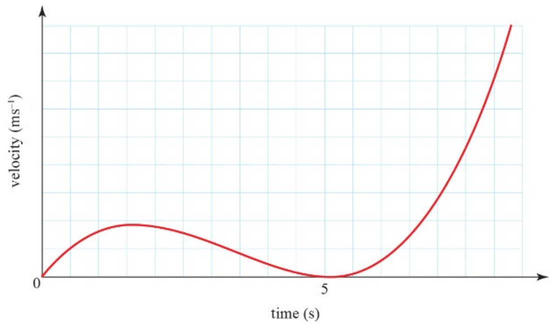
Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1a	Makes an attempt to substitute $t = 0$ into $v = -\frac{1}{3}\left(2t^2 - 9t - 18\right)$, $t \geqslant 0$	M1	1.1b	5th Write displacement, velocity and acceleration as functions of time.
	Correctly finds $v = 6$ (m s^{-1}).	A1	1.1b	
		(2)		
1b	Demonstrates an understanding that the body is at rest when $v = 0$. For example, $-\frac{1}{3}\left(2t^2 - 9t - 18\right) = 0$ is seen.	M1	3.1b	5th Write displacement, velocity and acceleration as functions of time.
	Simplifies and then factorises the LHS: $(2t + 3)(t - 6) = 0$	M1	1.1b	
	Correctly finds $t = 6$ (s).	A1	1.1b	
		(3)		
1c	States that at $t = 0$ (s), $v = 6$ (m s^{-1}).	M1	1.1b	6th Uses differentiation to solve problems in kinematics.
	Differentiates $-\frac{1}{3}\left(2t^2 - 9t - 18\right) = 0$	M1	3.1b	
	then sets $\frac{dv}{dt} = 0$ to find maximum.	M1	3.1b	
	Correctly finds the velocity at the turning point: $v = \frac{75}{8}$ or 9.375 (m s^{-1}). Accept 9.38 or 9.4 (m s^{-1}).	M1	1.1b	
	Concludes that the greatest speed in the given interval is $\frac{75}{8}$ or 9.375 (m s^{-1}). Accept 9.38 or 9.4 (m s^{-1}).	A1	3.5a	
		(5)		
				(10 marks)

Notes

1b

Award second method mark for an attempt to use the quadratic formula to find t.

Q	Scheme	Marks	AOs	Pearson Progression Step

				and Progress descriptor
2a	Figure 1  Correct shape of the graph.	M1	3.3	4th Use and interpret graphs of velocity against time.
	t = 5 labelled	A1	1.1b	
		(2)		
2b	t = 5, v = 0	B1	1.1b	6th Uses differentiation to solve problems in kinematics.
	Expands brackets and attempts differentiation. Reducing any power by one is sufficient evidence of differentiation.	M1	3.1b	
	Solves $25-20t+3t^2=0$ to find $t=\frac{5}{3}$. The expression can be factorised, or the quadratic formula can be used. t = 5 does not have to be seen to award the mark.	A1	1.1b	
	Makes an attempt to substitute $t=\frac{5}{3}$ into $v=\frac{1}{20}t(5-t)^2$. For example, $v=\left(\frac{1}{20}\right)\left(\frac{5}{3}\right)\left(\frac{10}{3}\right)^2$ is seen.	M1	2.2a	
	Correctly finds $v=\frac{25}{27}$ or 0.92… (m s^{-1}). Accept awrt 0.9 (m s^{-1}).	A1 ft	1.1b	
		(5)		
				(7 marks)

Notes

2b

Award the final method mark and the final accuracy mark for a correct substitution using their value for t.

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor

3	Integrates $a = 12t - 4$ to obtain $v = 6t^2 - 4t + A$ Any constant is acceptable.	**M1**	3.1b	6th Uses integration to solve problems in kinematics.
	Integrates $v = 6t^2 - 4t + A$ to obtain $s = 2t^3 - 2t^2 + At + B$. Any constant are acceptable.	**M1**	3.1b	
	Makes an attempt to form a pair of simultaneous equations by separately substituting (1, 2) and (3, 30) into the equation. For example: $2 = 2 - 2 + A + B$ and $30 = 54 - 18 + 3A + B$ are seen.	**M1**	3.1b	
	Simplifies to obtain a correctly pair of simultaneous equations: $A + B = 2$ and $3A + B = -6$ are seen.	**M1**	1.1b	
	Solves to find *A* = −4	**A1**	1.1b	
	Solves to find *B* = 6	**A1**	1.1b	
	Attempts to make a substitution of *t* = 2 into $s = 2t^3 - 2t^2 - 4t + 6$ For example, $s = 2(2)^3 - 2(2)^2 - 4(2) + 6$ is seen.	**M1**	1.1b	
	Correctly finds *s* = 6 (m).	**A1 ft**	1.1b	
		(8)		

(8 marks)

Notes

3

Award the final method mark and the final accuracy mark for a correct substitution using their values for *A* and *B*.