cope with fractions. A slight majority choose the substitution method rather than elimination. A few neglected to find y having found x .	
		Total	4		
2		$y = -0.5x + 3$ oe www isw	3	B2 for $2y = -x + 6$ oe	for 3 marks must be in form $y = ax + b$
				$= -\frac{1}{2}$ oe seen or used or M1 for gradient and M1 for $y - 1 = \text{their } m(x - 4)$ Examiner's Comments In finding the equation of the line, most candidates obtained full marks. The main mistake was to use a gradient of 2, due to confusion between	

				perpendicular and parallel. There was a significant number of arithmetic errors especially in coping with negative signs and the fraction $-\frac{1}{2}$.	
			Total	3	
3		<p>midpt M of</p> $AB = \left(\frac{1+6}{2}, \frac{5-1}{2} \right)$ <p>oe isw soi</p> <p>subst of their midpt into $y = 2x - 5$ and attempting to evaluate</p> <p>all work correct and 'Yes' oe</p>	<p>1</p> <p>condone lack of brackets; accept in the form $x = 7/2$ oe, $y = 2$ oe</p> <p>1</p> <p>eg $2 \times$ their $3.5 - 5 =$ their result</p> <p>accept $2 = 2 \times 3.5 - 5$</p> <p>Examiner's Comments</p> <p>Many obtained three marks here without any difficulty, with many candidates choosing to use the quick substitution of midpoint method to prove that the point was on the line. A minority failed to state a clear conclusion once this step had been performed. Longer methods were seen occasionally but were rarely completed successfully, with the equation of</p>	<p>alt methods: allow 2nd M1 for finding correct eqn of AB</p> $-\frac{6x}{5} + \frac{31}{5}$ <p>as $y =$ oe and</p> <p>attempting to solve as simult eqn with $y = 2x - 5$ for x or y</p> <p>or</p> <p>allow M1 for finding in unsimplified form the eqn of the line through their midpt with gradient 2 and A1 for showing it is $y = 2x - 5$, so Yes</p>	

					AB sometimes being found simply because the candidate did not know what to do.	
			Total	3		
4			Use of $-1/$ (their $\frac{1}{2}$) $y - 5 = -2(x - 1)$ $y = -2x + 7$	M1(AO 3.1a) M1(AO 1.1) A1(AO 1.1) [3]		
			Total	3		
5			correct ruled line of intercept (0, 1) and gradient -2 drawn on grid, extending at least from $(-1.5, 4)$ to $(2, -3)$, as per the circles on the overlay, tol. 1mm horizontally (ie half a square on the grid)	2	<p>M1 for correct line but eg not extending into 4th quadrant</p> <p>or M1 for line with correct gradient but wrong intercept</p> <p>or M1 for line with correct intercept and gradient negative but not -2</p> <p>or M1 for correct</p>	<p>NB page 12 shown in this image must be annotated as BP if blank.</p> <p>Highlight (to indicate seen) in q1 image of page 12 if just rough work crossed out.</p> <p>If a qn number is shown and relevant work seen, highlight the qn no in the q1 image then use full response view to link</p>

				[2]	<div style="border: 1px solid black; padding: 5px; display: inline-block; width: 100%;"> <p>plots but line not ruled</p> <p>page 12 to relevant question; also put a highlight by the image in the correct qn space to remind you there is extra work to look at.</p> </div> <p>Examiner's Comments</p> <p>Most candidates coped well with this question, usually scoring full marks. Errors included drawing a line with the wrong gradient, ie +2 or - 1/2 and marks were also dropped due to inaccurately drawn lines based upon plotting one point and roughly estimating where a gradient of -2 would be. It would have been much more accurate for those candidates to plot at least two points when drawing a straight line. If plotting points it would be wise for candidates to only mark a small point, not a large circular blob encompassing a complete square as some candidates did. It was sad to see some candidates not using a ruler and therefore drawing wobbly freehand lines.</p>	
			Total	2		
6		i	$AB^2 = 5^2 + 5^2 = 50$	B1	<div style="border: 1px solid black; padding: 5px; display: inline-block; width: 100%;"> <p>oe with AB; may go straight from correct unsimplified form to 50 with no interim working (applies to both marks), but for 2 marks any interim working must be correct</p> <p>for 2 marks to be awarded, notation used must be fully correct. Penalise only one mark if squares and square roots eg 50 and $\sqrt{50}$ confused, or brackets used incorrectly or AB and</p> </div>	

