1 **(i)**	grad AB = $\frac{1-3}{5-(-1)}$ [= −1/3] $y - 3$ = their grad $(x - (-1))$ or $y - 1$ = their grad $(x - 5)$ $y = -1/3x + 8/3$ or $3y = -x + 8$ o.e isw	**M1** **M1** **A1**	 or use of y = their gradient $x + c$ with coords of A or B or **M2** for $\frac{y-3}{1-3} = \frac{x-(-1)}{5-(-1)}$ o.e. o.e. eg $x + 3y - 8 = 0$ or $6y = 16 - 2x$ allow **B3** for correct eqn www
1 **(ii)**	when $y = 0$, $x = 8$; when $x = 0$, $y = 8/3$ or ft their (i) [Area =] $\frac{1}{2} \times 8/3 \times 8$ o.e. cao isw	**M1** **M1**	allow $y = 8/3$ used without explanation if already seen in eqn in (i) NB answer 32/3 given; allow $4 \times 8/3$ if first M1 earned; or M1 for $\int_0^8 \left[\frac{1}{3}(8-x)\right]dx = \left[\frac{1}{3}\left(8x - \frac{1}{2}x^2\right)\right]_0^8$ and M1 dep for $\frac{1}{3}(64 - 32[-0])$

1 **(iii)**	grad perp = −1/grad AB stated, or used after their grad AB stated in this part	**M1**	or showing $3 \times -1/3 = -1$ if (i) is wrong, allow the first M1 here ft, provided the answer is correct ft
	midpoint [of AB] = (2, 2)	**M1**	must state 'midpoint' or show working
	$y - 2$ = their grad perp $(x - 2)$ or ft their midpoint	**M1**	for **M3** this must be correct, starting from grad AB = −1/3, and also needs correct completion to given ans $y = 3x - 4$
	<u>alt method working back from ans</u>:	**or**	mark one method or the other, to benefit of candidate, not a mixture
	grad perp = −1/grad AB and showing/stating same as given line	**M1**	eg stating $-1/3 \times 3 = -1$
	finding intn of their $y = -1/3x - 8/3$and $y = 3x - 4$ is (2, 2)	**M1**	or showing that (2, 2) is on $y = 3x - 4$, having found (2, 2) first
	showing midpt of AB is (2, 2)	**M1**	[for both methods: for **M3** must be fully correct]

1 (iv)	subst $x = 3$ into $y = 3x - 4$ and obtaining centre = (3, 5) $r^2 = (5-3)^2 + (1-5)^2$ o.e. $r = \sqrt{20}$ o.e. cao eqn is $(x-3)^2 + (y-5)^2 = 20$ or ft their r and y-coord of centre	**M1** **M1** **A1** **B1**	or using $(-1-3)^2 + (3-b)^2 = (5-3)^2 + (1-b)^2$ and finding (3, 5) or $(-1-3)^2 + (3-5)^2$ or ft their centre using A or B condone $(x-3)^2 + (y-b)^2 = r^2$ o.e. or $(x-3)^2 + (y - \text{their } 5)^2 = r^2$ o.e. (may be seen earlier)

2 (ii)	$5x + 2(5 - x) = 20$ o.e. (10/3, 5/3) www isw	**M1** **A2**	for subst or for multn to make coeffts same and appropriate addn/subtn; condone one error or **A1** for $x = 10/3$ and **A1** for $y = 5/3$ o.e. isw; condone 3.33 or better and 1. or better **A1** for (3.3, 1.7)

3	$x^2 - 5x + 7 = 3x - 10$ $x^2 - 8x + 17$ [= 0] o.e or $y^2 - 4y + 13$ [= 0] o.e use of $b^2 - 4ac$ with numbers subst (condone one error in substitution) (may be in quadratic formula) $b^2 - 4ac = 64 - 68$ or -4 cao [or 16 – 52 or -36 if y used] [< 0] so no [real] roots [so line and curve do not intersect]	**M1** **M1** **M1** **A1** **A1**	or attempt to subst $(y + 10)/3$ for x condone one error; allow **M1** for $x^2 - 8x = -17$ [oe for y] only if they go on to completing square method or $(x - 4)^2 = 16 - 17$ or $(x - 4)^2 + 1 = 0$ (condone one error) or $(x - 4)^2 = -1$ or $x = 4 \pm \sqrt{-1}$ [or $(y - 2)^2 = -9$ or $y = 2 \pm \sqrt{-9}$] or conclusion from comp. square; needs to be explicit correct conclusion and correct ft; allow '< 0 so no intersection' o.e.; allow '-4 so no roots' etc allow A2 for full argument from sum of two squares = 0; A1 for weaker correct conclusion some may use the condition $b^2 < 4ac$ for no real roots; allow equivalent marks, with first A1 for 64 < 68 o.e.

