Mark Scheme

Question 1

Video Solution: https://www.youtube.com/watch?v=0lqSSD9jYts

(a)	$30^2 = 2a.300$	M1
	$a = 1.5$	A1 (2)
(b)	$0^2 = 30^2 - 2 \text{ x } 1.25s$ OR $0 = 30 - 1.25t_2$	M1
	$s = 360$ $\quad t_2 = 24$	A1
	$300 + 30T + 360 = 1500$ $\quad \frac{(20+T+24+T)}{2} \text{ x } 30 = 1500$	M1 A1
	$T = 28$ $\quad T = 28$	A1 (5)

Question 2

Video Solution: 5(a) https://www.youtube.com/watch?v=Fn79BWQn-UE

5(b) https://www.youtube.com/watch?v=BYcuPM6bEIQ

(a)	$v^2 = u^2 + 2as \Rightarrow 28^2 = u^2 + 2\times 9.8\times 17.5$		M1 A1
	Leading to $u = 21$ ✱	cso	A1 **(3)**
(b)	$s = ut + \frac{1}{2}at^2 \Rightarrow 19 = 21t - 4.9t^2$		M1 A1
	$4.9t^2 - 21t + 19 = 0$		
	$t = \frac{21 \pm \sqrt{21^2 - 4\text{x}4.9\text{.x}19}}{9.8}$		
	$t = 2.99$ or 3.0		DM1 A1 A1
	$t = 1.30$ or 1.3		**(5)**

Question 3

Video Solution: https://www.youtube.com/watch?v=rYYOO937nvY

(a)	$240 = \frac{1}{2}(u + 34)10$	M1 A1
	$u = 14$	A1
		(3)
(b)	$34 = 14 + 10a \quad => \quad a = 2$	M1 A1
	$120 = 14t + \frac{1}{2} \times 2 \times t^2$	M1 A1
	$t^2 + 14t - 120 = 0$	
	Solving, $t = -20$ or 6	**DM**1
	$t = 6$	A1
	OR	
	$34 = 14 + 10a \quad => \quad a = 2$	M1 A1
	$v^2 = 14^2 + 2 \times 2 \times 120 \quad \Rightarrow v = 26$	
	AND $26 = 14 + 2t$	M1 A1
	$t = 6$	**DM**1 A1
		(6)
		[9]

Question 4

Attempt to set up an equation of motion for 'A to B' using $s = 22$ and $t = 2$.	M1	
Sets up an equation in a and u only. (or a and V, where V is the velocity at B).	M1	
Obtains $22 = 2u + 2a$ or $22 = 2V - 2a$ (OE)	A1	
Sets up a second equation of motion using either 'A to C' or 'B to C' using either $s = 126$ and $t = 6$ (A to C) or $s = 104$ and $t = 4$ (B to C)	M1	
Obtains $126 = 6u + 18a$ or $104 = 4V + 8a$ (OE)	A1	
Attempts to solve the simultaneous equations. Note: If V is found, an attempt to find u must also be made.	M1	
Obtains correct values for u and a.	A1	
	7 marks	

From A to B:

$s = 22\text{ m}$
$u = u$
$v = ?$
$a = a$
$t = 2\text{ s}$

$$22 = 2u + \frac{1}{2}a(2)^2$$
$$22 = 2u + 2a \quad (1)$$

From A to C:

$s = 126\text{ m}$
$u = u$
$v = ?$
$a = a$
$t = 6\text{ s}$

$$126 = 6u + \frac{1}{2}a(6)^2$$
$$126 = 6u + 18a$$
$$21 = u + 3a \quad (2)$$

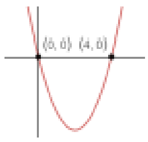
Solving (1) and (2) simultaneously:

$$u = 6\text{ ms}^{-1}, \quad a = 5\text{ ms}^{-2}$$

<u>Question 5</u>

(a)	Correct use of distance formula with at least three terms correct. *Note: Omission of square root scores M0A0*	M1	$AB = \sqrt{(-2-6)^2 + (7-1)^2}$ $AB = 10$
	Correct Answer	A1	
		2 marks	
(b)	Correct use of $\frac{y_2 - y_1}{x_2 - x_1}$ (condone one sign error)	M1	$m = \frac{7-1}{-2-6} = -\frac{3}{4}$
	Correct answer (OE)	A1	
		2 marks	
(c)	Attempt to find the gradient by rearranging $4x - 3y - 10 = 0$ to make y the subject.	M1	$4x - 3y - 10 = 0$ $3y = 4x - 10$ $y = \frac{4}{3}x - \frac{10}{3}$
	Attempt to use $m \times m_{\perp} = -1$ for *their* gradients. (may be implied by attempt to use of negative reciprocal)	B1ft	$\therefore$ Gradient is $\frac{4}{3}$
	Reaches correct conclusion (the lines are perpendicular) from correct working.	A1	$-\frac{3}{4} \times \frac{4}{3} = -1$
		3 marks	$\therefore$ The lines are perpendicular.

<u>Question 6</u>

Equates the two expressions.	M1	$y = 2x^2 - kx \qquad y = x^2 - k$
Obtains $x^2 - kx + k = 0$	A1	$\therefore \; 2x^2 - kx = x^2 - k$
Attempt to calculate discriminant for *their* three-term quadratic.	M1	$x^2 - kx + k = 0$
Determines that the curves intersect provided that $\Delta \geq 0$ and obtains $k^2 - 4k \geq 0$	R1	The curves intersect provided that $\Delta \geq 0$ $\therefore \; (-k)^2 - 4(1)(k) \geq 0$
Attempt to use valid method for solving *their* quadratic inequality e.g. sketching the graph / table of values	M1	$k^2 - 4k \geq 0$ $k(k-4) \geq 0$ 
Correct final answer from correct reasoning.	A1	
	6 marks	$\therefore$ Solutions exist provided that $k \leq 0$ or $k \geq 4$