			$BC^2 = 7^2 + 1^2 = 50$	B1 [2]	<table border="1"> <tr> <td>oe with BC</td> <td>BC missing, etc, but working is otherwise correct</td> </tr> </table> <p>Examiner's Comments Many obtained two marks here without any difficulty. Candidates who used less formal notation often lost marks due to missing brackets or confusion about whether they were working with AB or AB^2. A few candidates confused lengths and gradients.</p>	oe with BC	BC missing, etc, but working is otherwise correct	
oe with BC	BC missing, etc, but working is otherwise correct							
		ii	$\text{grad AC} = \frac{-1-3}{5-3} [= -2] \text{ oe isw}$ <p>grad perp = $\frac{1}{2}$ or ft from their grad AC or finding gradient of their BF</p> $y + 2 = \text{their } \frac{1}{2}(x + 2)$ $\text{or } -2 = \text{their } \frac{1}{2}(-2) + c \text{ oe}$ $y = \frac{1}{2}x - 1 \text{ isw}$	B1 M1 M1 A1 [4]	<table border="1"> <tr> <td> <p>or midpt F of</p> $\text{AC} = \left(\frac{5+3}{2}, \frac{3-1}{2} \right)$ <p>may be seen in eqn of perp</p> <p>or using coords of their F; no ft for using their grad AC for this</p> <p>allow both M1s for eqn of line through B and their F</p> </td> <td> <p>must be a changed gradient related to grad AC, or be their grad BF, to score this M1</p> </td> </tr> </table> <p>Examiner's Comments This was completed well by the majority of candidates. A few quoted the gradient formula incorrectly or had difficulty simplifying the gradient</p>	<p>or midpt F of</p> $\text{AC} = \left(\frac{5+3}{2}, \frac{3-1}{2} \right)$ <p>may be seen in eqn of perp</p> <p>or using coords of their F; no ft for using their grad AC for this</p> <p>allow both M1s for eqn of line through B and their F</p>	<p>must be a changed gradient related to grad AC, or be their grad BF, to score this M1</p>	
<p>or midpt F of</p> $\text{AC} = \left(\frac{5+3}{2}, \frac{3-1}{2} \right)$ <p>may be seen in eqn of perp</p> <p>or using coords of their F; no ft for using their grad AC for this</p> <p>allow both M1s for eqn of line through B and their F</p>	<p>must be a changed gradient related to grad AC, or be their grad BF, to score this M1</p>							

					accurately, but were then able to find the associated perpendicular gradient and use the equation of a straight line well.	
		iii	(10, 4)	2	<p>B1 for each coordinate or M1 for use of $\overrightarrow{AD} = \overrightarrow{BC}, \overrightarrow{CD} = \overrightarrow{BA}$ or $\overrightarrow{BF} = \overrightarrow{FD}$ or for correct method for intersection of (ii) line and line through A parallel to BC [$y = 3 + \frac{1}{7}(x - 3)$]</p> <p>oe or $y = \frac{1}{7}x + \frac{18}{7}$</p> <p>oe if correct] or line through C parallel to BA [$y = x - 6$ if correct]</p> <p>allow SC1 for (-4, 2) for ADBC found, or (0, -6) for ABDC found [both parallelograms, not rhombi]</p>	<p>NB more complicated methods exist using simultaneous equations and eg grad BD = $\frac{1}{2}$ and $AD^2 = BC^2$</p>
				[2]	<p>Examiner's Comments</p> <p>This presented a challenge to a significant number of candidates, with those who chose not to use a vector related method often getting bogged down with complicated algebra. A common error was to not appreciate the importance of the letter order ABCD, and instead give ACDB or ACBD,</p>	

which earned partial credit but affected the difficulty of part (iv), so limiting the marks available there.

$$\text{grad AD} = \frac{4-3}{10-3} \text{ or } \frac{1}{7} \text{ or ft}$$

relevant D

from attempt at ABCD

iv

M1

however, if D = (0, -6), or (-4, 2) or other attempt at ABDC or ADBC in (iii), or other attempt where one or both coords of D are less than the corresponding coords of (8, 3.8) award only **SC1** in (iv) for showing by diagram or coordinates that E is obviously outside the rhombus ABDC eg since its x-coordinate is greater than the x-coordinate of all the vertices (or similarly y-coordinates)

some are working with CD only, not AD. Give M0 but allow SC1 for showing that CD is $y = x - 6$ and then finding on CD when $y = 3.8$, $x = 9.8$ or when $x = 8$, $y = 2$; allow ft from wrong but relevant D – see ‘however’ in previous column

M1

so when $x = 8$, y-coord. on AD =

$$3 + \frac{1}{7} \times (8 - 3) \text{ or ft}$$

or use of $y - 3 = \frac{1}{7}(8 - 3)$ oe or M1 for

may use coords of their D not A in eqn

$$= 3\frac{5}{7} \text{ or } 3.7\dots$$

$$3\frac{5}{7}$$

conclusion E is outside rhombus, with $3\frac{5}{7}$ shown to be less than 3.8 if not seen earlier, if y used

or

$$\text{grad AD} = \frac{4-3}{10-3} \left[= \frac{1}{7} \right] \text{ or ft their D}$$

