Question			Answer	Marks	AOs	Guidance	
11	(i)	(a)	$18 = \left(\frac{8+u}{2}\right)(9)$	M1	3.4	Use of $s = \left(\frac{u+v}{2}\right)t$	
			$u = -4$ therefore the speed of P is 4 (m s^{-1})	A1 [2]	1.1	**AG**	
	(i)	(b)	eg $8 = -4 + 9a$	M1	3.4	Use of $v = u + at$ with their u **or** $s = vt - \frac{1}{2}at^2$ **or** $v^2 = u^2 + 2as$ with their u **or** $s = ut + \frac{1}{2}at^2$ with their u	
			$a = \frac{4}{3}$ (m s^{-2})	A1 [2]	1.1	Accept 1.33 or better	

Question		Answer	Marks	AOs	Guidance
(ii)		$0 = -4 + \frac{4}{3}t$	M1	3.1b	Use of $v = u + at$ with $v = 0$ and their a and u
		$t = 3$	A1	1.1	
		$-s_{max} = -4t + \frac{1}{2}\left(\frac{4}{3}\right)t^2$	M1	3.4	Use of $s = ut + \frac{1}{2}at^2$ with their a, u & t
		$s_{max} = 6 < 10$ so P is never at B	A1 [4]	2.2a	Compare with 10 or suitable comment
	OR				
			M1		Use of $s = ut + \frac{1}{2}at^2$ with their u and a and suitable s
		$-10 = -4t + \frac{1}{2}\left(\frac{4}{3}\right)t^2$	A1		
			M1		Consider $b^2 - 4ac$ or attempt to solve three term quadratic in t
		e.g. det $= -24$ therefore not possible	A1		Or $36 - 60 < 0$ therefore not possible
	OR				
		$0 = (\pm 4)^2 + 2\left(\frac{4}{3}\right)s$ or $v^2 = (\pm 4)^2 + 2\left(\frac{4}{3}\right)(-10)$	M2		Use of $v^2 = u^2 + 2as$ with their a and u and either $v = 0$ or $s = \pm 10$
		$s = -6$ or $v^2 = -\frac{32}{3}$	A1		
		Suitable conclusion	A1		Dependent on previous A mark

Question	Answer	Marks	AOs	Guidance	
(iii)	$x = at^3 + bt^2 + ct$				
	$\dot{x} = 3at^2 + 2bt + c$	**M1**	**1.1**	Attempt to differentiate once	Two terms differentiated correctly
	$\ddot{x} = 6at + 2b$	**M1**	**2.1**	Attempt to differentiate again and substitute $t = 0$ into both equations and substitute their acceleration in their second derivative and their u in their first derivative	Two terms differentiated correctly following through from their first derivative
	$c = -4$ and $b = \frac{2}{3}$	**A1ft**	**1.1**	$b =$ 0.5× their accel. and $c = \pm 4$	Allow $b = 0.665$ from accel. = 1.33
	$18 = a(6)^3 + \frac{2}{3}(6)^2 - 4(6) \Rightarrow a = \frac{1}{12}$	**A1ft**	**1.1**	Allow $a = -\frac{5}{36}, -\frac{7}{108}, \frac{1}{108}$ which come from $u = 4$	
	Velocity of $Q = \left(\frac{1}{4}(6)^2 + \frac{4}{3}(6) - 4\right) = 13\,(\text{m s}^{-1})$	**A1** **[5]**	**1.1**	cao	