Question	Answer	Marks	Partial Marks
	$d = 5$	**2**	**M1FT** for $[u_{31} =]159 = 9 + 30d$ or $\frac{31}{2}\{18 + 30d\} = 2604$ **FT** *their* derived value of n OR **M1 FT** for $\frac{1}{2}\left(\frac{150+d}{d}\right)\left\{18 + \left(\frac{150+d}{d} - 1\right)d\right\} = 2604$ **FT** *their* derived expression for n in terms of d
	$r = \frac{11}{16}$ oe, isw or 0.6875	**2**	**M1FT** $[u_{12} =]9 + 11(their 5)$ or 64 and $[u_8 =]9 + 7(their 5)$ or 44 soi **FT** *their* value of d
	$\left[S_6 = \frac{64(1 - 0.6875^6)}{1 - 0.6875} =\right]$ 183 or 183.2 or 183.17[4…]	**A1**	
9(b)(i)	cos 45° = 0.707… cos 135 ° = –0.707… therefore $-1 < \cos\theta < 1$ oe OR $-1 < \cos\theta < 1$ oe → $0° < \theta < 180°$ oe	**B1**	
9(b)(ii)	$\left[\frac{a}{1-r} =\right]$ $\frac{\sin\theta}{1 - \cos\theta}$	**M1**	
	$\frac{\sin\theta}{1 - \cos\theta} \times \frac{1 + \cos\theta}{1 + \cos\theta}$	**A1**	
	$\frac{\sin\theta(1 + \cos\theta)}{1 - \cos^2\theta} = \frac{\sin\theta(1 + \cos\theta)}{\sin^2\theta}$	**A1**	
	$\frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta} = \text{cosec}\,\theta + \cot\theta$	**A1**	
10(a)	[magnitude direction =] $\sqrt{20^2 + 21^2}$ oe	**B1**	
	[velocity vector =] $\frac{58}{29}(20\mathbf{i} + 21\mathbf{j})$	**M1**	Correctly written column vectors are acceptable all through Q10
	[position vector =] $-30\mathbf{j} + t(40\mathbf{i} + 42\mathbf{j})$ or $(40t)\mathbf{i} + (-30 + 42t)\mathbf{j}$ oe	**A1**	

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Question	Answer	Marks	Partial Marks
10(b)	[direction vector =] $24\mathbf{i} + 7\mathbf{j}$ or x-component: $\cos\alpha = \frac{24}{25}$ and y-component: $\sin\alpha = \frac{7}{25}$	**B1**	
	[velocity vector =] $\frac{75}{\sqrt{24^2+7^2}}(24\mathbf{i}+7\mathbf{j})$ oe	**M1**	**FT** *their* direction vector
	$72\mathbf{i}+21\mathbf{j}$ oe	**A1**	
	[position vector =] $-10\mathbf{i} + 18\mathbf{j} + t(72\mathbf{i} + 21\mathbf{j})$ or $(-10 + 72t)\mathbf{i} + (18 + 21t)\mathbf{j}$	**A1**	**FT** *their* velocity vector
10(c)	Solves $40t = -10 + 72t$ and $-30 + 42t = 18 + 21t$ or solves one equation and substitutes the value of t into the other equation	**M1**	**FT** *their* position vectors of P and Q at time t
	Shows correctly that the values of t are not consistent e.g. $t = \frac{10}{32}$ and $t = \frac{48}{21}$ oe so do not collide oe	**A1**	
11	A correct and simplified equation e.g. $n+1 = \frac{437}{n-3}$	**B2**	**B1** for an equation with $\left[\frac{(n+1)!}{n!} =\right]$ $n + 1$ and 437 or $\left[\frac{(n-3)!}{(n-4)!}\text{ oe } =\right]$ $n - 3$ and 437 OR for $\frac{(n+1)!}{437(n-4)!} = \frac{n!}{(n-3)!}$
	$n^2 - 2n - 440$ [= 0]	**B1**	**dep** on **B2**
	$n = 22$ as only solution	**B1**	**dep** on all previous marks awarded