OCR
RECOGNISING ACHIEVEMENT

GCSE

Mathematics B (MEI)

General Certificate of Secondary Education **GCSE 1968**

Mark Schemes for the Units

June 2006

1968/MS/R/06

Oxford Cambridge and RSA Examinations

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General Certificate of Secondary Education

GCSE Mathematics B (1968)

MARK SCHEMES FOR THE UNITS

Mark Scheme 2311
June 2006

SECTION A

		MARKS	NOTES	
1	(a) (i) 18 (ii) 4 (iii) 3 (b) 25% 3/10 oe 0.09	B1 B1 B1 B1 B1 B1	 3/10, 30/100, 15/50 tec	**6**
2	(a) £2.43 (b) (i) 150 (ii) 18 (c) 100 × 4 = 400 or 100 × 4.2 = 420	M2A1 M1A1 M1A1 M1A1	M1 £1.85+72p=(£2.57) M1 £5 – their £2.57 M1 600 ÷ 100 × 25 oe seen M1 45 ÷ 5 × 2 M1 100 or 4 seen	**9**
3	(a) (i) 5 (ii) 11 (b) 4	B1 B1 M1A1	Accept embedded answers on answer line for (i) and (ii) M1 18 or 14 seen	**4**
4	£20.00	M1A1	M1 1/8 or ÷ 8 oe seen	**2**
5	4*b* 4*a* + 2*b*	B1 B2	 B1 either 4*a* or 2*b*	**3**
6	(a) **27** (b) **39**	**B1** **B1**	If key not interpreted, penalise the first answer only	**2**
7	(a) **6 by 4 by 3** cuboid correctly drawn. (b) **108**	**B2** **B2**	Must use isometric paper correctly - no horizontals B1 for 6, 4, 3 cuboid drawn – uses paper correctly in 2 dimensions. M1 for 6 × 4, 6 × 3 and 4 × 3 o.e. s.o.i. (answer 54)	**4**
8	(a) 40 (b) 120g	B1 M1A1	 M1 80 × 30 ÷ 20 oe	**3**
9	20 cm²	M1A1 U1	M1 (their 10) × 4 , Mark separately	**3**

SECTION B

		MARKS	NOTES	
10	bars equal width, any spacings must be equal even scale frequency bar heights all correct	B1 B1` B1		**3**
11	(a) correct plots (b) (3, − 2)	B1 B1 B1		**3**
12	(a) km (b) kg or g (c) ml, cl or l	B1 B1 B1		**3**
13	(a) 7.8 - 8.2 cm (b) 113(.0…..) cm²	B1 M1A1	M1 36 × (their value for π)	**3**
14	6/25 11/15	B1 B1		**2**
15	£38.25	M2A1	M1 75 × 0.17 = 12.75 M1 their 12.75 + 25.50	**3**
16	(a) odd (b) even (c) odd	B1 B1 B1		**3**
17	(i) 23 (ii) 16	B1 M2A1	M1 12 + 17 + ……. + 25 M1 their 192 ÷ 12, 169.083 implies M2	**4**
18	(a) 70 (b) 480	M1A2 M2A1	M1 2500 ÷ 36 A1 69(.444…) seen M1 Vols 225 or 108000 seen M1 (their 108000) ÷ (their 225) Or M1 60 ÷ 7.5 or 3 or 10 Or 30 ÷ 7.5 or 3 or 10 M1 their a × b × c (8, 20, 3) or (4, 20, 6) or (8, 10, 6)	**6**
19	(a) 109.79 cao final answer (b) 180	B3 B3	B2 for 109.79021 r.o.t. M1 for 157 ⏐ 1.43 (implied by ans 109 – 110) M2 for 330 ⏐ 110 × 60 o.e. M1 for 330 ⏐ 110 s.o.i. (3)	**6**

