

Question			Answer	Marks	AO	Guidance	
11	(a)		$-4 = (25 \sin 15)t - \frac{1}{2}(10)t^2$ $t = 1.75 \text{ (s)}$	M1 A1 A1 [3]	3.3 1.1 2.2a	Use of $s = ut + \frac{1}{2}at^2$ with $a = \pm g$ and $s = \pm 4$ BC (1.750981765...) 1.75 only	Allow sin/cos confusion For reference: 1.779296952... (if $g = 9.8$ used) Penalise $g = 9.8$ only once in the question
			Alternative method $0 = (25 \sin 15)^2 + 2(-10)s_1$ and $0 = 25 \sin 15 + (-10)t_1$ $4 + s_1 = \frac{1}{2} 10 t_2^2$ and $t = t_1 + t_2$ $t = 0.6470476... + 1.1039341... = 1.75 \text{ (s)}$	M1* M1dep* A1		Finding the maximum height $s_1 (= 2.093353...)$ above A and corresponding time $t_1 (= 0.647047...)$ Complete correct method to find t	Using $v = 0$ and $a = \pm 10$ Using $u = 0$ and where $t_2 (= 1.1039341...)$ is the time from the maximum height to the ground
11	(b)		$(25 \cos 15)t$ 42.3 (m)	M1 A1FT [2]	3.4 1.1	Use of $s = ut$ with their t from (a) 42.2829627... - ft their positive value of t from (a) but must be using $(25 \cos 15)t$	Allow sin/cos confusion For reference: 42.96672196... (if $g = 9.8$ used)

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11	(c)		$v_h = 25 \cos 15$ $v_v = 25 \sin 15 - 10(1.5)$ $\tan \theta = \frac{v_v}{v_h}$ 19.5° below the horizontal	B1 B1 M1 A1 [4]	1.2 3.3 3.1b 3.2a	Correct expression for horizontal velocity component (soi) Correct expression for vertical velocity component at $t = 1.5$ (condone positive value) Use of tan to find angle (allow reciprocal) – dependent on one B mark earned oe (e.g., 70.5° to the downward vertical)	24.14814... – 8.529523... M0 if using expressions for displacements For reference: 18.8° (if $g = 9.8$ used)
11	(d)		e.g., a less accurate value of g was used e.g., no consideration of the wind e.g., no consideration of (back)spin on the ball (but not topspin)	B1 [1]	3.5a	Any valid reason (do not accept mention of resistance e.g., air/wind <u>resistance</u>)	