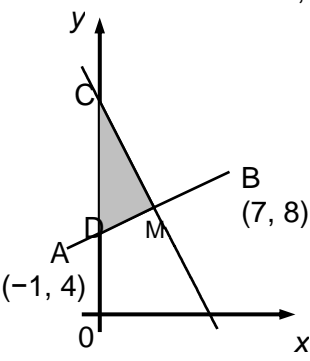# Mark Scheme 4751
# January 2007

Section A

| 1 | $y = 2x + 4$ | 3 | M1 for $m = 2$ stated [M0 if go on to use $m = -\frac{1}{2}$ ] or M1 for $y = 2x + k$, $k \neq 7$ and M1indep for $y - 10 = m(x - 3)$ or (3, 10) subst in $y = mx + c$; allow 3 for $y = 2x + k$ and $k = 4$ | 3 |
|---|---|---|---|---|
| 2 | neg quadratic curve<br>intercept (0, 9)<br><u>through</u> (3, 0) and (−3, 0) | 1<br>1<br>1 | condone (0, 9) seen eg in table | 3 |
| 3 | $[a =]\dfrac{2c}{2-f}$ or $\dfrac{-2c}{f-2}$ as final answer | 3 | M1 for attempt to collect $a$s and $c$s on different sides and M1 ft for $a(2 - f)$ or dividing by $2 - f$; allow M2 for $\dfrac{7c-5c}{2-f}$ etc | 3 |
| 4 | f(2) = 3 seen or used<br><br>$2^3 + 2k + 5 = 3$ o.e.<br>$k = -5$ | M1<br><br>M1<br>B1 | allow M1 for divn by $(x - 2)$ with $x^2 + 2x + (k + 4)$ or $x^2 + 2x - 1$ obtained<br><u>alt:</u> M1 for $(x - 2)(x^2 + 2x - 1) + 3$ (may be seen in division) then M1dep (and B1) for $x^3 - 5x + 5$<br><u>alt</u> divn of $x^3 + kx + 2$ by $x - 2$ with no rem. | 3 |
| 5 | 375 | 3 | allow $375x^4$; M1 for $5^2$ or 25 used or seen with $x^4$ and<br>M1 for 15 or $\dfrac{6\times5}{2}$ oe eg $\dfrac{6!}{4!2!}$ or 1  6  15<br>… seen [$^6C_4$ not sufft] | 3 |
| 6 | (i) 125<br><br>(ii) $\dfrac{9}{49}$ as final answer | 2<br><br>2 | M1 for $25^{\frac{1}{2}} = \sqrt{25}$ soi or for $\sqrt{25^3}$<br><br>M1 for $a^{-1} = \dfrac{1}{a}$ soi eg by 3/7 or 3/49 | 4 |
| 7 | showing $a + b + c = 6$ o.e<br><br>$bc = \dfrac{9^2-17}{16}$<br><br><br><br>=64/16 o.e. correctly obtained<br><br>completion showing $abc = 6$ o.e. | 1<br><br>M1<br><br><br><br>A1<br><br>A1 | simple equiv fraction eg 192/32 or 24/4<br><br>correct expansion of numerator; may be unsimplified 4 term expansion; M0 if get no further than $\left(\sqrt{17}\right)^2$; M0 if no evidence before 64/16 o.e.<br><br>may be implicit in use of factors in completion | 4 |

| 8 | $b^2 - 4ac$ soi <br><br> use of $b^2 - 4ac < 0$ <br> $k^2 < 16$ [may be implied by $k < 4$] <br> $-4 < k < 4$ or $k > -4$ and $k < 4$ isw | M1 <br> M1 <br> A1 <br> A1 | may be implied by $k^2 < 16$ <br> deduct one mark in qn for ≤ instead of <; <br> allow equalities earlier if final inequalities correct; condone $b$ instead of $k$; if M2 not earned, give SC2 for qn [or M1 SC1] for $k$ [=] 4 and $-4$ as answer] | 4 |
|---|---|---|---|---|
| 9 | (i) $12a^5b^3$ as final answer <br><br> (ii) $\dfrac{(x+2)(x-2)}{(x-2)(x-3)}$ <br><br> $\dfrac{x+2}{x-3}$ as final answer | 2 <br><br> M2 <br><br><br> A1 | 1 for 2 'terms' correct in final answer <br><br> M1 for each of numerator or denom. correct or M1, M1 for correct factors seen separately | 5 |
| 10 | correct expansion of both brackets seen (may be unsimplified), or difference of squares used <br><br><br> $4m^2$ correctly obtained <br> [$p$ =] [±]$2m$ cao | M2 <br><br><br><br> A1 <br> A1 | M1 for one bracket expanded correctly; for M2, condone done together and lack of brackets round second expression if correct when we insert the pair of brackets | 4 |

