1			$y = 4x + 10$	B3	**M1** for $y = 4x + b$ oe and **M1** for $y - 6 =$ their a $(x + 1)$ oe or for $(-1, 6)$ subst in $y =$ (their a)$x + b$ oe or **M1** for $y = ax + 10$	
			(0, 10) or ft	B1	condone $y = 10$ isw	condone lack of brackets and eg $y = 10$, $x = -2.5$ or ft isw but B0, SC1 for poor notation such as $(-2.5, 10)$ with no better answers seen
			$(-10/4, 0)$ oe or ft	B1 **[5]**	condone $x = -10/4$ isw	Throughout the scheme, note that for evaluated rational answers, unless specified otherwise, fractional or decimal equivalents are acceptable, but not triple-decker fractions etc; integer answers must be simplified to an integer

2			$x + 3(5x - 2) = 8$ or $y = 5(8 - 3y) - 2$	M1	for subst to eliminate one variable; condone one error;	or multn or divn of one or both eqns to get a pair of coeffts the same, condoning one error
			$16x = 14$ or $16y = 38$	M1	for collecting terms and simplifying; condoning one error ft	appropriate addn or subtn to eliminate a variable, condoning an error in one term; if subtracting, condone eg y instead of 0 if no other errors
			$(7/8, 19/8)$ oe	A2 **[4]**	or $x = 14/16$, $y = 38/16$ oe isw allow **A1** for each coordinate	

3			midpt M of AB = $\left(\frac{1+6}{2}, \frac{5-1}{2}\right)$ oe isw soi	M1	condone lack of brackets; accept in the form $x = 7/2$ oe, $y = 2$ oe	
			subst of their midpt into $y = 2x - 5$ and attempting to evaluate	M1	eg 2 × their 3.5 − 5 = their result accept 2 = 2 × 3.5 − 5	<u>alt methods</u>: allow 2nd M1 for finding correct eqn of AB as $y = -\frac{6x}{5} + \frac{31}{5}$ oe <u>and</u> 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
			all work correct and 'Yes' oe	A1 **[3]**		

4			$y = -0.5x + 3$ oe www isw	3 **[3]**	B2 for $2y = -x + 6$ oe or M1 for gradient = $-\frac{1}{2}$ oe seen or used and M1 for $y - 1 =$ *their m* $(x - 4)$	for 3 marks must be in form $y = ax + b$ or M1 for $y =$ *their* $mx + c$ and (4, 1) substituted

5	**(i)**		midpt of AB = $\left(\frac{1}{2}, \frac{5}{2}\right)$ oe www	B2	allow unsimplified B1 for one coordinate correct	if working shown, should come from $\left(\frac{3+-2}{2}, \frac{4+1}{2}\right)$ oe NB B0 for x coord. = $\frac{5}{2}$, (obtained from subtraction instead of addition)
			grad AB = $\frac{4-1}{3-(-2)}$ oe	M1	must be obtained independently of given line; accept 3 and 5 correctly shown eg in a sketch, followed by 3/5 M1 for rise/run = 3/5 etc M0 for just 3/5 with no evidence	for those who find eqn of AB first, M0 for just $\frac{y-4}{1-4} = \frac{x-3}{-2-3}$ oe, but M1 for $y-4 = \frac{1-4}{-2-3}(x-3)$ oe ignore their going on to find the eqn of AB after finding grad AB
			using gradient of AB to obtain grad perp bisector	M1	for use of $m_1 m_2 = -1$ soi or ft their gradient AB M0 for just $\frac{-5}{3}$ without AB grad found	this second M1 available for starting with given line = $\frac{-5}{3}$ and obtaining grad. of AB from it
			$y - 2.5 = \frac{-5}{3}(x - 0.5)$ oe	M1	eg M1 for $y = \frac{-5}{3}x + c$ and subst of midpt; ft their gradient of perp bisector and midpt; M0 for just rearranging given equation	no ft for gradient of AB used