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SECTION A

		MARKS	NOTES	
1	(a) 1000 (b) 400	B1 B2	B1 for either 16 **and** 25 **seen in working or** complete correct method with one slip	**3**
2	(a) 27 (b) 39	B1 B1	If key not interpreted, penalise the first answer only	**2**
3	Square Rhombus	B1 B1	Either order	**2**
4	(a) 6 by 4 by 3 cuboid correctly drawn. (b) 108	B2 B2	Must use isometric paper correctly - no horizontals B1 for 6, 4, 3 cuboid drawn – uses paper correctly in 2 dimensions **or** correct with 1 dimension error M1 for 6 × 4, 6 × 3 and 4 × 3 o.e. s.o.i. (answer 54)	**4**
5	(a) 42 (b) 3.5 o.e.	B2 B3	M1 for 30 - - 12 o.e. seen in working M2 for $10x = 35$ or $2x = 7$ M1 for $10x - 20$ seen or 15 ⏐ 5 as correct first step. or SC2 for embedded correct answers	**5**
6	(a) 3200 (b) 9 : 7	B3 B2	M2 for 8 · (4800 ⏐ 12) o.e. M1 for 4800 ⏐ 12 o.e M1 for 18 and 14 s.o.i. (1.285…: 1) (1 : 0.7r) SC1 for 7 : 9	**5**
7	(a) $6x - 21$ final answer (b) $3 (3a + 4)$ final answer (c) $(t=) \frac{v-u}{a}$ o.e. final answer	B1 B1 B2	 Condone final bracket omitted M1 for $v - u = at$ or $\frac{v}{a} = \frac{u}{a} + t$	**4**
8	(a) 75 (b) Shows $\pi \cdot \underline{15''} = \underline{225}\ \pi$ (= 675) $225\ \pi$ ⏐ 2 (= 112.5π)	B3 M1 E1	M2 for (π × 30)/2 s.o.i. (45 www) Condone 3.1 or better used for π M1 for π (3) · 30 seen (90 www) Beware multiple method attempts – M0 unless clear selection Must see the division by 2 o.e. After M0, SC1 for (π × 15²)/2 shown	**5**

		MARKS	NOTES	
9	(a) $2^3 \times 5$ o.e. (b) 90 or 2 × 3² × 5	B2 B2	M1 for correct factor tree o.e. (i.s.w. for 1 once) or factor staircase B1 for any other multiple of 90 given or 2 correct factor trees (30) and (18) www	**5**
10	Volume Three dimensional o.e.	B1 B1 dep	Accept **relates** to volume of a cylinder o.e.	**2**

SECTION B

		MARKS	NOTES	
11	$5x + 9$ bottom left $2x - 3$ top right	B2 B1	B1 for $5x$ or $+ 9$	**3**
12	(a) 109.79 c.a.o. final answer (b) 180	B3 B3	B2 for 109.79021 r.o.t. (3 s.f..or better) M1 for 157 ⏐ 1.43 (implied by ans. 109 to 110) M2 for 330 ⏐ 110 × 60 o.e. M1 for 330 ⏐ 110 s.o.i. (3)	**5**
13	(a) 6 and 2 on table (b) Correct ruled line over full x range 0 to 4 (c) 1.5 c.a.o	T1 B2 B1	Within 1 mm accuracy M1 for correct but freehand **or** correct plots of **their** 3 points	**4**
14	29.68	B3	M2 for $28 \cdot 1.06$ o.e. – long method usually M1 for $28 \cdot 0.06$ (1.68)	**3**
15	23.6 to 23.7	B4	M3 for ½ × 5.5·5.1 + ½ (5.5 + 3.7)·2.1 o.e. M2 for ½ × 5.5·5.1 **or** ½ (5.5 + 3.7) ·2.1 o.e. (14.025) (9.66) M1 for 5.1 <u>used</u> for ht of triangle	**4**
16	(a) 42 (b) -11	B1 B3	Not embedded alone M2 for $-x = 21 - 10$ o.e. M1 for $10 - x = 3 \times 7$ o.e. or SC2 for embedded correct answers	**4**
17	11.78 to 11.8 mark at most acc. i.s.r.	B3	M2 for $\sqrt{11.7^2 + 1.4^2}$ M1 for $11.7^2 + 1.4^2$ (138.85)	**3**

		MARKS	NOTES	
18	(a) 38, 70, 90, 100 on table	B1		
	(b) 6 plotted points within ½ small square	P2f.t	f.t. dependent on S shape (not linear, no decrease) P1 f.t. for 4 or 5 pts correct ± 1mm If bars as well – must **mark** points	
	Curve or line through 6 plotted points	C1ft	f.t curve/line within one square of points dep S shape. Ignore first section. No bars Available for mid-values plotted	
	(c) (i) 16.5 to 17.5	B1		
	(ii) 8.5 to 10.25 www	B2	M1 for UQ 20.5 to 21.5 **or** LQ 11.25 to 12	
	(d) Compares medians correctly	B1ft	Boys spend less time on average. o.e	
	Correct IQR comparison	B1ft	Boys results are more widespread. o.e Both comments must be general and f.t their (c)	**9**