Section B

| 11 | iA | 0.2 to 0.3 and 3.7 to 3.8 | 1+1 | [tol. 1mm or 0.05 throughout qn]; if 0, allow M1 for drawing down lines at both values | 2 |
|---|---|---|---|---|---|
| | iB | $x + \dfrac{1}{x} = 4 - x$ <br> their $y = 4 - x$ drawn <br><br><br><br><br> 0.2 to 0.35 and 1.65 to 1.8 | M1 <br><br> M1 <br><br><br><br> B2 | condone one error <br><br> allow M2 for plotting positive branch of $y = 2x + 1/x$ [plots at (1,3) and (2,4.5) and above other graph] or for plot of $y = 2x^2 - 4x + 1$ <br><br> 1 each | 4 |
| | ii | $(0, \pm\sqrt{3})$ | 2 | condone $y = \pm\sqrt{3}$ isw; 1 each or M1 for $1 + y^2 = 4$ or $y^2 = 3$ o.e. | 2 |
| | iii | centre (1, 0) radius 2 <br> touches at (1, 2) [which is distance 2 from centre] <br> all points on other branch > 2 from centre | 1+1 <br> 1 <br><br> 1 | allow seen in (ii) <br><br> allow ft for both these marks for centre at (−1, 0), rad 2; <br> allow 2 for good sketch or compass-drawn circle of rad 2 centre (±1, 0) | 4 |

| 12 | i | (3, 6) | 2 | 1 each coord | |
|---|---|---|---|---|---|
| | | grad AB = (8 − 4)/(7 − −1) or 4/8 | M1 | indep obtained | |
| | | grad normal = −2 or ft | M1 | for use of $m_1m_2 = -1$; condone stated/used as −2 with no working only if 4/8 seen | |
| | | perp bisector is $y − 6 = −2(x − 3)$ or ft their grad. of normal (not AB) and/or midpoint correct step towards completion | M1 A1 | or M1 for showing grad given line = −2 and M1 for showing (3, 6) fits given line | 6 |
| | ii | Bisector crosses $y$ axis at C (0, 12) seen or used | M1 | may be implicit in their area calcn | |
| | | AB crosses $y$ axis at D (0, 4.5) seen or used | B2 | M1 for 4 + their grad AB or for eqn AB is $y − 8 =$ their ½ $(x − 7)$ oe with coords of A or their M used or M1 for $[MC]^2 = 3^2 + 6^2$ or 45 or $[MD]^2 = 3^2 + 1.5^2$ or 11.25 oe and M1 for ½ × their MC × MD; all ft their M | |
| | | ½ × (12 − their 4.5) × 3 (may be two triangles M1 each) | M2 | | |
| | | 45/4 o.e. without surds, isw | A1 | <u>MR</u>: AMC used not DMC: lose B2 for D but then allow ft M1 for MC$^2$ or MA$^2$ [=$4^2 + 2^2$] and M1 for ½ × MA × MC and A1 for 15 | |
| | |  | | <u>MR</u>: intn used as D(0, 4) can score a max of M1, B0, M2 (eg M1 for their DM = √13), A0 | |
| | | <u>alt</u> allow integration used: $\int_0^3 (-2x+12)\mathrm{d}x \ [= 27]$ | M1 | condone poor notation allow if seen, with correct line and limits seen/used | |
| | | obtaining AB is $y − 8 =$ their ½ $(x − 7)$ oe $[y = ½ x + 4.5]$ | M1 M1 | as above | |
| | | $\int_0^3 (\tfrac{1}{2}x+4.5)\mathrm{d}x$ | A1 | ft from their AB | |
| | | = 63/4 o.e. cao their area under CB − their area under AB | M1 | allow only if at least some valid integration/area calculations for these trapezia seen | |
| | | = 45/4 o.e. cao | A1 | if combined integration, so 63/4 not found separately, mark equivalently for Ms and allow A2 for final answer | 6 |
| 13 | i | $x − 2$ is factor soi | M1 | eg may be implied by divn | |
| | | attempt at divn by $x − 2$ as far as $x^3 − 2x^2$ seen in working | M1 | or other factor $(x^2 ....-1)$ or $(x^2 + 2x...)$ | |
| | | $x^2 + 2x − 1$ obtained | A1 | or B3 www | |
| | | attempt at quad formula or comp square | M1 | ft their quadratic | |
| | | $-1\pm\sqrt{2}$ as final answer | A2 | A1 for $\dfrac{-2\pm\sqrt{8}}{2}$ seen; or B3 www | 6 |

| | | | | | |
|---|---|---|---|---|---|
| **ii** | $f(x − 3) = (x − 3)^3 − 5(x − 3) + 2$ | B1 | or $(x − 5)(x − 2 + \sqrt{2})(x − 2 − \sqrt{2})$ soi or ft from their (i) | | |
| | $(x − 3)(x^2 − 6x + 9)$ or other constructive attempt at expanding $(x − 3)^3$ eg 1 3 3 1 soi | M1 | for attempt at multiplying out 2 brackets or valid attempt at multiplying all 3 | | |
| | $x^3 − 9x^2 + 27x − 27$ $− 5x + 15$ [+2] | A1 B1 | alt: A2 for correct full unsimplified expansion or A1 for correct 2 bracket expansion eg $(x − 5)(x^2 − 4x + 2)$ | 4 | |
| **iii** | 5 $2 \pm \sqrt{2}$ or ft | B1 B1 | condone factors here, not roots if B0 in this part, allow SC1 for their roots in (i) − 3 | 2 | |