| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 3(a) | $\overrightarrow{QR} = \overrightarrow{PR} - \overrightarrow{PQ} = 13\mathbf{i} - 15\mathbf{j} - (3\mathbf{i} + 5\mathbf{j})$ | M1 | 1.1a |
| | $= 10\mathbf{i} - 20\mathbf{j}$ | A1 | 1.1b |
| | | **(2)** | |
| (b) | $\left| \overrightarrow{QR} \right| = \sqrt{"10"^2 + "(-20)"^2}$ | M1 | 2.5 |
| | $= 10\sqrt{5}$ | A1ft | 1.1b |
| | | **(2)** | |
| (c) | $\overrightarrow{PS} = \overrightarrow{PQ} + \dfrac{3}{5}\overrightarrow{QR} = 3\mathbf{i} + 5\mathbf{j} + \dfrac{3}{5}("10\mathbf{i} - 20\mathbf{j}") = ...$ <br> or <br> $\overrightarrow{PS} = \overrightarrow{PR} + \dfrac{2}{5}\overrightarrow{RQ} = 13\mathbf{i} - 15\mathbf{j} + \dfrac{2}{5}("-10\mathbf{i} + 20\mathbf{j}") = ...$ | M1 | 3.1a |
| | $= 9\mathbf{i} - 7\mathbf{j}$ | A1 | 1.1b |
| | | **(2)** | |
| | | **(6 marks)** | |

**Notes**

(a)

M1: Attempts subtraction either way round. This cannot be awarded for adding the two vectors. If no method shown it may be implied by one correct component. eg $10\mathbf{i} - 10\mathbf{j}$ on its own can score M1.

A1: Correct answer. Allow $10\mathbf{i} - 20\mathbf{j}$ and $\begin{pmatrix} 10 \\ -20 \end{pmatrix}$ but not $\begin{pmatrix} 10\mathbf{i} \\ -20\mathbf{j} \end{pmatrix}$

(b)

M1: Correct use of Pythagoras. Attempts to "square and add" before square rooting. The embedded values are sufficient. Follow through on their $\overrightarrow{QR}$

A1ft: $10\sqrt{5}$ following (a) of the form $\pm 10\mathbf{i} \pm 20\mathbf{j}$

(c)

M1: Full attempt at finding a $\overrightarrow{PS}$ . They must be attempting $\overrightarrow{PQ} \pm \dfrac{3}{5}\overrightarrow{QR}$ or

$\overrightarrow{PS} = \overrightarrow{PR} \pm \dfrac{2}{5}\overrightarrow{RQ}$ but condone arithmetical slips after that.

Cannot be scored for just stating eg $\overrightarrow{PQ} \pm \dfrac{3}{5}\overrightarrow{QR}$

Follow through on their $\overrightarrow{QR}$ . Terms do not need to be collected for this mark. If no method shown it may be implied by one correct component following through on their $\overrightarrow{QR}$

**A1:** Correct vector as shown. Allow $9\mathbf{i} - 7\mathbf{j}$ and $\begin{pmatrix} 9 \\ -7 \end{pmatrix}$.

Only withhold the mark for $\begin{pmatrix} 9\mathbf{i} \\ -7\mathbf{j} \end{pmatrix}$ if the mark has not already been withheld in (a) for $\begin{pmatrix} 10\mathbf{i} \\ -20\mathbf{j} \end{pmatrix}$

**Alt (c)** (Expressing $\overrightarrow{PS}$ in terms of the given vectors) They must be attempting $\dfrac{2}{5}\overrightarrow{PQ} + \dfrac{3}{5}\overrightarrow{PR}$

**M1:** $\left(\overrightarrow{PS} = \overrightarrow{PQ} + \dfrac{3}{5}\overrightarrow{QR} = \overrightarrow{PQ} + \dfrac{3}{5}(\overrightarrow{PR} - \overrightarrow{PQ})\right)$

$\Rightarrow \dfrac{2}{5}\overrightarrow{PQ} + \dfrac{3}{5}\overrightarrow{PR} = \dfrac{2}{5}(3\mathbf{i} + 5\mathbf{j}) + \dfrac{3}{5}(13\mathbf{i} - 15\mathbf{j}) = \textbf{...}$

**A1:** Correct vector as shown. Allow $9\mathbf{i} - 7\mathbf{j}$ and $\begin{pmatrix} 9 \\ -7 \end{pmatrix}$.

Only withhold the mark for $\begin{pmatrix} 9\mathbf{i} \\ -7\mathbf{j} \end{pmatrix}$ if the mark has not already been withheld in (a) for $\begin{pmatrix} 10\mathbf{i} \\ -20\mathbf{j} \end{pmatrix}$