Question Number	Solution	Marks	Notes
8a	Horizontal component: $p = 8$	B1	
	Vertical component: $-12 = q - 3g$	M1	Complete method to find q using *suvat*. Condone sign errors.
	$q = 17.4$	A1	17 or better
	Speed $= \sqrt{8^2 + 17.4^2}$	M1	Use of Pythagoras to find speed using their velocity. Independent M mark
	$= 19.2 \quad (19) \left(\text{m s}^{-1}\right)$	A1	3 sf or 2 sf
		(5)	
8b	Use of Pythagoras to find vertical component	M1	
	vertical component $= \pm 6$	A1	Seen or implied Accept without +/-
	$-6 = 6 - 9.8T$	DM1	Complete method using *suvat* to find required time Dependent on the previous M1
	$T = 1.22 \quad (1.2)$	A1	3 sf or 2 sf. Not $\frac{60}{49}$
		(4)	
8b alt	Use *suvat* and Pythagoras to form an equation in t	M1	Or an inequality
	$8^2 + (17.4 - gt)^2 = 100$	A1	Correct unsimplified equation for t Accept inequality
	Solve for T	DM1	Complete method to obtain T Dependent on the previous M1
	$T = 1.22 \quad (1.2)$	A1	3 sf or 2 sf. Not $\frac{60}{49}$
		(4)	
8c	Velocity perpendicular $\Rightarrow$ vertical component $= \frac{2}{3} \times 8$	M1	Complete method to find vertical component of velocity at B
	$= \frac{16}{3}$	A1	
	$(-12)^2 = \left(\frac{16}{3}\right)^2 - 2g(-h)$	DM1	Complete method to find the required vertical distance using their vertical component of the velocity Dependent on the previous M1
	$h = 5.90 \quad (5.9) (\text{m})$	A1	Max 3 sf
		(4)	
8c alt	$\begin{pmatrix} 8 \\ 17.4 - gt \end{pmatrix} . \begin{pmatrix} 8 \\ -12 \end{pmatrix} = 0$ and time $= 3 - t$	M1	Complete method to find the time from B to A
	Time $= 3 - 1.23... = 1.768...$	A1	
	$s = vt - \frac{1}{2} gt^2 = 12t - 4.9t^2$	DM1	Complete method to find the required vertical distance using their time Dependent on the previous M1
	$s = 5.9$ (m)	A1	Max 3 sf

		[13]	

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