

Question	Scheme	Marks	AOs
5(a)	$2(3)^3 - 9(3)^2 + 5(3) + k = 0 \Rightarrow k = \dots$	M1	1.1b
	$54 - 81 + 15 + k = 0 \Rightarrow k = 12^*$ or $-12 + k = 0 \Rightarrow k = 12^*$	A1*	1.1b
		(2)	
	<b>(a) Alternative by verification:</b>		
	$2(3)^3 - 9(3)^2 + 5(3) + 12 = 0$	M1	1.1b
	$54 - 81 + 15 + 12 = 0$ Hence $k = 12^*$	A1*	1.1b
		(2)	
(b)	$\int (2x^3 - 9x^2 + 5x + 12) dx \dots x^4 \pm \dots x^3 \pm \dots x^2 \pm \dots x \pm \dots$	M1	3.1a
	$\frac{1}{2}(3)^4 - 3(3)^3 + \frac{5}{2}(3)^2 + 12(3) + c = -10 \Rightarrow c = \dots$	dM1	1.1b
	$(0, -28)$	A1	2.2a
		(3)	
(5 marks)			
Notes			
<p><b>(a) Mark (a) and (b) together</b></p> <p><b>M1:</b> Substitutes <math>x = 3</math> completely into the given derivative, sets = 0 and solves for <math>k</math>.  e.g., <math>2(3)^3 - 9(3)^2 + 5(3) + k = 0 \Rightarrow k = \dots</math>  May be implied by e.g. <math>54 - 81 + 15 + k = 0 \Rightarrow k = \dots</math> with at least 2 correctly evaluated powers.</p> <p><b>A1*:</b> Obtains <math>k = 12</math> with no errors seen and sufficient working shown. As a minimum you would need to see e.g., <math>2(3)^3 - 9(3)^2 + 5(3) + k = 0 \Rightarrow -12 + k = 0 \Rightarrow k = 12</math> <b>or</b> <math>54 - 81 + 15 + k = 0 \Rightarrow k = 12</math> <b>or</b> <math>2 \times 27 - 9 \times 9 + 5(3) + k = 0 \Rightarrow k = 12</math>  But <math>2(3)^3 - 9(3)^2 + 5(3) + k = 0 \Rightarrow k = 12</math> scores M1A0 for lack of working</p> <p>Note that some are just writing the expression for <math>\frac{dy}{dx}</math>, then write “sub in <math>x = 3</math>” but don't actually show 3 substituted in and then go on to write <math>-12 + k = 0</math> leading to <math>k = 12</math> scores M0A0*.</p> <p><b>Alternative:</b></p> <p><b>M1:</b> Substitutes <math>x = 3</math> and <math>k = 12</math> into the given derivative and attempts to evaluate</p> <p><b>A1*:</b> Correct work to obtain an answer of 0 with a (minimal) conclusion e.g., tick, hence proven etc.  As a minimum you would need to see e.g., <math>2(3)^3 - 9(3)^2 + 5(3) + 12 = 54 - 81 + 15 + 12 = 0 \checkmark</math></p> <p><b>(b)</b></p> <p><b>M1:</b> Attempts to integrate. Evidence can be taken for integrating to obtain at least 2 from:  <math>2x^3 \rightarrow \dots x^4</math> or <math>-9x^2 \rightarrow \dots x^3</math> or <math>5x \rightarrow \dots x^2</math> or <math>12 \rightarrow \dots x</math> where ... are constants</p> <p><b>dM1:</b> Substitutes <math>x = 3</math> into their integrated expression that includes a constant of integration, sets this equal to <math>\pm 10</math> and proceeds to find their constant. <b>Depends on the previous mark.</b>  If the substitution is not shown this mark may be implied by their value for <math>c</math> or by their equation e.g., <math>18 + c = \pm 10</math></p> <p><b>A1:</b> <math>(0, -28)</math> Condone <math>-28</math> or <math>y = -28</math> but not just <math>c = -28</math>. There must be no other values or points.  Condone <math>(-28, 0)</math> following <math>y = -28</math></p> <p><b><u>Beware of circular arguments which avoid doing part (a) e.g.</u></b>  Integration is used on the given derivative to give <math>y</math> in terms of <math>x</math>, <math>k</math> and <math>c</math>  <math>(3, -10)</math> is substituted to give <math>3k + c = 8</math>  Part (b) is then done first using <math>k = 12</math> to find <math>c = -28</math></p>			

This is then substituted into  $3k + c = 8$  to give  $k = 12$   
 This scores (a) M0A0 (b) M1dM1A1 (if  $-28$  is identified as the intercept)

**Alternative for part (a) using algebraic division:**

$$\begin{array}{r}
 2x^2 - 3x - 4 \\
 x - 3 \overline{) 2x^3 - 9x^2 + 5x + k} \\
 \underline{2x^3 - 6x^2} \phantom{+ 5x + k} \\
 -3x^2 + 5x \phantom{+ k} \\
 \underline{-3x^2 + 9x} \phantom{+ k} \\
 -4x + k \\
 \underline{-4x + 12} \\
 k - 12 \text{ (or 0)}
 \end{array}$$

leading to  $k - 12 = 0$  and then  $k = 12$ .

**M1:** Attempts to divide the given cubic by  $(x - 3)$  and proceeds as far as a remainder set  $= 0$ .

Requires at least  $2x^2 \pm 3x$ .

**A1\*:** Obtains  $k = 12$  with no errors seen and sufficient working. Their algebraic division needs to be correct but allow them to have either  $k - 12$  or  $0$  as their “remainder”. If their remainder is given in their working as  $0$  they may proceed directly to  $k = 12$ .