| | | | |
|---|---|---|---|
| | Allow use of column vectors | | |
| 3a | $(5\mathbf{i}+2\mathbf{j})+(-3\mathbf{i}+\mathbf{j})+\mathbf{F}_3=\mathbf{0}$ oe | M1 | Use equilibrium to find $\mathbf{F}_3$ |
| | $\mathbf{F}_3=-2\mathbf{i}-3\mathbf{j}\,(\Rightarrow a=-2,\quad b=-3)$ | A1 | Correct $\mathbf{F}_3$ |
| | $\tan\theta=\frac{2}{3}$ | M1 | For an equation in a relevant angle using their $a$ and $b$ |
| | $\theta=33.7°$ | A1 | $34°$ or better. 0.588 (0.59) rads |
| | | **(4)** | |
| 3b | Resultant force $=(2+\lambda)\mathbf{i}+(3+3\lambda)\mathbf{j}$ | B1 | Seen or implied. They must collect the **i**'s and **j**'s. |
| | $\mathbf{F}=4\mathbf{a}$ oe, where **F** is their resultant, seen or implied (could be implied by $\lvert\mathbf{F}\rvert=13$) | M1 | Must have attempted to add all 3 forces.<br>**N.B.**<br>$3.25=\frac{1}{4}\left[(2+\lambda)\mathbf{i}+(3+3\lambda)\mathbf{j}\right]$ oe<br>Scores B1M1M0M0A0 but allow recovery. |
| | Finding magnitude of their **a** or **F** $\sqrt{\left(\frac{2+\lambda}{4}\right)^2+\left(\frac{3+3\lambda}{4}\right)^2}$ or $\sqrt{(2+\lambda)^2+(3+3\lambda)^2}$ | M1 | |
| | Use of $\lvert\mathbf{a}\rvert=3.25$ or $\lvert\mathbf{F}\rvert=13$ to form (3 term quadratic in $\lambda$) $=0$ $(10\lambda^2+22\lambda-156=0)$ | M1 | |
| | $\lambda=3$ | A1 | A0 if they give 2 values. |
| | | **(5)** | |
| | | **[9]** | |
| | | | |