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 $y = ax + b$.

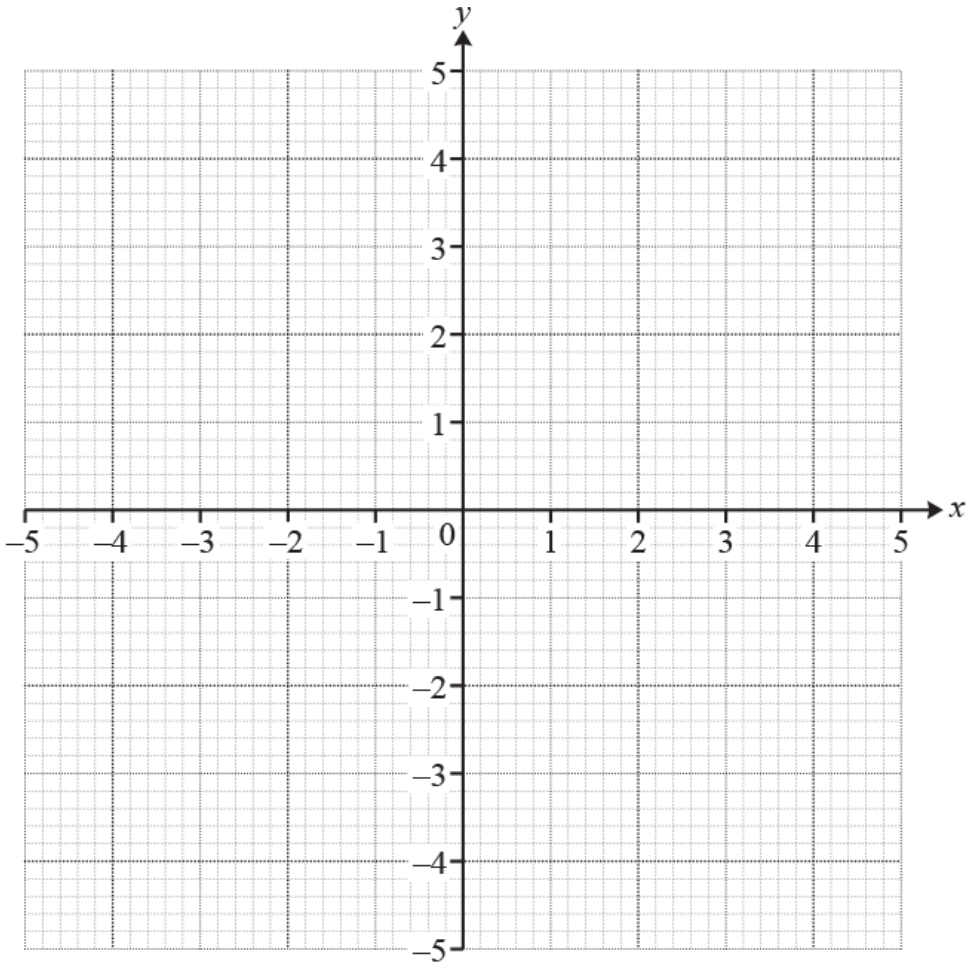
[3]

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.

