Question Number	Scheme	Marks
3(a)	Resultant force with terms collected $(2\mathbf{i}-3\mathbf{j})+(p\mathbf{i}+q\mathbf{j})=(p+2)\mathbf{i}+(q-3)\mathbf{j}$	M1
	Use parallel vector to form an equation in p and q only	M1
	$\frac{p+2}{q-3}=\frac{1}{2}$	A1
	$4+2p=-3+q$	dM1
	$2p-q+7=0$ *	A1*
		(5)
3(b)	$q=11\Rightarrow p=2$	B1
	Find the resultant force with their p $\mathbf{R}=(p+2)\mathbf{i}+(11-3)\mathbf{j}\quad(=4\mathbf{i}+8\mathbf{j})$	M1
	Use of N2L with their **R** or $\lvert\mathbf{R}\rvert$ Either **F** = m**a** $\Rightarrow$ $4\mathbf{i}+8\mathbf{j}=2\mathbf{a}$ $(\mathbf{a}=2\mathbf{i}+4\mathbf{j})$ or $\lvert\mathbf{F}\rvert = m\lvert\mathbf{a}\rvert$ $\Rightarrow$ $4\sqrt{5}=2\lvert\mathbf{a}\rvert$	M1
	Correct use of Pythagoras to find $\lvert\mathbf{a}\rvert$ or $\lvert\mathbf{R}\rvert$ $\lvert\mathbf{a}\rvert=\sqrt{2^2+4^2}$ or $\lvert\mathbf{R}\rvert=\sqrt{4^2+8^2}$	M1
	$(\lvert\mathbf{a}\rvert=)\sqrt{20}=4.5$ or better (m s^{-2})	A1
		(5)
		[10]
Notes		
Accept column vectors throughout		
3(a)		
M1	Find the resultant force ($\mathbf{F}_1+\mathbf{F}_2$) and collect terms in the form $\mathbf{R}=a\mathbf{i}+b\mathbf{j}$. May be implied by the components $(p+2)$ and $(q-3)$ used correctly in working.	
M1	Use the parallel vector to form a scalar equation in p and q only. For the method mark, condone the reciprocal, $\frac{p+2}{q-3}=\frac{2}{1}$. Note: If using the multiplier approach, the mark is awarded when the equation is reduced to p and q only. However, M0 if $\lambda=1$ $\left.\begin{matrix}p+2=\lambda\\q-3=2\lambda\end{matrix}\right\}\Rightarrow\quad q-3=2(p+2)$	
A1	Correct equation in p and q only (accept any equivalent form)	

Question Number	Scheme	Marks
dM1	Dependent on both previous method marks. Complete and correct method to obtain given answer.	
A1*	Obtain the given answer from complete and correct working with no errors and exact values. There must be at least one stage of working between the initial equation in p and q only and the given answer. Allow rearrangement but must equal zero. A0 for unconventional vector notation, eg $\frac{(2+p)\mathbf{i}}{(-3+q)\mathbf{j}} = \frac{(1)\mathbf{i}}{(2)\mathbf{j}}$	
3(b)		
B1	Correct value seen	
M1	Use p or their p with $q = 11$ to find the resultant force as a vector. Must sum the forces. M0 if weight is included with resultant force.	
M1	Correct use of N2L with their $\mathbf{R}$ or $\lvert\mathbf{R}\rvert$, must attempt ($\mathbf{F}_1 \pm \mathbf{F}_2$) only. Condone g in ma or $m\mathbf{a}$ term but M0 if weight is included with the resultant force. Allow with p or their p.	
M1	Correct use of Pythagoras (must involve square and add) to find the magnitude of their acceleration or the magnitude of their resultant force. Must have two non-zero components. M0 if using just $\lvert\mathbf{F}_1\rvert$ or $\lvert\mathbf{F}_2\rvert$. Allow with p or their p.	
A1	Correct answer from correct working. Accept any equivalent form eg $2\sqrt{5}$	