Continued question 5
Notes:
(a) **M1:** For dealing with P($X \geqslant 16$) – they need to use cumulative prob. function on calc **A1:** awrt 0.0509 (from calculator)
(b) **B1**: For both hypotheses in terms of p or π and H_1 must be 2-tail
(c) **M1:** For correct use of tables to find probability associated with critical value **A1:** For the correct lower limit of the CR. Do not award for P($Y \leqslant 2$) **A1:** For the correct upper limit
(d) **B1:** ft on their 0.0355 and (1 – their 0.9520) provided each probability is less than 0.05
(e) **B1:** ft for a comment that relates 12 to their CR and makes a consistent comment relating this to the manager's suspicion
(f) **BI:** For a comment that: gives a suitable reason based on lack of independence **or** the sample not being random **so** the binomial model is not valid

Question	Scheme	Marks	AOs
6.	Using distance = total area under graph (e.g. area of rectangle + triangle **or** trapezium **or** rectangle – triangle)	M1	2.1
	e.g. $D = UT + \frac{1}{2} Th$, where h is height of triangle	A1	1.1b
	Using gradient = acceleration to substitute $h = aT$	M1	1.1b
	$D = U T + \frac{1}{2} aT^2$ *	A1 *	1.1b
		(4)	
			(4 marks)

Notes:
M1: For use of distance = total area to give an equation in D, U, T and one other variable **A1:** For a correct equation **M1:** For using gradient = a to eliminate the other variable to give an equation in D, U, T and a *only* **A1*:** For a correct given answer

Question	Scheme	Marks	AOs
7(i)(ii)	Using a correct strategy for solving the problem by setting up two equations in a and u only and solving for either	M1	3.1b
	Equation in a and u only	M1	3.1b
	$22 = 2u + \frac{1}{2} a 2^2$	A1	1.1b
	Another equation in a and u only	M1	3.1b
	$126 = 6u + \frac{1}{2} a 6^2$	A1	1.1b
	5 m s^{-2}	A1	1.1b
	6 m s^{-1}	A1ft	1.1b
			(7 marks)

Notes:

M1: For solving the problem by setting up two equations in a and u only and solving for either
M1: Use of (one or more) *suvat* formulae to produce an equation in u and a only
A1: For a correct equation
M1: Use of (one or more) *suvat* formulae to produce another equation in u and a only
A1: For a correct equation
A1: For correct accln 5 m s^{-2}
A1: For correct speed 6 m s^{-1} (The second of these A marks is an **ft** mark, following an incorrect value for u or a, depending on which has been found first)

N.B. Do not award the ft mark for absurd answers e.g. $a > 15$, $u > 50$

See alternative on the next page

ALTERNATIVE

Question	Scheme	Marks	AOs
7(i)(ii)	Using a correct strategy for solving the problem by obtaining actual speeds at two times and using a = change in speed / time taken	M1	3.1b
	Actual speed at $t = 1$ = Average speed over interval	M1	3.1b
	$22/2 = 11$	A1	1.1b
	Actual speed at $t = 4$ = Average speed over interval	M1	3.1b
	$104/4 = 26$	A1	1.1b
	$5\ \text{m s}^{-2}$	A1	1.1b
	$6\ \text{m s}^{-1}$	A1ft	1.1b
			(7 marks)

Notes:

M1: For solving the problem by obtaining two actual speeds and use of $a = (v - u)/t$
M1: Use of speed at half-time = av speed over interval to produce a speed at $t = 1$
A1: For a correct speed
M1: Use of speed at half-time = av speed over interval to produce a speed at $t = 4$
A1: For a correct speed
A1: For correct accln $5\ \text{m s}^{-2}$
A1: ft for correct speed $6\ \text{m s}^{-1}$ (This is an ft mark, following an incorrect value of a)

N.B. Do not award the ft mark for absurd answers e.g. $a > 15$, $u > 50$

Question	Scheme	Marks	AOs
8(a)	Substitution of both $t = 0$ and $t = 10$	M1	2.1
	$s = 0$ for both $t = 0$ and $t = 10$	A1	1.1b
	Explanation ($s > 0$ for $0 < t < 10$) since $s = \frac{1}{10}t^2(t-10)^2$	A1	2.4
		(3)	
(b)	Differentiate displacement s w.r.t. t to give velocity, v	M1	1.1a
	$v = \frac{1}{10}(4t^3 - 60t^2 + 200t)$	A1	1.1b
	Interpretation of 'rest' to give $v = \frac{1}{10}(4t^3 - 60t^2 + 200t) = \frac{2}{5}t(t-5)(t-10) = 0$	M1	1.1b
	$t = 0, 5, 10$	A1	1.1b
	Select $t = 5$ and substitute their $t = 5$ into s	M1	1.1a
	Distance = 62.5 m	A1ft	1.1b
		(6)	
			(9 marks)

Notes:

(a)

M1: For substituting $t = 0$ and $t = 10$ into s expression

A1: For noting that $s = 0$ at both times

A1: Since s is a perfect square, $s > 0$ for all other t- values

(b)

M1: For differentiating s w.r.t. t to give v (powers of t reducing by 1)

A1: For a correct v expression in any form

M1: For equating v to 0 and factorising

A1: For correct t values

M1: For substituting their intermediate t value into s

A1: ft following an incorrect t-value

Question	Scheme	Marks	AOs
9(a)(i)	Equation of motion for A	M1	3.3
	$T - 12.7 = 2.5a$	A1	1.1b
(ii)	Equation of motion for B	M1	3.3
	$1.5g - T = 1.5a$	A1	1.1b
		(4)	
(b)	Solving two equations for a	M1	1.1b
	$a = 0.5$	A1	1.1b
		(2)	
(c)	$1 = \frac{1}{2} \leftarrow 0.5\, t^2$	M1	3.4
	$t = 2$ seconds	A1ft	1.1b
		(2)	
(d)	Valid improvement, see below in notes	B1	3.5c
	Valid improvement, see below in notes	B1	3.5c
		(2)	
			(10 marks)

Continued question 9
Notes:
(a)(i) **M1:** For resolving horizontally for A **A1:** For a correct equation
(a)(ii) **M1:** For resolving vertically for B **A1:** For a correct equation
(b) **M1:** For complete correct strategy for solving the problem, setting up **two** equations in a, and then solving them for a **A1:** For $a = 0.5$
(c) **M1:** For a complete method (which could involve use of more than one *suvat* formula) to give an equation in t only **A1:** Ft from their a to get time in seconds
(d) **B1, B1** for any two of e.g. Include the dimensions of the ball in the model so that the distance it falls changes e.g. Include the dimensions of the pulley in the model so string not parallel to table e.g. Include a variable resistance in the model instead of taking it to be constant e.g. Include a more accurate value for g in the model