Question Number	Scheme	Marks
2(a)	Midpoint of $(-2,5)$ and $(4,15)$ is $\left(\frac{-2+4}{2},\frac{5+15}{2}\right)=(1,10)$	B1
	Attempts radius ^{2} or diameter ^{2}: e.g. $D^2=(4--2)^2+(15-5)^2=136$	M1
	Radius^2 = 34	A1
	$(x-1)^2+(y-10)^2=34$	M1, A1
		(5)
(b)	$(1,10-\sqrt{34})$	B1 , dB1
		(2)
		(7 marks)

(a)

B1: Finds the midpoint of the two given points. Must be simplified to score this mark.
Can be implied by circle formula. Allow e.g. $x=1,\ y=10$ or may be without brackets. May be seen on a diagram.

M1: Attempts to find the radius^2 or diameter^2. Can be implied by the circle formula e.g.
$(x\pm...)^2+(y\pm...)^2=34$
It does not need to be correctly labelled but they must be attempting to find the difference between the *x* coordinates and the difference between the *y* coordinates before squaring.
Condone square rooting to find the radius or diameter (which may be all that is seen)
e.g. $2\sqrt{34}$, $\sqrt{136}$ $(=11.66..)$, $\sqrt{34}$ $(=5.83...)$. Allow decimals for this mark.
May be seen embedded within $x^2+y^2+2fx+2gy+c=0$

A1: Calculates the radius^2 = 34 o.e. (or allow to be implied by radius = $\sqrt{34}$)
Can be implied by circle formula or a value of $c=67$ in $x^2+y^2+2fx+2gy+c=0$

M1: Attempts correct form for the circle $(x\pm"1")^2+(y\pm"10")^2="34"$ or $(x\pm"1")^2+(y\pm"10")^2=\frac{"136"}{4}$
Do not allow this mark if they have clearly attempted to use their radius instead of their radius^2
If they have found the length of the diameter or diameter^2 however they have labelled it, then they must have attempted to divide by 4.
They may alternatively attempt $x^2+y^2+2fx+2gy+c=0$ where $f="\pm1"$, $g="\pm10"$ and $c="\pm67"$
If a centre has not been found or attempted with just values appearing in the equation then they must be correct.

A1: $(x-1)^2+(y-10)^2=34$ but not $(x-1)^2+(y-10)^2=\left(\sqrt{34}\right)^2$ isw after a correct answer
Also allow equivalent expressions e.g. $x^2+y^2-2x-20y+67=0$

(b) Note coordinates may be seen on a diagram. Do not allow $x=1$ if just the midpoint from (a) is stated.

B1: Either $x=1$ or $y=10-\sqrt{34}$ Condone lack of labelling for this mark.
Isw after an exact coordinate is seen.

dB1: Both $x=1$ and $y=10-\sqrt{34}$ Isw after both exact coordinates are seen. **Note B0B1 is not possible.**

Question Number	Scheme	Marks
3	$\int_1^4 3x+\frac{16}{x^2}-8\,\mathrm{d}x=\frac{3}{2}x^2-\frac{16}{x}-8x \quad (+c)$ e.g. Area $=\frac{3}{2}(5+11)-\left[\frac{3}{2}x^2-\frac{16}{x}-8x\right]_1^4=24-\left(-12+\frac{45}{2}\right)=\frac{27}{2}$	M1, A1, A1 dM1, A1 **(5)** **(5 marks)**

M1: Attempts to integrate the curve and achieves at least one term with the correct index i.e. $x\to x^2$, $x^{-2}\to x^{-1}$ or $-8\to\pm 8x$ (indices do not need to be processed for this mark e.g. $x\to x^{1+1}$)

A1: Two correct terms from $\frac{3}{2}x^2-\frac{16}{x}-8x$, may be unsimplified but indices must be processed.
Allow equivalent forms.

A1: $\frac{3}{2}x^2-\frac{16}{x}-8x$, may be unsimplified. Allow the presence of the constant of integration.
Do not be concerned with spurious notation or any limits.

dM1: Full method including correct area (value or expression) of trapezium. The expression with correct limits substituted in or partially evaluated as evidence is sufficient for this mark and condone subtracting either way round. They cannot just proceed to the final answer without additional evidence of using the limits. Note area of trapezium = 24, area under curve = 10.5.
Condone slips in evaluating some of the terms provided the intention is clear.

A1: 13.5 o.e following all previous marks scored. Note if they use the limits the wrong way round resulting in a negative value for the integral then we must see that calculated correctly before they state the area is 13.5

Alternative: line – curve

$$\int_1^4 (13-2x)-\left(3x+\frac{16}{x^2}-8\right)\mathrm{d}x=\int_1^4\left(-5x-\frac{16}{x^2}+21\right)\mathrm{d}x=\left[-\frac{5x^2}{2}+\frac{16}{x}+21x\right]_1^4=48-\frac{69}{2}=\frac{27}{2}$$

Note: They may not fully simplify/collect terms in this method so score according to the main scheme for the first 3 marks.

M1: Attempts to integrate and achieves at least one term with the correct index . i.e. $x\to x^2$, $x^{-2}\to x^{-1}$ or $"21"\to"\pm 21"x$ (allow slips in their collecting terms). Indices do not need to be processed for this mark.

A1: Two correct terms from $-\frac{5x^2}{2}+\frac{16}{x}+21x$, which may be unsimplified but indices must be processed.
Allow equivalent forms including terms which have not been collected.

A1: Correct integration, may be unsimplified. Allow the presence of the constant of integration.
Allow equivalent forms including terms which have not been collected.
Do not be concerned with spurious notation or any limits.