			completion to given answer $3y + 5x = 10$, showing at least one interim step	M1 **[6]**	condone a slight slip if they recover quickly and general steps are correct (eg sometimes a slip in working with the c in $y = \frac{-5}{3}x + c$ - condone $3y = -5x + c$ followed by substitution and consistent working) M0 if clearly 'fudging'	NB answer given; mark process not answer; annotate if full marks not earned eg with a tick for each mark earned scores such as B2M0M0M1M1 are possible after B2, allow full marks for complete method of showing given line has gradient perp to AB (grad AB must be found independently at some stage) and passes through midpt of AB
5	**(ii)**		$3y + 5(4y - 21) = 10$ $(-1, 5)$ or $y = 5$, $x = -1$ isw	M1 A2 **[3]**	or other valid strategy for eliminating one variable attempted eg $\frac{-5}{3}x + \frac{10}{3} = \frac{x}{4} + \frac{21}{4}$; condone one error A1 for each value; if AO allow SC1 for both values correct but unsimplified fractions, eg $\left(\frac{-23}{23}, \frac{115}{23}\right)$	or eg $20y = 5x + 105$ and subtraction of two eqns attempted no ft from wrong perp bisector eqn, since given allow M1 for candidates who reach $y = 115/23$ and then make a worse attempt, thinking they have gone wrong NB M0A0 in this part for finding E using info from (iii) that implies E is midpt of CD

5	**(iii)**		$(x-a)^2+(y-b)^2=r^2$ seen or used	M1	or for $(x+1)^2+(y-5)^2=k$, or ft their E, where $k>0$	
			1^2+4^2 oe (may be unsimplified), from clear use of A or B	M1	for calculating AE or BE or their squares, or for subst coords of A or B into circle eqn to find r or r^2, ft their E;	this M not earned for use of CE or DE or ½ CD NB some cands finding $AB^2=34$ then obtaining 17 erroneously so M0
			$(x+1)^2+(y-5)^2=17$	A1	for eqn of circle centre E, through A and B; allow A1 for $r^2=17$ found after $(x+1)^2+(y-5)^2=r^2$ stated and second M1 clearly earned if $(x+1)^2+(y-5)^2=17$ appears without clear evidence of using A or B, allow the first M1 then M0 SC1	SC also earned if circle comes from C or D and E, but may recover and earn the second M1 later by using A or B
			showing midpt of CD = (–1, 5)	M1		
			showing CE or DE = $\sqrt{17}$ oe or showing one of C and D on circle	M1	alt M1 for showing $CD^2=68$ oe allow to be earned earlier as an invalid attempt to find r	

				[5]	showing that both C and D are on circle and commenting that E is on CD is enough for last M1M1; similarly showing $CD^2 = 68$ and both C and D are on circle oe earns last M1M1	other methods exist, eg: may find eqn of circle with centre E and through C or D and then show that A and B and other of C/D are on this circle – the marks are then earned in a different order; award M1 for first fact shown and then final M1 for completing the argument; if part-marks earned, annotate with a tick for each mark earned beside where earned

6			$y = -2x + 7$ isw (0, 7) and (3.5, 0) oe or ft their $y = -2x + c$	2 1 **[3]**	M1 for $y - 1 = -2(x - 3)$ or $1 = -2 \times 3 + c$ oe	condone lack of brackets and eg $y = 7$, $x = 3.5$ or ft isw but 0 for poor notation such as (3.5, 7) and no better answers seen

7			$4k^2 - 4 \times 1 \times 5$ or $k^2 - 5$ [< 0] oe or $[(x + k)^2 +]\ 5 - k^2$ [> 0] oe	M2	allow =, > , ≤ etc instead of < or M1 for $b^2 - 4ac$ soi (may be in formula) or for attempt at completing square	allow M2 for $2k^2 < 20$, $2k^2 - 20 = 0$ etc but M1 only for just $2k^2 - 20$ ignore rest of quadratic formula ignore $\sqrt{b^2 - 4ac} < 0$ seen if $b^2 - 4ac < 0$ then used, otherwise just M1 for $\sqrt{b^2 - 4ac} < 0$
			$-\sqrt{5} < k < \sqrt{5}$	A2 **[4]**	may be two separate inequalities or A1 for one 'end' correct or B1 for 'endpoint' = $\sqrt{5}$	allow SC1 for $-\sqrt{10} < k < \sqrt{10}$ following at least M1 for $2k^2 - 20$ oe