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1		$(t=)(v-u)/a$ o.e. final answer	B2	M1: for $v-u=at$ or v/a = u/a + t o.e.	2
2	(a)	75 (Condone 76.5 & 77.1)	B3	M2: for (π x 30)/2 s.o.i. (45) Condone 3.1 or better for π M1 for π (3) x 30 seen (90 - www)	
	(b)	Shows π x 15² = 225π (675)	M1	Must see both 15² and 225 – beware multiple method attempts – M0 unless clear selection	5
		225π / 2 (= 112.5π)	E1	Must see the division by 2 o.e. If M0, SC1 for (π x 15²)/2 shown	
3		$3\frac{13}{15}$ or $\frac{58}{15}$ not spoilt or 3.86 recurring	B3	M1: $\frac{10}{15}-\frac{12}{15}$ or $\frac{25}{15}-\frac{12}{15}$ or $\frac{20}{3}-\frac{14}{5}$ DM1: $\frac{-2}{15}$ or $\frac{13}{15}$ or $\frac{100}{15}-\frac{42}{15}$ [If M0 and DM0 then SC1 for 1 correct conversion] or M1: 6.6 recurring M1: 2.8 SC2: 3.86	3
4	(a)	$2^3\times5$ or 2 x 2 x 2 x 5	B2	M1: 2,2,2,5 or correct factor tree (allow one "1" seen) or factor staircase (last prime not seen) B1: any other multiple of 90 given (e.g. 2x3³x5) M1: 2 x 3 x 3 and 2 x 3 x 5 no isw (eg. not HCF)	4
	(b)	90 or 2 x 3 x 3 x 5 o.e.	B2		
5		$x > 0.8$ o.e.	B2	M1: $10x > 8$ or $10x = 8$ or x = 0.8	2
6		Volume Three dimensional	B1 B1 dep	Accept relates to volume of a cylinder	2
7	(a)	$(x-5)(x+5)$	B1		
	(b)	$\frac{x-5}{2x-5}$ **No isw**	B3	M2: $(2x-5)(x+5)$ Or SC2 $\frac{x+5}{2x+5}$ **No isw** Or M1: $(2x+5)(x-5)$	8
	(c)	7, $-\frac{3}{2}$ o.e.	B4	M1: $2x^2-11x-21$ or 2x² - 21 = 11x o.e. DM2: $(x-7)(2x+3)$ or DM1: $(x+7)(2x-3)$ or $(x...3)(2x...7)$ or M1: (11±√289)/4 DM2: (11±17)/4	
8	(a)	$(4\sqrt{3}+\sqrt{3})^2=(5\sqrt{3})^2=25\times3$ which is an integer [not required if 75 seen] or $48+2\times\sqrt{48}\times\sqrt{3}+3=48+2\times12+3$ which is an integer [not required if 75 seen]	B3	M1: $\sqrt{48}=4\sqrt{3}$ soi + M1: $(3\sqrt{3})^2=9\times3$ M1: 3 terms correct in $48+\sqrt{48}\times\sqrt{3}+\sqrt{48}\times\sqrt{3}+3$ + M1f.t.: $\sqrt{48}\times\sqrt{3}=12$	5
	(b)	$\frac{1}{125}$ or 0.008	B2	M1: $\sqrt{25}$ soi or reciprocal soi	
9	(a)	b = 2, c = –11 B1 + B2	B3	M2: $9x^2+6bx+b^2$ soi (e.g. 6b = 12 & $b^2+c=-7$) or M1: 6b = 12 or $b^2+c=-7$	5
	(b)	$(-\frac{2}{3},-11)$ B1 + B1	B2	Correct, or ft from $(-\frac{b}{3},c)$	

10		0.029… or 0.03 **www**	B4	M2: $\pi \times 6^2 (\approx 113)$ DM1: $113 \times 3 (\approx 339)$ Or SC3: 0.007… or M1: $\pi \times 12^2 (\approx 452)$ DM1: $452 \times 3 (\approx 1357)$	4
11	(a)	10.5 o.e.	B3	M2: $4x = 42$ Or M1: $4x + 28$ seen or $2x - 3.5 = x + 7$ M1: for correct second step f.t.	
	(b)	$x = 3.5$, $y = -2$ **www**	B4	$\text{M1}: \begin{cases} 12x + 10y = 22 \\ 12x - 9y = 60 \end{cases}$ allow one arithmetical error M1f.t.: $19y = -38$ A1: $y = -2$ $\text{M1}: \begin{cases} 18x + 15y = 33 \\ 20x - 15y = 100 \end{cases}$ allow one arithmetical error M1f.t: $38x = 133$ A1: $x = 3.5$ [Similarly, M1(allow one error), M1f.t., A1, A1 for **substitution**] SC2 for 2 correct answers and no working.	7
12	(a)	38, 70, 90, 100 on table	B1		
	(b)	6 plotted points within ½ small square	P2f.t.	f.t. dependent on S shape (not linear, no decrease)	
		Curve or line through 6 plotted points	C1f.t.	P1 f.t. for 4 or 5 pts correct $\pm$ 1mm If bars as well – must **mark** points f.t curve/line within one square of points dep S shape. Ignore first section. No bars Available for mid-values plotted	
	(c)	(i) 16.5 to 17.5	B1		11
		(ii) 8.5 to 10.25 **www** in answer space	B2	M1 for UQ 20.5 to 21.5 or LQ 11.25 to 12	
	(d)	Compares medians correctly	B1ft	Boys spend less time on average o.e.	
		Correct IQR comparison	B1ft	Boys results are more widespread o.e. Both comments must be general and f.t their (c)	
	(e)	e.g. (Select at random from) year groups in proportion to number in year group.	B2	B1: specific strata suggested B1: in proportion, random or systematic	
13		19.2(6…)° or 19.3° Accept 19 **www**	B3	M1: selects sine DM1: $\sin\theta = 0.33$ soi SC2: 0.336 (rad) or 21.4 (gra)	3
14		28 or 27.999 or better	B2	M1: 75.5 or 47.5 seen Accept 75.499 or better	2
15		39 or 39.1(…) or 39.2(…) Accept 40 **www**	B3	M2: $\sqrt{120} \times 8 / \sqrt{5}$ or $8 \times \sqrt{24}$ or $\sqrt{120} \times 3.577$... Or (√120) / 3.58 or (√120) / 0.279 Or M1: $8 = k\sqrt{5}$ soi e.g. 3.57(7…) seen 8k = √5 e.g 0.279 …seen Allow for change of units.	3

