

Question	Scheme	Marks
5(a)	$\left(v = \int (3t - 4) dt = \right) \frac{3t^2}{2} - 4t + c$ (When $t = 0, v = 0 \Rightarrow c = 0$) $(v =) \frac{3 \times 4^2}{2} - 4 \times 4 = 8 \text{ [m/s]}$	M1 M1A1 [3]
(b)	$0 = \frac{3t^2}{2} - 4t \Rightarrow t \left(\frac{3t}{2} - 4 \right) = 0 \Rightarrow \frac{3t}{2} = 4 \Rightarrow t = \frac{8}{3}$	M1A1 [2]
(c)	$\left(x = \int \left(\frac{3t^2}{2} - 4t \right) dt = \right) \frac{3t^3}{2 \times 3} - \frac{4t^2}{2} (+c) = \left[\frac{t^3}{2} - 2t^2 + c \right]$ When $t = 0$ P is at the point with coordinates $(-10, 0)$ $\Rightarrow c = -10$ $\Rightarrow (x =) \frac{3^3}{2} - 2 \times 3^2 - 10 = -\frac{29}{2} \text{ (m)}$	M1 M1 dM1A1 [4]
Total 9 marks		

Part	Mark	Notes
(a)	M1	For a minimally acceptable attempt (see general guidance) to integrate the given expression. At least one term correctly integrated. Terms do not need to be simplified to attain this mark. No power of t to decrease.
	M1	For substituting the value of $t = 4$ into their changed expression (general rule of marking unless precluded, this method mark may be implied from a correct answer, unless from incorrect working).
	A1	For $(v =) 8$
We do not need to see the calculation of $c = 0$ Note: substitution of $t = 4$ into the expression for a also gives an answer of 8 – please watch out for this and do not mark this correct.		
(b)	M1	For setting their changed expression = 0 and a fully correct attempt to solve, leading to a value for t . Note a correct value of t can imply this mark. If the quadratic is not the correct quadratic, method must be shown.
	A1	For the value of $t = \frac{8}{3}$, ignore $t = 0$ is given. Accept answers which round to 2.7 or clear indication of 2.6 recurring.
(c)	M1	For a minimally acceptable attempt (see general guidance) to integrate their expression for v , which must be a minimum 2 term expression. Terms don't need to be simplified at this point. c does not need to be present. No power of t to decrease.
	M1	For correct substitution, into their changed expression, of $t = 0$ and $P = -10$ to find the value of c . -10 , if seen at any point will usually imply this mark. The mark is for substitution of the correct values, to find c , if they rearrange incorrectly, the mark can still be awarded.
	dM1	For substituting the value of $t = 3$ into their changed expression, with their c . Dependent on the previous method mark.
	A1	For the displacement of $-\frac{29}{2}$ If distance of $\frac{29}{2}$ is given A0, no isw here.