4 (i)	grad CD = $\frac{5-3}{3-(-1)}\left[=\frac{2}{4} \text{ o.e.}\right]$ isw grad AB = $\frac{3-(-1)}{6-(-2)}$ or $\frac{4}{8}$ isw same gradient so parallel www	**M1** **M1** **A1**	NB needs to be obtained independently of grad AB must be explicit conclusion mentioning 'same gradient' or 'parallel' if M0, allow **B1** for 'parallel lines have same gradient' o.e.
4 (ii)	$[BC^2=]\ 3^2 + 2^2$ $[BC^2 =]\ 13$ showing $AD^2 = 1^2 + 4^2$ [=17] [$\neq BC^2$] isw	**M1** **A1** **A1**	accept $(6 - 3)^2 + (3 - 5)^2$ o.e. or [BC =] $\sqrt{13}$ or [AD =] $\sqrt{17}$ or equivalent marks for finding AD or AD^2 first alt method: showing AC $\neq$ BD – mark equivalently

4 (iii)	[BD eqn is] $y = 3$ eqn of AC is $y - 5 = 6/5 \times (x - 3)$ o.e [$y = 1.2x + 1.4$ o.e.] M is (4/3, 3) o.e. isw	**M1** **M2** **A1**	eg allow for 'at M, $y = 3$' or for 3 subst in eqn of AC or **M1** for grad AC = 6/5 o.e. (accept unsimplified) and M1 for using their grad of AC with coords of A(−2, −1) or C (3, 5) in eqn of line or **M1** for 'stepping' method to reach M allow : at M, $x = 16/12$ o.e. [eg =4/3] isw A0 for 1.3 without a fraction answer seen
4 (iv)	midpt of BD = (5/2, 3) or equivalent simplified form cao midpt AC = (1/2, 2) or equivalent simplified form cao or 'M is 2/3 of way from A to C' conclusion 'neither diagonal bisects the other'	**M1** **M1** **A1**	or showing BM ≠ MD oe [BM = 14/3, MD = 7/3] or showing AM ≠ MC or $AM^2 \neq MC^2$ in these methods A1 is dependent on coords of M having been obtained in part (iii) or in this part; the coordinates of M need not be correct; it is also dependent on midpts of both AC and BD attempted, at least one correct alt method: show that mid point of BD does not lie on AC (M1) and vice-versa (M1), A1 for both and conclusion

5	(0, 14) and (14/4, 0) o.e. isw	4	M2 for evidence of correct use of gradient with (2, 6) eg sketch with 'stepping' or $y - 6 = -4(x - 2)$ seen or $y = -4x + 14$ o.e. or M1 for $y = -4x + c$ [accept any letter or number] and M1 for $6 = -4 \times 2 + c$; A1 for (0, 14) [$c = 14$ is not sufficient for A1] and A1 for (14/4, 0) o.e.; allow when $x = 0$, $y = 14$ etc isw	4

6		$y = 3x$	2	M1 for grad AB = $\frac{1-3}{6}$ or − 1/3 o.e.	2
	ii	eqn AB is $y = -1/3\ x + 3$ o.e. or ft $3x = -1/3x + 3$ or ft $x = 9/10$ or 0.9 o.e. cao $y = 27/10$ oe ft their 3 × their x	M1 M1 A1 A1	need not be simplified; no ft from midpt used in (i); may be seen in (i) but do not give mark unless used in (ii) eliminating x or y , ft their eqns if find y first, cao for y then ft for x ft dep on both Ms earned	4
	iii	$\left(\frac{9}{10}\right)^2\left(1+3^2\right)$ o.e completion to given answer	2	or square root of this; M1 for $\left(\frac{9}{10}\right)^2+\left(\frac{27}{10}\right)^2$ or 0.81 + 7.29 soi or ft their coords (inc midpt) <u>or</u> M1 for distance = 3 cos θ and tan θ = 3 and M1 for showing $\sin\theta=\frac{3}{\sqrt{10}}$ and completion	2
	iv	$2\sqrt{10}$	2	1 for $6^2 + 2^2$ or 40 or square roots of these	2
	v	9 www or ft their $a\sqrt{10}$	2	M1 for ½ × 3 × 6 or $\frac{1}{2}\times\text{their}2\sqrt{10}\times\frac{9}{10}\sqrt{10}$	2
					12