Question	Scheme	Marks
2	Use of Impulse momentum equation	M1
	$\mathbf{I} = 3(x\mathbf{i} + y\mathbf{j}) - 3\times 5\mathbf{i}$ $\left(= 3(x-5)\mathbf{i} + 3y\mathbf{j}\right)$	A1
	$\lvert I\rvert^2 = 9\left((x-5)^2 + y^2\right) = 9\times 82\ (=738)$	M1
	Equation for change in KE	M1
	$\frac{1}{2}\times 3\left(x^2 + y^2 - 25\right) = 138$ $\left(x^2 + y^2 - 25 = 92\right)$	A1
	$(x-5)^2 + y^2 = 82$ $x^2 + y^2 = 117 \ \Rightarrow 10x = 60$	DM1
	$\mathbf{v} = 6\mathbf{i} + 9\mathbf{j}\left(\text{m s}^{-1}\right)$	A1
		(7)
ALT	Use of $I = \begin{pmatrix} 3\sqrt{82}\cos\theta \\ 3\sqrt{82}\sin\theta \end{pmatrix}$ $I = \begin{pmatrix} 3\sqrt{82}\cos\theta \\ 3\sqrt{82}\sin\theta \end{pmatrix} = 3\begin{pmatrix} x \\ y \end{pmatrix} - 3\begin{pmatrix} 5 \\ 0 \end{pmatrix}$	M1 A1
	$\lvert I\rvert^2 = 9\left((x-5)^2 + y^2\right) = 9\times 82$	M1
	Equation for change in KE $\frac{1}{2}\times 3\left(x^2 + y^2 - 25\right) = 138$	M1 A1
	Leads to $\theta = 83.66...$ $x = 5 + 3\sqrt{82}\cos\theta = 6$ $y = 3\sqrt{82}\sin\theta = 9$ $\mathbf{v} = 6\mathbf{i} + 9\mathbf{j}\left(\text{m s}^{-1}\right)$	DM1 A1
	Notes	
M1	Find the difference in momenta. Dimensionally correct. Condone subtraction in wrong order. Must use both components. (Ignore $3\sqrt{82}$ if it appears on LHS)	
A1	Correct unsimplified expression for difference in momentum. Condone subtraction the wrong way round.	
M1	Correct use of Pythagoras with $3\sqrt{82}$ and both components of impulse. Ignore poor **i**-**j** notation, eg $\mathbf{i}^2$ for this mark, if recovered by correct subsequent working.	
M1	Use change in KE to produce an equation in terms of x and y. Dimensionally correct, requires 2 KE terms of correct structure. Condone subtraction in wrong order. Ignore poor **i**-**j** notation eg $(x\mathbf{i})^2 + (y\mathbf{j})^2$ for this mark, if recovered by correct subsequent working.	

	M0 For use of velocity.	
A1	Correct unsimplified equation A0 for incorrect notation. A0 for subtraction the wrong way round.	
DM1	Dependent on all preceding M marks. Solve for x or y	
A1	Correct velocity only. Accept column vector. ISW if continue to find speed.	