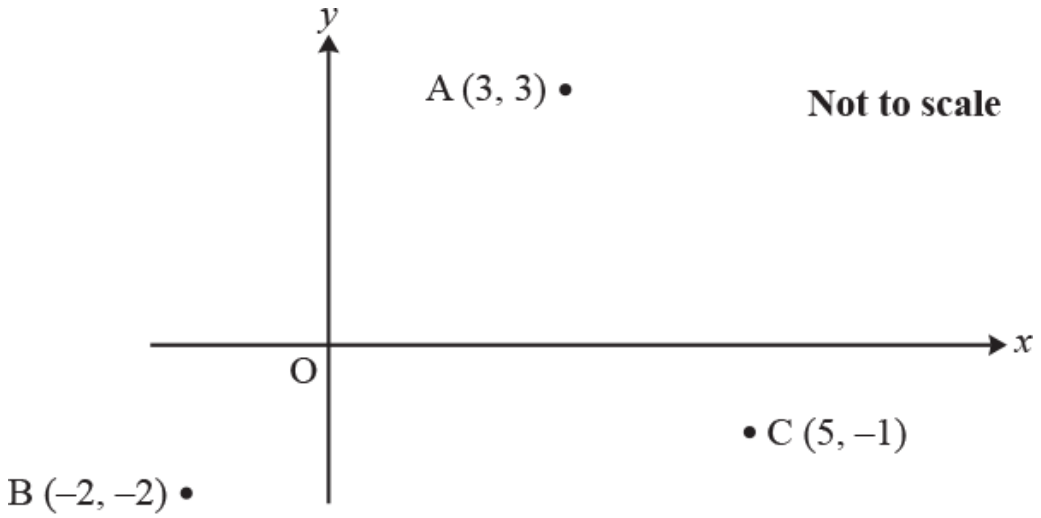


Fig. 10

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

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

(ii) Find the equation of the line through B which is perpendicular to AC. Give your answer 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
$y = 3x + 5$.

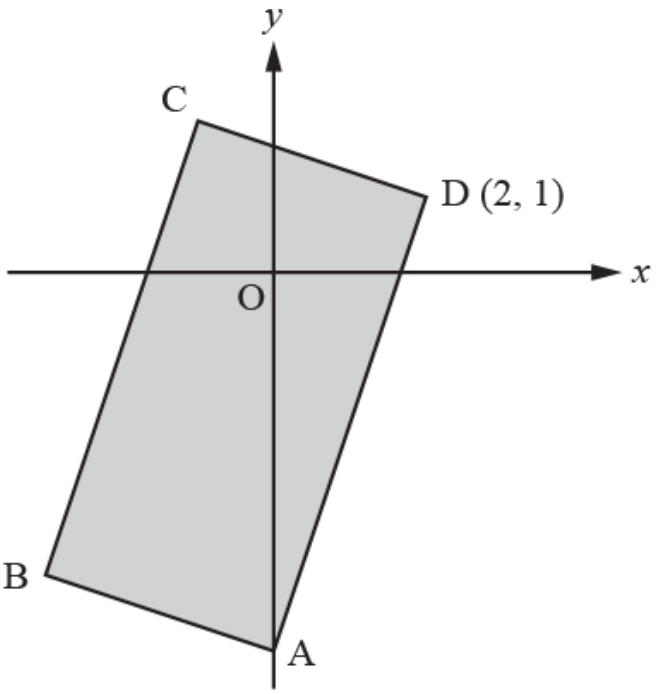


Fig. 4

(a) Determine the coordinates of A. **[3]**

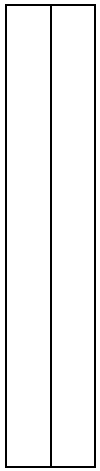
(b) Determine the area of ABCD. **[7]**

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	
			simplification to $ax = b$ or $ax - b = 0$ form, or equivalent for y	M1	or appropriate subtraction / addition; condone one error in either method	independent of first M1
					A1 each	
					Examiner's Comments	
			(0.7, 0.1) oe or $x = 0.7$, $y = 0.1$ oe isw	A2	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 or M1 for gradient $= -\frac{1}{2}$ oe seen or used 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	for 3 marks must be in form $y = ax + b$ or M1 for $y = \text{their } mx + c$ and (4, 1) substituted

					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			midpt M of AB = $\left(\frac{1+6}{2}, \frac{5-1}{2}\right)$ oe isw soi	1	condone lack of brackets; accept in the form $x = 7/2$ oe, $y = 2$ oe	alt methods: allow 2nd M1 for finding correct eqn of AB as $y = -\frac{6x}{5} + \frac{31}{5}$ oe and attempting to solve as simult eqn with $y = 2x - 5$ for x or y or 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
			subst of their midpt into $y = 2x - 5$ and attempting to evaluate	1	eg 2 × their 3.5 – 5 = their result accept 2 = 2 × 3.5 – 5	
			all work correct and 'Yes' oe	1	**Examiner's Comments** 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	

					AB sometimes being found simply because the candidate did not know what to do.	
			Total	**3**		
4			Use of –1/ (their ½) $y - 5 = -2(x - 1)$ $y = -2x + 7$	**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	**M1** for correct line but eg not extending into 4th quadrant or **M1** for line with correct gradient but wrong intercept or **M1** for line with correct intercept and gradient negative but not –2 or **M1** for correct	NB page 12 shown in this image must be annotated as BP if blank. Highlight (to indicate seen) in q1 image of page 12 if just rough work crossed out. 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

