Question Number	Scheme	Marks
7(a)	$\dfrac{\mathrm{d}v}{\mathrm{d}t} = 6t - 4$	M1
	$t = 2 \quad \text{accel} = 8\,(\text{m/s}^2)$	A1 (2)
(b)	v is min when $\dfrac{\mathrm{d}v}{\mathrm{d}t} = 0$ ie when $t = \dfrac{2}{3}$	M1
	$v_{\min} = 3 \times \left(\dfrac{2}{3}\right)^2 - 4 \times \dfrac{2}{3} + 7 = 5\dfrac{2}{3}\,(\text{m/s})$ (Accept 5.67, $\dfrac{17}{3}$)	M1A1 (3)
(c)	$V = 7$	B1 (1)
(d)	$3t^2 - 4t + 7 = 7$	
	$t(3t - 4) = 0 \qquad (t = 0)\ t = \dfrac{4}{3}$	B1
	$AB = \displaystyle\int_0^{\frac{4}{3}} \left(3t^2 - 4t + 7\right)\mathrm{d}t$	M1
	$= \left[t^3 - 2t^2 + 7t\right]_0^{\frac{4}{3}}$	M1A1
	$= \left(\dfrac{4}{3}\right)^3 - 2 \times \left(\dfrac{4}{3}\right)^2 + 7 \times \dfrac{4}{3}\ (-0)$	dM1
	$= 8\dfrac{4}{27}\,(\text{m}),\ \dfrac{220}{27}$ (Accept 8.15 or better)	A1cao,cso (6)
		[12]

(a)	
M1	Differentiate given expression for *v* wrt *t*. Power must decrease on at least one term
A1	Substitute $t = 2$ and obtain accel $= 8$ (m/s^2)
	Correct answer with no working shown Award both marks
(b)	
M1	Set their $\dfrac{\mathrm{d}v}{\mathrm{d}t} = 0$ and solve to $t = ...$ or deduce the nec value of *t* from work in (a)
M1	Substitute their value of *t* in the GIVEN expression for *v*
A1	$5\dfrac{2}{3}$ or $\dfrac{17}{3}$ or 5.67 Decimal to be 3 sf or better
	Correct answer with no working Award 3/3
ALT	Complete the square on *v* $v = 3\left(t - \dfrac{2}{3}\right)^2 + 7 - ...$ M1
	Identify the constant $"7 - \dfrac{4}{3}"$ as the min or take $t = \dfrac{2}{3}$ from bracket and substitute M1
	Correct answer A1
(c)	
B1	$(V =)\,7$ Need not say $V =$
(d)	
B1	Equate the expression for *v* to 7 and solve to obtain $t = 4/3$ No need to show $t = 0$
M1	Form the required integral with lower limit $= 0$ and their value of *t* as the upper limit
	Do NOT give this mark until limits are seen.
M1	Attempt the integration. Power to increase on at least one term.
A1	Correct integration
dM1	Substitute their upper limit in a changed function. Depends on the first M mark but not the second. Sub of lower limit need not be seen (it gives 0)
A1cao cso	$8\dfrac{4}{27}$ or $\dfrac{220}{27}$ Decimal to be 3 sf or better
ALT:	By Indefinite integration:
	B1 As above; M1 Do NOT award until $t = 0$ is used to find the constant of integration
	M1A1 for the integration constant can be omitted dM1A1 as above