# Mark Scheme 4751
# June 2006

Section A

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|---|---|---|---|---|
| **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 + 4$a$ + 7 = 0 o.e. obtained eg by division by ($x$ + 2) | 2 |
| **3** | 3$x$ + 2$y$ = 26 or $y$ = –1.5$x$ + 13 isw | 3 | M1 for 3$x$ + 2$y$ = $c$ or $y$ = –1.5$x$ + $c$<br>M1 for subst (2, 10) to find $c$ or for<br>or for $y$ − 10 = their gradient × ($x$ − 2) | 3 |
| **4** | (i) P ⇐ Q<br>(ii) P ⇔ Q | 1<br>1 | condone omission of P and Q | 2 |
| **5** | $x$ + 3(3$x$ + 1) = 6 o.e.<br><br><br><br>10$x$ = 3 or 10$y$ = 19 o.e.<br>(0.3, 1.9) or $x$ = 0.3 <u>and</u> $y$ = 1.9 o.e. | M1<br><br><br><br>A1<br>A1 | for subst <u>or</u> for rearrangement and multn to make one pair of coefficients the same <u>or</u> for both eqns in form '$y$ =' (condone one error)<br><br>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<br>[condone $x$ < 1, $x$ > −3] | 4 | B3 for –3 and 1 or<br>M1 for $x^2$ + 2$x$ – 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;<br>if 0, then SC1 for one of $x$ < 1, $x$ > −3 | 4 |
| **7** | (i) 28√6<br><br>(ii) 49 – 12√5 isw | 2<br><br>3 | 1 for 30√6 or 2√6 or 2√2√3 or 28√2√3<br><br>2 for 49 and 1 for – 12√5 or M1 for 3 correct terms from 4 − 6√5 − 6√5 + 45 | 5 |
| **8** | 20<br><br>–160 or ft for –8 × their 20 | 2<br><br>2 | 0 for just 20 seen in second part; M1 for 6!/(3!3!) or better<br>condone −160$x^3$; M1 for [–]$2^3$ × [their] 20 seen or for [their] 20 × (−2$x$)$^3$; allow B1 for 160 | 4 |
| **9** | (i) 4/27<br><br>(ii) $3a^{10}b^8c^{-2}$ or $\dfrac{3a^{10}b^8}{c^2}$ | 2<br><br>3 | 1 for 4 or 27<br><br>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** | $x^2$ + 9$x^2$ = 25<br>10$x^2$ = 25<br><br><br>$x$= ±(√10)/2 or.±√(5/2) or ±5/√10 oe<br>$y$ = [±] 3√(5/2) o.e. eg $y$ = [±] √22.5 | M1<br>M1<br><br><br>A2<br>B1 | for subst for $x$ or $y$ attempted<br>or $x^2$ = 2.5 o.e.; condone one error from start [allow 10$x^2$ − 25 = 0 + correct substn in correct formula]<br>allow ±√2.5; A1 for one value<br>ft 3 × their $x$ value(s) if irrational;<br>condone not written as coords. | 5 |

Section B

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