OCR FINAL MARK SCHEME 4751 MEI PURE MATHS C1 JANUARY 2005

Section A

1	$2x - 6 < 6x + 15$ or $-4x < 21$ $-21 < 4x$ or ft $x > -21/4$ .o.e. (allow 21/–4 or better)	M1 M1 A1	condone ≤ for both Ms for inequality with +ve x coefft; if M0, SC1 for –21/4 found	3
2	$r = \sqrt[3]{\frac{3V}{4p}}$ o.e.	3	M2 for $r^3 = \frac{3V}{4p}$ o.e., with r^3 as subject, M1 for cube root of their r^3	3
3	(i) [P] ⇐ [Q] (ii) [P] ⇔ [Q]	1 1	condone Q ⇒ P; in both parts, condone arrows not implication symbols	2
4	1080 [x^3]	4	M1 for each of 2^2 and 3^3 or $(3x)^3$, and M1 for 10 or (5×4×3)/(3×2×1) or for 1 5 10 10 5 1 seen but not for $^5C_3$	4
5	(i) 9 (ii) 8 [condone –8 or ±8]	2 2	M1 for 3^2 or $(3/1)^2$ or $1/(1/3)^2$ M1 for $16^{\frac{1}{4}} = 2$; M0 for $\sqrt[4]{4096}$	4
6	$y = -2x + c$ $2 = -2\times5 + c$ or ft their gradient o.e. $c = 12$ (0, 12) or ft their line (6, 0) or ft their line	M1 M1 A1 1 1	or M1 gradient of $L = -2$ M1 for $x = 0$, $y = 2 - 5\times-2$ M1 for $y = 0$, $x = 5 - 2/(-2)$ no ft for $y = -2x + 1$ used or B5 for both correct answers; condone not given as coords if clear which axis	5
7	$a = 3$, $b = 9$ sketch of parabola correct way up min at (3, –9) or ft their $(x - 3)^2 - 9$ crossing x axis at 0 and 6	1+1 G1 G1 G1	or $(x - 3)^2 - 9$ seen isw correct shape, must extend above x axis may be stated elsewhere; need not be coords. may be stated elsewhere	5
8	$y = -4x + 19$ cao midpoint = (4, 3) verifying on line $x + 2y = 10$	3 1 1	M1 for $m = (-1-7)/(5-3)$ o.e. and M1 for $y - 7 =$ their m $(x - 3)$ o.e.	5
9	[9 – 2 =] 7 $\frac{1+\sqrt{2}}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}}$ $= \frac{3+2+3\sqrt{2}+\sqrt{2}}{7 \text{ or f.t}}$ o.e. $= \frac{5}{7} + \frac{4}{7}\sqrt{2}$	1 M1 M2 A1	 dep on prev M; M1 if one error [1 out of 5 terms, or 1 out of 3 or 4 terms if collected] condone $\frac{5+4\sqrt{2}}{7}$, isw	5

Section B

10	**i**	$(x-2)^2 + (y-1)^2 = 5^2$ $x^2 - 4x + 4 + y^2 - 2y + 1 = 25$ or $x^2 - 4x + 4$ and $y^2 - 2y + 1$ seen	M2 1	M1 for one side correct; for backwards working: M1 for $(x-2)^2 + (y-1)^2$ seen, A1 correct completing of squares shown; A1 for $(x-2)^2 + (y-1)^2 = 5^2$ or M1 for quote of *fgc* formula, A1 for correct substn, A1 completion for *c*	3
	ii	$y^2 - 2y - 20 = 0$ $y = \frac{2 \pm \sqrt{4+80}}{2}$ $= 1 \pm \sqrt{21}$	M1 M1 A1	subst of $x = 0$ attempt at use of formula or completing square; dep on prev M1 Pythag method: M1 for obtaining $\sqrt{21}$, A1 for each *y* value SC2 for $x = 2 \pm \sqrt{24}$ or $2 \pm 2\sqrt{6}$ from use of $y = 0$	3
	iii	subst of (5, –3) in eqn for circle grad. of CA = *y* diff / *x* diff attempt = –4/3 o.e. grad of tgt = ¾ or ft –1/their grad. $y + 3 = \frac{3}{4}(x - 5)$ ft their grad $4y + 12 = 3x - 15$ or $y = \frac{3}{4}x - 27/4$ o.e. NB ans $4y = 3x - 27$ given	1 M1 A1 M1 M1 1	or showing AC = 5 or M1 for $x = \frac{4y+27}{3}$ or $y = \frac{3x-27}{4}$ M1 for subst in eqn for circle M1 expn with at most one error A1 correctly obtaining $x = 5$ or $y = -3$ as only root A1 double root so tgt	6
11	**i**	f(1) attempted 1+1–10+8=0 one of $(x + 4)$ and $(x - 2)$ found the other [if B0 then M1 for roots –4 and 2] sketch of cubic the correct way up all ints with axes marked,	M1 A1 B1 B2 G1 G1	or M1 long divn as far as $x^2 + kx$ or $(x-1)(x^2 + bx - 8)$ A2 for $x^2 + 2x - 8$ oe B2 for $(x + 4)(x - 2)$ [mixed methods: mark one or other to adv. of cand.] correct or ft from their factors	7
	ii	$(x + 3)^3 + (x + 3)^2 - 10(x + 3) + 8$ or $(x + 7)(x + 2)(x + 1)$ oe eg $x^3 + 10x^2 + 23x + 14$ 14, or ft from their eqn if M1 or more earned; [20 from f$(x - 3)$]	3 2	M2 for $y = f(x + 3)$ or attempt to subst $(x + 3)$ or intercepts –7, –2, –1 or M1 for $y = f(x - 3)$ or subst $(x - 3)$ or intercepts –1, 4, 5 M1 for subst $x = 0$ in their eqn	5
12	**i**	use of $b^2 - 4ac$ [may be in quad. formula] $= 9 - 44$ oe [negative] so no [real] roots [condone not showing a pos. value]	M1 A1 A1	or M1 for $(x - 3/2)^2 + k$ and M1 for $k = 11 - (\text{their } 3/2)^2$ [or M1 for $y' = 2x - 3$ and M1 use of $y' = 0$] and A1 for min $y = 35/4$ or showing min is +ve	3
	ii	$(2x + 5)(x - 2)$ [>0] 2 and –2.5 oe identified sketch of parabola $x > 2$ or $x < -2.5$	M1 A1 M1 A1	[M0 for formula] or B2 or algebraic argument or B2; both needed; B1 if '=' included	4
	iii	$x^2 - 3x + 11 = 2x^2 + x - 10$ [0 =] $x^2 + 4x - 21$ [0 =] $(x + 7)(x - 3)$ $x = 3$ or –7; $y = 11$ or 81	M1 M1 M1 A1 A1	or subtraction to eliminate *y* rearrange to 0; condone one error attempt to factorise or use formula or A1 for (3, 11) and A1 for (–7, 81); M0 A0 for trial and imp.	5