Question number	Scheme	Marks
4 (a)	When P is at rest $v=0$ $2t^2-16t+30=0 \Rightarrow (2t-6)(t-5)=0$ $t=3,5$	M1A1 (2)
(b)	$\frac{\mathrm{d}v}{\mathrm{d}t}=4t-16$	M1
	$t=3 \quad \frac{\mathrm{d}v}{\mathrm{d}t}=-4$	M1
	$t=5 \quad \frac{\mathrm{d}v}{\mathrm{d}t}=4$	A1 (3)
(c)	$s=\int\left(2t^2-16t+30\right)\mathrm{d}t=\frac{2t^3}{3}-8t^2+30t \ (+c)$	M1
	when $t=0,\ s=-4 \Rightarrow c=-4$	B1
	$s=\frac{2\times 3^3}{3}-8\times 3^2+30\times 3-4=32 \quad \text{(m)}$	A1 (3) [8]

Additional Notes		
Part	**Mark**	**Guidance**
(a)	M1	Sets $2t^2-16t+30=0$ **and** attempts to solve the quadratic. (See General Guidance for the definition of an attempt) They must achieve two values of t for this mark
	A1	For $t=3,5$ Accept $t=3,5$ without working shown.
(b)	M1	For an attempt to differentiate the **given** v (See General Guidance for the definition of an attempt)
	M1	For substituting **both** values of t to achieve **two** values for the acceleration.
	A1	$\frac{\mathrm{d}v}{\mathrm{d}t}=-4$ and 4
(c)	M1	For an attempt to integrate the **given** v **and** substitute $t = 3$ into their integrated expression and find a value for s. (See general guidance for the definition of an attempt) c is not required for this mark ALT using definite integration; Integrated and evaluated $\left[{'}\frac{2t^3}{3}-8t^2+30t{'}\right]_0^3(-4)$ This must be a complete method for this mark.
	B1	Uses the information given to find that $c = -4$ ALT using definite integration; subtracts 4 from their evaluated integrated expression.
	A1	For $s = 32$ (m) cso