8	**(i)**		$AB^2 = (1-(-1))^2 + (5-1)^2$	M1	oe, or square root of this; condone poor notation re roots; condone $(1+1)^2$ instead of $(1-(-1))^2$ allow M1 for vector AB = $\begin{pmatrix}-2\\-4\end{pmatrix}$, condoning poor notation, or triangle with hyp AB and lengths 2 and 4 correctly marked	
			$BC^2 = (3-(-1))^2 + (-1-1)^2$	M1	oe, or square root of this; condone poor notation re roots; condone $(3+1)^2$ instead of $(3-(-1))^2$ oe allow M1 for vector BC = $\begin{pmatrix}4\\-2\end{pmatrix}$, condoning poor notation, or triangle with hyp BC and lengths 4 and 2 correctly marked	
			shown equal eg $AB^2 = 2^2 + 4^2$ [=20] and $BC^2 = 4^2 + 2^2$ [=20] with correct notation for final comparison	A1 **[3]**	or statement that AB and BC are each the hypotenuse of a right-angled triangle with sides 2 and 4 so are equal SC2 for just $AB^2 = 2^2 + 4^2$ and $BC^2 = 4^2 + 2^2$ (or roots of these) with no clearer earlier working; condone poor notation	eg A0 for AB = 20 etc

8	**(ii)**		[grad. of AC =] $\frac{5-(-1)}{1-3}$ or $\frac{6}{-2}$ oe	M1	award at first step shown even if errors after	
			[grad. of BD =] $\frac{5-1}{11-(-1)}$ or $\frac{4}{12}$ oe	M1		if one or both of grad AC = -3 and grad BD = 1/3 seen without better working for both gradients, award one M1 only. For M1M1 it must be clear that they are obtained independently
			showing or stating product of gradients = –1 or that one gradient is the negative reciprocal of the other oe	B1 **[3]**	eg accept $m_1 \times m_2 = -1$ or 'one gradient is negative reciprocal of the other' B0 for 'opposite' used instead of 'negative' or 'reciprocal'	may be earned independently of correct gradients, but for all 3 marks to be earned the work must be fully correct

8	**(iii)**		midpoint E of AC = (2, 2) www	B1	condone missing brackets for both B1s	0 for ((5+ –1)/2, (1+3)/2) = (2, 2)
			eqn BD is $y = \frac{1}{3}x + \frac{4}{3}$ oe	M1	accept any correct form isw or correct ft their gradients or their midpt F of BD this mark will often be gained on the first line of their working for BD	may be earned using (2, 2) but then must independently show that B or D or (5, 3) is on this line to be eligible for A1
			eqn AC is $y = -3x + 8$ oe	M1	accept any correct form isw or correct ft their gradients or their midpt E of AC this mark will often be gained on the first line of their working for AC [see appendix for alternative methods instead showing E is on BD for this M1]	if equation(s) of lines are seen in part ii, allow the M1s if seen/used in this part
			using both lines and obtaining intersection E is (2, 2) (NB must be independently obtained from midpt of AC)	A1		[see appendix for alternative ways of gaining these last two marks in different methods]
			midpoint F of BD = (5,3)	B1	this mark is often earned earlier	
					see the appendix for some common alternative methods for this question; for all methods, for A1 to be earned, all work for the 5 marks must be correct	for all methods show annotations M1 B1 etc then omission mark or A0 if that mark has not been earned
				[5]		

9			grad = –1/5 oe	M1		allow embedded eg $5 \times -\frac{1}{5} = -1$
			$y - 6 =$ their m $(x - 1)$ or $6 =$ their m [× 1] + c	M1		if first M1 not earned, allow second M1 for $y - 6 = k(x - 1)$ oe, k any number except 0 and 1
			$y = -0.2x + 6.2$ oe isw	A1 **[3]**	terms collected, with y as subject or for $a = -0.2$, $b = 6.2$ oe	allow A1 for $c = 6.2$ oe if $y = -0.2x + c$ oe already seen condone $y = \frac{-x+31}{5}$ for A1