Mark Scheme 4751
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Section A

1	$[r]=[\pm]\sqrt{\dfrac{3V}{\pi h}}$ o.e. 'double-decker'	3	2 for $r^2=\dfrac{3V}{\pi h}$ or $r=\sqrt{\dfrac{V}{\frac{1}{3}\pi h}}$ o.e. or M1 for correct constructive first step or for $r=\sqrt{k}$ ft their $r^2=k$	3
2	$a=¼$	2	M1 for subst of −2 or for −8 + 4a + 7 = 0 o.e. obtained eg by division by (x + 2)	2
3	3x + 2y = 26 or y = −1.5x + 13 isw	3	M1 for 3x + 2y = c or y = −1.5x + c M1 for subst (2, 10) to find c or for or for y − 10 = their gradient × (x − 2)	3
4	(i) P ⇐ Q (ii) P ⇔ Q	1 1	condone omission of P and Q	2
5	x + 3(3x + 1) = 6 o.e. 10x = 3 or 10y = 19 o.e. (0.3, 1.9) or x = 0.3 and y = 1.9 o.e.	M1 A1 A1	for subst or for rearrangement and multn to make one pair of coefficients the same or for both eqns in form 'y =' (condone one error) graphical soln: (must be on graph paper) M1 for each line, A1 for (0.3, 1.9) o.e cao; allow B3 for (0.3, 1.9) o.e.	3
6	−3 < x < 1 [condone x < 1, x > −3]	4	B3 for −3 and 1 or M1 for x^2 + 2x − 3 [< 0]or (x + 1)^2 < / = 4 and M1 for (x + 3)(x − 1) or x= (−2 ±4)/2 or for (x + 1) and ±2 on opp. sides of eqn or inequality; if 0, then SC1 for one of x < 1, x > −3	4
7	(i) 28√6 (ii) 49 − 12√5 isw	2 3	1 for 30√6 or 2√6 or 2√2√3 or 28√2√3 2 for 49 and 1 for − 12√5 or M1 for 3 correct terms from 4 − 6√5 − 6√5 + 45	5
8	20 −160 or ft for −8 × their 20	2 2	0 for just 20 seen in second part; M1 for 6!/(3!3!) or better condone −160x^3; M1 for [−]2^3 × [their] 20 seen or for [their] 20 × (−2x)^3; allow B1 for 160	4
9	(i) 4/27 (ii) 3$a^{10}b^8c^{-2}$ or $\dfrac{3a^{10}b^8}{c^2}$	2 3	1 for 4 or 27 2 for 3 'elements' correct, 1 for 2 elements correct, −1 for any adding of elements; mark final answer; condone correct but unnecessary brackets	5
10	x^2 + 9x^2 = 25 10x^2 = 25 x= ±(√10)/2 or.±√(5/2) or ±5/√10 oe y = [±] 3√(5/2) o.e. eg y = [±] √22.5	M1 M1 A2 B1	for subst for x or y attempted or x^2 = 2.5 o.e.; condone one error from start [allow 10x^2 − 25 = 0 + correct substn in correct formula] allow ±√2.5; A1 for one value ft 3 × their x value(s) if irrational; condone not written as coords.	5

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Section B

11	i	grad AB = 8/4 or 2 or $y = 2x - 10$	1	or M1 for $AB^2 = 4^2 + 8^2$ or 80 and		
		grad BC = 1/–2 or – ½ or	1	$BC^2 = 2^2 + 1^2$ or 5 and $AC^2 = 6^2 + 7^2$ or		
		$y = -½ x + 2.5$		85; M1 for $AC^2 = AB^2 + BC^2$ and 1 for		
		product of grads = –1 [so perp]	1	[Pythag.] true so AB perp to BC;		
		(allow seen or used)		if 0, allow G1 for graph of A, B, C	3	
	ii	midpt E of AC = (6, 4.5)	1			
		$AC^2 = (9 - 3)^2 + (8 - 1)^2$ or 85	M1	allow seen in (i) only if used in (ii); or		
				$AE^2 = (9 - \text{their } 6)^2 + (8 - \text{their } 4.5)^2$ or		
		rad = ½ √85 o.e.	A1	rad.^{2} = 85/4 o.e. e.g. in circle eqn		
		$(x - 6)^2 + (y - 4.5)^2 = 85/4$ o.e.	B2	M1 for $(x - a)^2 + (y - b)^2 = r^2$ soi or for		
				lhs correct		
		$(5-6)^2 + (0-4.5)^2 = 1 + 81/4$ [=	1	some working shown; or 'angle in		
		85/4]		semicircle [=90°]'	6	
	iii	$\overrightarrow{BE} = \overrightarrow{ED} = \begin{pmatrix} 1 \\ 4.5 \end{pmatrix}$	M1	o.e. ft their centre; or for $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$		
		D has coords (6 + 1, 4.5 + 4.5) ft	M1			
		or		or (9 − 2, 8 + 1); condone mixtures of		
		(5 + 2, 0 + 9)	A1	vectors and coords. throughout part iii		
		= (7, 9)		allow B3 for (7,9)	3	
12	i	f(–2) used	M1	or M1 for division by $(x + 2)$ attempted		
		$-8 + 36 - 40 + 12 = 0$	A1	as far as $x^3 + 2x^2$ then A1 for $x^2 + 7x +$		
				6 with no remainder	2	
	ii	divn attempted as far as $x^2 + 3x$	M1	or inspection with $b = 3$ or $c = 2$ found;		
		$x^2 + 3x + 2$ or $(x + 2)(x + 1)$	A1	B2 for correct answer	2	
	iii	$(x + 2)(x + 6)(x + 1)$	2	allow seen earlier;		
				M1 for $(x + 2)(x + 1)$	2	
	iv	sketch of cubic the right way up	G1	with 2 turning pts; no 3rd tp		
		<u>through</u> 12 marked on y axis	G1	curve must extend to $x > 0$		
		intercepts –6, –2, –1 on x axis	G1	condone no graph for $x < −6$	3	
	v	$[x](x^2 + 9x + 20)$	M1	or other partial factorisation		
		$[x](x + 4)(x + 5)$	M1			
		$x = 0, -4, -5$	A1	or B1 for each root found e.g. using		
				factor theorem	3	
13	i	$y = 2x + 3$ drawn on graph	M1			
		$x = 0.2$ to 0.4 and -1.7 to -1.9	A2	1 each; condone coords; must have		
				line drawn	3	
	ii	$1 = 2x^2 + 3x$	M1	for multiplying by x correctly		
		$2x^2 + 3x - 1 [= 0]$	M1	for correctly rearranging to zero (may		
				be earned first) or suitable step re		
				completing square if they go on		
		attempt at formula or completing	M1	ft, but no ft for factorising		
		square				
		$x = \dfrac{-3 \pm \sqrt{17}}{4}$	A2	A1 for one soln	5	
	iii	branch through (1,3),	1	and approaching $y = 2$ from above		
		branch through (−1,1),approaching				
		$y = 2$ from below	1	and extending below x axis	2	
	iv	−1 and ½ or ft intersection of their	2	1 each; may be found algebraically;		
		curve and line [tolerance 1 mm]		ignore y coords.	2	