| | Allow column vectors or i j form for vectors throughout. | | |
|---|---|---|---|
| **Question Number** | **Scheme** | **Marks** | **Notes** |
| 3a | Resultant force $=\left(-2\mathbf{i}+3\mathbf{j}+4\mathbf{i}+2\mathbf{j}\right)=\left(2\mathbf{i}+5\mathbf{j}\right)\left(\mathrm{N}\right)$ | B1 | Seen or implied |
| | Correct use of $\mathbf{F}=m\mathbf{a}$ | M1 | Must have added the forces |
| | Acceleration $=\left(\mathbf{i}+2.5\mathbf{j}\right)\left(\mathrm{m\,s^{-2}}\right)$ | A1 | Isw if they find the magnitude |
| | | [3] | |
| | | | |
| 3b | $\mathbf{v}=\left(3\mathbf{i}-4\mathbf{j}\right)+3\mathbf{a}$ | M1 | Use of $\mathbf{v}=\mathbf{u}+\mathbf{a}t$ |
| | $\mathbf{v}=\left(3\mathbf{i}-4\mathbf{j}\right)+3\left(\mathbf{i}+2.5\mathbf{j}\right)$ | A1ft | Correct unsimplified Follow their a |
| | Use of Pythagoras | DM1 | Correct method to obtain the speed, dependent on M1 |
| | $\left\|\mathbf{v}\right\|=\sqrt{6^2+3.5^2}=6.95\left(\mathrm{m\,s^{-1}}\right)$ | A1 | 6.9 or better (6.94622……) Allow $\sqrt{\frac{193}{4}}$ oe |
| | | [4] | |
| | | | |
| 3c | Resultant force $=\left(\left(2+b\right)\mathbf{i}+\left(5+c\right)\mathbf{j}\right)\left(\mathrm{N}\right)$ | B1 | i's and j's must be collected but can be unsimplified, seen or implied. |
| | Correct use of direction to form equation in *b* and c only e.g $2+b=5+c$ or $2+b=\lambda$ and $5+c=\lambda$ with $\lambda$ eliminated | M1 | M0 if they use a specific numerical value for $\lambda$ or they use $2+b=-(5+c)$ |
| | $b-c=3$ * | A1* | Obtain given answer from correct working |
| | | [3] | |
| | | | |
| 3d | Use magnitude of resultant to form an equation in *b* and c | M1 | Allow square roots |
| | $200=\left(2+b\right)^2+\left(5+c\right)^2$ | A1ft | Correct unsimplified equation with no square roots. Follow their resultant. |
| | Form an equation in *b* or c only | DM1 | e.g. $200=2\left(5+c\right)^2$ or $200=2\left(2+b\right)^2$ |

| | | | |
|---|---|---|---|
| | | | dependent on M1 |
| | ALT 1:<br>Use magnitude of resultant to form equation in $\lambda$ | M1 | |
| | $200=\lambda^2+\lambda^2$ | A1 | |
| | Use either $\lambda=10$ or $\lambda=-10$<br>to find equations in *b* and c<br>$2+b=10$ and $5+c=10$<br>Or $2+b=-10$ and $5+c=-10$ | DM1 | Dependent on M1 |
| | $\mathbf{F}_3=(8\mathbf{i}+5\mathbf{j})\text{N}$<br>$\mathbf{F}_3=(-12\mathbf{i}-15\mathbf{j})\text{N}$ | A1 | Both forces, condone missing N's. |
| | | [4] | |
| | | | N.B. If they go for $2+b=10$ and $5+c=10$ to obtain $(8\mathbf{i}+5\mathbf{j})\text{N}$ only, allow M1A1M1A0 for obtaining one force. |
| | | (14) | |
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