				[2]	plots but line not ruled 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. **Examiner's Comments** 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.	
			Total	**2**		
6		i	$AB^2 = 5^2 + 5^2 = 50$	B1	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 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	

			$BC^2 = 7^2 + 1^2 = 50$	B1 [2]	oe with BC	BC missing, etc, but working is otherwise correct	

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.

		ii	grad $AC = \frac{-1-3}{5-3}\left[=-2\right]$ oe isw grad perp = ½ or ft from their grad AC or finding gradient of their BF $y+2 = their\ \frac{1}{2}(x+2)$ or $-2 = their\ \frac{1}{2}(-2)+c$ oe $y = \frac{1}{2}x - 1$ isw	B1 M1 M1 A1 [4]	or midpt F of $AC = \left(\frac{5+3}{2}, \frac{3-1}{2}\right)$ may be seen in eqn of perp or using coords of their F; no ft for using their grad AC for this allow both M1s for eqn of line through B and their F	must be a changed gradient related to grad AC, or be their grad BF, to score this M1	

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

					accurately, but were then able to find the associated perpendicular gradient and use the equation of a straight line well.	
		iii	(10, 4)	2 [2]	**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 [$y=3+\frac{1}{7}(x-3)$ oe or $y=\frac{1}{7}x+\frac{18}{7}$ oe if correct] or line through C parallel to BA [$y = x - 6$ if correct] allow **SC1** for (–4 , 2) for ADBC found, or (0 , –6) for ABDC found [both parallelograms, not rhombi] NB more complicated methods exist using simultaneous equations and eg grad BD = ½ and $AD^2 = BC^2$ **Examiner's Comments** 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,	

					which earned partial credit but affected the difficulty of part (iv), so limiting the marks available there.	
		iv	grad $\text{AD} = \frac{4-3}{10-3}$ or $\frac{1}{7}$ or ft relevant D from attempt at ABCD so when $x = 8$, y–coord. on AD = $3+\frac{1}{7}\times(8-3)$ or ft	M1 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) or use of $y-3=\frac{1}{7}(8-3)$ oe or M1 for	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 may use coords of their D not A in eqn

			$= 3\frac{5}{7}$ or 3.7…	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 $y=3+\frac{1}{7}(x-3)$ oe or $y=\frac{1}{7}x+\frac{18}{7}$ oe if correct]	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	
			conclusion E is outside rhombus, with $3\frac{5}{7}$ shown to be less than 3.8 if not seen earlier, if y used	A1	or on AD when $y = 3.8$, $x = 8.6$ no ft from wrong D		
			or	or			
			grad $AD = \frac{4-3}{10-3}\left[=\frac{1}{7}\right]$ or ft their D	M1	no ft from wrong D	similarly may find line through E parallel to AD (M1 for gradient of AD as in first method	

			grad $AE = \frac{0.8}{5}$ [=0.16]	M1		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 $3.8 - \frac{8}{7} > \frac{18}{7}$, A1 for conclusion E is outside rhombus	
			grad. AE shown to be greater than grad AD eg 0.16 > 0.14… or grad DE shown to be less than grad AD eg 0.1 < 0.014…	A1	or allow M1, for DE used, dep on first M1, for grad $DE = \frac{0.2}{2}[=0.1]$, no ft from wrong D	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 $DE \frac{0.2}{2}[=0.1]$	
			conclusion E is outside rhombus	A1	no ft from wrong D;		
				[4]			

					no ft from wrong D **Examiner's Comments** 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 substituted x = 8 into AD found $y = 3\frac{5}{7}$ but 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.	
			Total	**12**		
7		a	AB has gradient 3 $\frac{1-y_2}{2}=3$ (0, –5)	B1(AO3.1a) M1(AO1.1) A1(AO2.2a) [3]	Answer given as coordinates	

		b	AB has gradient $-\frac{1}{3}$	M1(AO3.1a)		
			Equation of AB is $y=-\frac{1}{3}x-5$	M1(AO1.1)		
			AB meets BC where $-\frac{1}{3}x-5=3x+5$	M1(AO3.1a)		
			$3\frac{1}{3}x=-10\Rightarrow x=-3$	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]		
			Total	**10**		

Use of $m_1m_2 = -1$	Or gradient of DC Or DC is $y=-\frac{1}{3}x-5$ Or DC meets BC where $-\frac{1}{3}x-5=3x+5$ $3\frac{1}{3}x=-10\Rightarrow x=-3$ Or C is (–1, 2)