Question Number	Scheme	Marks	AOs
6 (a)	Attempts a scale factor $\frac{10}{4},\frac{4}{10}$ o.e.	M1	3.1a
	$p=-15$	A1	1.1b
		(2)	
(b)	Attempts either $\lvert\mathbf{a}+\mathbf{c}\rvert=\left\lvert\begin{pmatrix}4+q\\-3\end{pmatrix}\right\rvert=\sqrt{(4+q)^2+9}$ **or** $\lvert\mathbf{d}\rvert=\sqrt{30^2+6^2}$ $\left\{=\sqrt{936}=6\sqrt{26}\right\}$	M1	1.1b
	$2\lvert\mathbf{a}+\mathbf{c}\rvert=\lvert\mathbf{d}\rvert\Rightarrow 4\left((4+q)^2+9\right)=30^2+6^2$ $\{=936\}$	dM1	1.1b
	$(4+q)^2=225\Rightarrow 4+q=\pm15\Rightarrow q=...$ **or** $q^2+8q-209=0\Rightarrow q=...$	ddM1	2.1
	$\Rightarrow q=11,-19$	A1	1.1b
		(4)	
			(6 marks)
Notes:			

(a)

M1: Uses the fact that the vectors are parallel and attempts a scale factor.

May be implied by e.g. $\begin{pmatrix}4\\-6\end{pmatrix}=\lambda\begin{pmatrix}10\\p\end{pmatrix}\Rightarrow\lambda=...$ or $4=10\lambda\Rightarrow\lambda=...$

A1: $p=-15$ Sight of this with no incorrect working scores both marks including e.g. $\begin{pmatrix}10\\-15\end{pmatrix}$

Note $p=-15\mathbf{j}$ scores M1A0.

(b)

M1: Attempts a correct method of finding the modulus or modulus^2 for either vector **a** + **c** or **d**.
If using **a** + **c** then they must clearly be adding the vectors.
Condone incorrect labelling, e.g., $\lvert\mathbf{a}+\mathbf{c}\rvert=(4+q)^2+9$ as it is not a "show that".

dM1: Uses the information to set up a quadratic equation in q with square roots removed.
Dependent on the previous method mark.
When finding $\lvert\mathbf{a}+\mathbf{c}\rvert$ they must clearly be adding the vectors.

Correct algebraic work is required but condone poor squaring e.g. $(4+q)^2=16+q^2$ and numerical slips such as failure to square the 2 i.e. $2\left((4+q)^2+9\right)=30^2+6^2$ or omission of the 2 i.e. $(4+q)^2+9=30^2+6^2$

Similarly, condone failure to multiply both components of **a** + **c** by 2 leading to e.g.
$\sqrt{(8+2q)^2+3^2}=\sqrt{30^2+6^2}$

Use of $|\mathbf{a}+\mathbf{c}| \to |\mathbf{a}|+|\mathbf{c}|$ is dM0, as is poor square rooting e.g. $\sqrt{q^2+8q+25} = \sqrt{q^2+8q} + 5$

ddM1: Full and complete attempt to find at least one value for q, condoning failure to square the 2 or similar.

Dependent on both previous method marks.

If they expand the brackets, then for this mark they must achieve a 3TQ and go on to solve it using the usual rules. They may also use a calculator, in which case values will need checking.

Note that the correct 3TQ is $4q^2+32q-836=0$ or $q^2+8q-209=0$

Note also that if they fail to square the 2 then they are likely to achieve $2q^2+16q-886=0$ or $q^2+8q-443=0$ which leads to $q=-4\pm3\sqrt{51}$

A1: cao Both $q=11,-19$ and no others. Must be simplified. A0 if either value is rejected.

Note: You may see correct answers coming from incorrect work,

e.g. $4\left((4+q)^2-9\right)=30^2-6^2$ which will score M0dM0ddM0A0

Alt(b): You may see perfectly valid responses such as

$$2\left|\begin{pmatrix}4+q\\-3\end{pmatrix}\right| = \left|\begin{pmatrix}30\\6\end{pmatrix}\right| \Rightarrow \left|\begin{pmatrix}8+2q\\-6\end{pmatrix}\right| = \left|\begin{pmatrix}30\\6\end{pmatrix}\right| \Rightarrow \pm(8+2q)=30 \Rightarrow q=11,-19$$

M1: Sets up the modulus equation $\left|\begin{pmatrix}8+2q\\-6\end{pmatrix}\right| = \left|\begin{pmatrix}30\\6\end{pmatrix}\right|$ which may be implied by either $|8+2q|=30$

or **both** 8 + 2q = 30 **and** –8 – 2q = 30

Condone a slip on the **i** component e.g. $\left|\begin{pmatrix}8+q\\-6\end{pmatrix}\right| = \left|\begin{pmatrix}30\\6\end{pmatrix}\right|$

dM1: Deduces **either** linear equation in q following the award of the previous mark.

ddM1: For solving **both** linear equations in q

A1: cao Both $q=11,-19$ and no others. Must be simplified. A0 if either value is rejected.