

Question			Answer	Marks	AO	Guidance	
12	(a)	(i)	Vertical component of $U = 10\sin 40$ Vertical component of velocity = $10\sin 40 - gt = 0$ Obtain $t = 0.656$ Vertical displacement = $10\sin 40t - \frac{1}{2}gt^2$ (+c) Obtain $2.11 + 1.5 = 3.61$ m	B1 M1 A1 M1 A1FT [5]	1.1 3.3 1.1 3.4 1.1	Use $v = u - gt$ with $v = 0$ Allow sign error or sin/cos confusion Use $s = ut + \frac{1}{2}gt^2$ or $s = \int v dt$ FT their “2.11” + 1.5	0.6559057242... Allow if initial height not seen M1 may be awarded if seen in part (a)(ii) 3.608040363...
12	(a)	(ii)	Horizontal component of $U = 10\cos 40$ $6 = 10\cos 40t$ $t = 0.783$ $(2.028586218 + 1.5) - 2.5 = 1.03$ m	B1 M1 A1 A1 [4]	1.1 3.3 1.1 3.4	Use the horizontal component of U Attempt horizontal resolution equated to 6 Allow sin/cos error Substitute t in $10\sin 40t - \frac{1}{2}gt^2$ (+1.5) and subtract 2.5	Allow $10\sin 40$ if $10\cos 40$ given in part (i) 0.7832443736...
12	(b)		Use $1 = 6 \tan 40 - \frac{(9.8)6^2 \sec^2 40}{2U^2}$ $U^2 = 74.5....$ Obtain $U = 8.63$	M1 M1 A1 [3]	3.1b 1.1 1.1	Use $y = x \tan \theta - \frac{gx^2 \sec^2 \theta}{2U^2}$ with $x = 6$ and $\theta = 40$ Attempt to make U the subject BC	Allow $y = 2.5$ for M1 OR BC 8.631677404...

Question			Answer	Marks	AO	Guidance	
12	(c)		E.g. Not very appropriate since it relies on throwing at a very precise angle and velocity. E.g. Not very appropriate since it does not take into account air resistance which will cause the ball to fall short E.g. Not very appropriate since the target she is aiming at is actually a ring, so she has some flexibility	E1 [1]	3.5a	E1 for one valid statement	
12	(d)		E.g. The ball could not be modelled as a particle so that air resistance is included. E.g. The angle could be a variable. E.g. Angles and velocities could be given as ranges. E.g. The hoop could be modelled as a line of points.	E1 [1]	3.5c	E1 for one valid improvement	