Question Number	Scheme	Marks
3 (a)	Attempts $\left(2\mathbf{i}-3\mathbf{j}+4\mathbf{k}\right)-\left(8\mathbf{i}-5\mathbf{j}+3\mathbf{k}\right)$	M1
	$\overrightarrow{RQ}=-6\mathbf{i}+2\mathbf{j}+\mathbf{k}$	A1 **(2)**
(b)	Attempts $\overrightarrow{PQ}\square\overrightarrow{RQ}=2\times-6+-3\times2+4\times1$	M1
	Full attempt to find $\cos PQR$ E.g. $2\times-6+-3\times2+4\times1=\sqrt{29}\sqrt{41}\cos PQR$	dM1
	Angle PQR = 114°	A1 **(3)** **(5 marks)**

(a)

M1: Attempts to subtract vectors $\overrightarrow{PQ}$ and $\overrightarrow{PR}$ either way around. Look for $\overrightarrow{PQ}-\overrightarrow{PR}$ or $\overrightarrow{PR}-\overrightarrow{PQ}$. If a method is not shown it can be implied by two correct components of $\pm6\mathbf{i}\pm2\mathbf{j}\pm\mathbf{k}$ Note that an attempt such as $\overrightarrow{PR}-\overrightarrow{QP}$ is M0

A1: $\overrightarrow{RQ}=-6\mathbf{i}+2\mathbf{j}+\mathbf{k}$ o.e. such as $\begin{pmatrix}-6\\2\\1\end{pmatrix}$ Do not accept coordinates or indeed $\begin{pmatrix}-6\mathbf{i}\\2\mathbf{j}\\\mathbf{k}\end{pmatrix}$

(b)

M1: Attempts scalar product of $\overrightarrow{PQ}$ and their $\overrightarrow{RQ}$. Look for an attempt at multiplying together the components and adding. There will be some confusion over direction so allow for sight of

$$\left(\pm2\times\text{"}\pm6\text{"}\right)+\left(\pm3\times\text{"}\pm2\text{"}\right)+\left(\pm4\times\text{"}\pm1\text{"}\right)$$

This cannot be scored if they attempt a scalar product of $\overrightarrow{PQ}$ and $\overrightarrow{PR}$ for instance.

dM1: Full attempt to find $\cos PQR$ using $\mathbf{a}.\mathbf{b}=\left|\mathbf{a}\right|\left|\mathbf{b}\right|\cos\theta$ using vectors $\pm\overrightarrow{PQ}$ and their $\pm\overrightarrow{RQ}$.

There must be an attempt at both moduli with at least one correct (which may be unsimplified)

but you should ft on their $\overrightarrow{RQ}$. Don't be concerned whether the angle is acute or obtuse.

A1: Angle PQR = awrt 114° ISW after sight of this, e.g followed by 66°

Alt (b)

M1: Attempts all three lengths or all three lengths^2 using Pythagoras' Theorem. Look for an attempt to square and add with at least one modulus or modulus^2 correct.

dM1: Attempts to use the cosine rule with the lengths in the correct positions in order to find angle PQR

Look for $\cos PQR=\dfrac{PQ^2+QR^2-PR^2}{2\times PQ\times QR}$

There are more round about methods including finding other angles first and then using the sine rule

but this method mark can only be awarded when an attempt is made at angle PQR

A1: Angle PQR = awrt 114°

It must be found using "correct" vectors, e.g . $\pm\left(-6\mathbf{i}+2\mathbf{j}+\mathbf{k}\right)$ and $\pm\left(2\mathbf{i}-3\mathbf{j}+4\mathbf{k}\right)$

If, for example $\overrightarrow{RQ}$ is incorrect, e.g. $6\mathbf{i}-2\mathbf{j}+\mathbf{k}$, A0 will be awarded even if 114° is stated

Question Number	Scheme	Marks
4(a)	$\dfrac{1}{\sqrt{4-x^2}}=\left(4-x^2\right)^{-\frac{1}{2}}=4^{-\frac{1}{2}}\left(1-...\right)$	B1
	$\left(1-\frac{1}{4}x^2\right)^{-\frac{1}{2}}=1+\left(-\frac{1}{2}\right)\left(-\frac{1}{4}x^2\right)+\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{3}{2}\right)}{2}\left(-\frac{1}{4}x^2\right)^2+\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{3}{2}\right)\times\left(-\frac{5}{2}\right)}{3!}\left(-\frac{1}{4}x^2\right)^3$	M1, A1
	$\dfrac{1}{\sqrt{4-x^2}}=\dfrac{1}{2}+\dfrac{1}{16}x^2+\dfrac{3}{256}x^4+\dfrac{5}{2048}x^6$	A1, A1
		(5)
(b)	$\left\|x\right\|<2$	B1
		(1)
(c)	Substitutes an appropriate value of x in both sides with LHS in terms of $\sqrt{3}$	M1
	E.g. with $x=1$ $\sqrt{3}=\dfrac{2048}{1181}$ or $\dfrac{3543}{2048}$	A1
		(2)
		(8 marks)

(a) Note that the first mark in (a) is M1 on epen. We are now marking it as B1

B1: Correct constant term/ factor.

Accept as $4^{-\frac{1}{2}}$ or $\dfrac{1}{2}$ as the constant term or as the factor with the bracket starting (1....

M1: Correct attempt at the third or the fourth term of binomial expansion of form $\left(1+ax^2\right)^{-\frac{1}{2}}$

Look for a correct binomial coefficient with a correct power of x

E.g. $\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}-1\right)}{2}\left(\pm ax^2\right)^2$ or $\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}-1\right)\times\left(-\frac{1}{2}-2\right)}{3!}\left(\pm ax^2\right)^3$ where a could be 1

A1: Correct unsimplified

For example

$\left(1-\frac{1}{4}x^2\right)^{-\frac{1}{2}}=1+\left(-\frac{1}{2}\right)\left(-\frac{1}{4}x^2\right)+\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}-1\right)}{2}\left(-\frac{1}{4}x^2\right)^2+\dfrac{\left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}-1\right)\times\left(-\frac{1}{2}-2\right)}{3!}\left(-\frac{1}{4}x^2\right)^3$

A1: Two correct and simplified terms of $\dfrac{1}{2}+\dfrac{1}{16}x^2+\dfrac{3}{256}x^4+\dfrac{5}{2048}x^6$

A1: $\dfrac{1}{2}+\dfrac{1}{16}x^2+\dfrac{3}{256}x^4+\dfrac{5}{2048}x^6$. Accept as a list, ignore any terms with indices greater than these.

(b)

B1: States a correct range. E.g $\left|x\right|<2$ or $-2<x<2$ o.e.

(c) For example: See **

M1: Substitutes an exact value of x into both sides of their expansion that enables $\sqrt{3}$ to be found

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