Question Number	Scheme	Marks
6(a)	Integrate a w.r.t. t	M1
	$(v=)\ t^2-3t\ \ (+c)$	A1
	Substitute to evaluate c: $t=3,\ v=2\ \Rightarrow c=2$	M1
	$v=t^2-3t+2$	A1
		(4)
6(b)	$v=0=t^2-3t+2\quad(=(t-1)(t-2))\quad\Rightarrow t=\ldots$	M1
	$t=1,\ 2$	A1
	$s=\int_1^2\left(t^2-3t+2\right)\mathrm{d}t$	M1
	$=\left[\frac{1}{3}t^3-\frac{3}{2}t^2+2t\right]_1^2$	A1ft
	$=\left[\frac{1}{3}(2)^3-\frac{3}{2}(2)^2+2(2)\right]-\left[\frac{1}{3}-\frac{3}{2}+2\right]$	dM1
	Distance $=\frac{1}{6}$ (m)	A1
		(6)
		(10 marks)

Notes	
(a) M1	Integrate the given expression for a. Must see both powers increase by 1.
A1	Correct expression. Condone missing $+c$.
M1	Use of given values to find c (or definite integral with values substituted)
A1	Cao including "$v=$"
(b) M1	Set their $v=0$ and solve for t to get two values.
A1	Cao
M1	Integrate their v (must have at least two terms). At least two powers increasing by 1.
A1ft	Condone without limits. Ft their v (at least two terms).
dM1	A correct method for the required distance, E.g. use of their values of t as limits. Dependent on previous M. Must see evidence of substitution: E.g. at least $\frac{2}{3}-\frac{5}{6}$ M0 for incorrect sums, E.g. $\int_0^1 \mathrm{d}t+\int_1^2 \mathrm{d}t$
A1	0.17 or better (do not accept e.g. 0.166). Must be positive.

7. A particle P is projected from a fixed point A with speed $12\,\text{m s}^{-1}$ at an angle α above the horizontal and moves freely under gravity.

As P passes through the point B on its path, P is moving with speed $8\,\text{m s}^{-1}$ at an angle β below the horizontal.

(a) By using the principle of the conservation of mechanical energy, find the vertical distance between A and B.

(4)

Particle P takes 1.5 seconds to travel from A to B.

(b) Find the size of angle α.

(3)

(c) Find the size of angle β.

(3)

(d) Find the length of time for which the speed of P is less than $8\,\text{m s}^{-1}$.

(4)

(Total for Question 7 is 14 marks)