A1

$$3.8 - 3 = \frac{1}{7}(x - 3)$$

oe, after correct method for finding eqn of AD using coords of A and D – need not be simplified [AD is

$$y = 3 + \frac{1}{7}(x - 3) \text{ oe}$$

$$\text{or } y = \frac{1}{7}x + \frac{18}{7} \text{ oe}$$

if correct]

A1

or on AD when $y = 3.8, x = 8.6$

or

no ft from wrong D

no ft from wrong D

M1

i.e. M1 for substituting one coord of E in their equation for AD after correct method seen for AD, or AD correct; condone substituting both coords of E

similarly may find line through E parallel to AD (M1 for gradient of AD as in first method

$$\text{grad AE} = \frac{0.8}{5} [=0.16]$$

grad

grad. AE shown to be greater than grad AD eg
 $0.16 > 0.14\dots$ or grad DE shown to be less than
 grad AD eg $0.1 < 0.14\dots$

conclusion E is outside rhombus

M1

A1

A1

[4]

or allow M1, for DE
 used, dep on first
 M1, for grad

$$\text{DE} = \frac{0.2}{2} [=0.1],$$

no ft from wrong D

no ft from wrong D;

and M1 for eqn

$$y = \frac{1}{7}x + (3.8 - \frac{8}{7})$$

oe and compare
 with eqn of AD

$$y = 3 + \frac{1}{7}(x - 3)$$

oe: A1 for showing

$$3.8 - \frac{8}{7} > \frac{18}{7}, \quad \text{A1}$$

for conclusion E is
 outside rhombus

the SC for working
 with CD rather than
 AD is also available
 if they use gradients
 – allow SC1 if they
 find grad CD = 1,
 and grad CE =
 $4.8/3$ or 1.6 or grad

$$\text{DE} \frac{0.2}{2} [=0.1]$$

					<table border="1"> <tr> <td>no ft from wrong D</td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </table> <p>Examiner's Comments</p> <p>This part required candidates to apply some reason and insight rather than just applying well-drilled techniques. Candidates would have found it helpful to sketch a diagram with their D marked, to ensure that they were comparing E to the correct line (AD). Most started by finding the equation of AD and a good number successfully used this to decide whether E was above or below AD. Some who</p> $y = 3\frac{5}{7}$ <p>substituted $x = 8$ into AD found</p> <p>did not prove that this is less than 3.8. Some compared with CD rather than AD. Some candidates used other methods, often efficiently, such as showing that the gradient of AE was greater than the gradient of AD.</p>	no ft from wrong D				
no ft from wrong D										
			Total	12						
7		a	<p>AB has gradient 3</p> $\frac{1 - y_2}{2} = 3$ <p>(0, -5)</p>	<p>B1(AO3.1a)</p> <p>M1(AO1.1)</p> <p>A1(AO2.2a)</p> <p>[3]</p>	<table border="1"> <tr> <td>Answer given as coordinates</td> <td></td> </tr> </table>	Answer given as coordinates				
Answer given as coordinates										

		<div data-bbox="320 76 701 164" style="border: 1px solid black; padding: 5px;"> AB has gradient $-\frac{1}{3}$ </div>		
		<div data-bbox="320 272 712 360" style="border: 1px solid black; padding: 5px;"> Equation of AB is $y = -\frac{1}{3}x - 5$ </div>	M1(AO3.1a)	
			M1(AO1.1)	
		<div data-bbox="320 504 739 592" style="border: 1px solid black; padding: 5px;"> AB meets BC where $-\frac{1}{3}x - 5 = 3x + 5$ </div>	M1(AO3.1a)	
	b			
		$3\frac{1}{3}x = -10 \Rightarrow x = -3$	A1(AO2.2a)	
		B is the point (-3, -4)	M1(AO1.1)	
		$AB = \sqrt{10}$	M1(AO1.1)	
		$AD = \sqrt{40}$	A1(AO2.2a)	
		Area = 20		
			[7]	
				<div data-bbox="965 328 1615 975" style="border: 1px solid black; padding: 10px;"> <p>Use of $m_1 m_2 = -1$</p> <p>Or gradient of DC</p> <p>Or DC is $y = -\frac{1}{3}x - 5$</p> <p>Or DC meets BC where $-\frac{1}{3}x - 5 = 3x + 5$</p> <p>$3\frac{1}{3}x = -10 \Rightarrow x = -3$</p> <p>Or C is (-1, 2)</p> </div>
		Total	10	