16	(a)	$\frac{3}{4}\times 2\pi\times 40 = 2\pi r$ (LHS: M1) or $\frac{3}{4}\times \pi\times 40^2 = \pi r\times 40$ (LHS: M1)	B2	Accept explanation in words SC1 $\frac{270}{360}$ x 40 = 30 or $\frac{3}{4}$ x 40 = 30	
	(b)	25000 Accept answer in [24900, 25000]	B4	M1: $40^2 - 30^2$ (=700) A1: $\sqrt{700}\,(\approx 26.457...)$ M1f.t.: π x 30² x √("their h") / 3 (h ≠ 40)	6

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SECTION A

		MARKS	NOTES	
1	(a) 20 (b) 200	B1 M1 A1	M1 $2\times5\times20$ or ft. $2\times5\times$ their 20. sc1 for 280	**3**
2	(a) (i) 6.8 cm (ii) 5.4 cm (b) (i) and (ii) 5 15p and 1 10p 3 15p and 4 10p 1 15p and 7 10p	M1 A1 M1 A1 B1 B1 B1	M1 $3\times2+4\times0.2$ Accept units changed from mm – 68mm M1 $2\times2.4+3\times0.2$ Accept units changed to mm – 54mm If zero for part a), then allow sc1 once only for either i) 6.4 or ii) 5 Any order ↓ *(part ii) B1 once only for two correct plus wrong combinations)*	**7**
3	**B** **D** **A**	B1 B1 B1		**3**
4	3.9 $1^1/_4$ or 1.25 *or* $^5/_4$ 7	B1 B1 B1		**3**
5	(a) 6.3 cm or 63 mm (b) 67^o (c) p and r	B1 B1 B1	$\pm$ 1 mm $\pm 2^o$	**3**
6	(a) 12, 15 (b) 27 (c) 21	B1 M1 A1 M1 A1	M1 $(10-1)\times3$ or $9+3\times6$ *or continues sequence/diagram to tenth term.* M1 $(60+3)\div3$ or equivalent	**5**
7	All 12 correct squares shaded	B3	B2 two correct Ls, *or Rot Sym order 4(ignoring grid) - but not just a square.* B1 one correct L or any shape with Rotational symmetry *order 2 ignoring grid SC1 for square smaller than whole grid.*	**3**
8	(a) 17 (b) 30	B1 B1		**2**
9	(a) $\frac{11}{35}$ *isw* (b) 15	M1 A1 M1 A1	M1 fraction (not top-heavy)including either 11 as the numerator or 35 as the denominator *(-1 for in/out of; zero for ratio.)* M1 finding total number of beads is 20 (*Explicitly).*	**4**

		MARKS	NOTES	
10	(a) $x = 35$ (b) Angle sum of a triangle (= 180) Isosceles (triangle) or base angles equal $y = 112$ Allied angles (b) trapezium One pair of parallel sides	B1 R1 R1 B1 R1 B1 R1	*condone omission of 180 if answer correct or if seen in working.* *accept two equal sides so two equal angles* allow interior (supplementary) angles. Condone [angles, *or unambiguous use of corresponding or alternate angles <u>and</u> angles on straight line etc.* 0 for isosceles trapezium *accept 'two parallel lines' unless rubbish follows*	**7**
11	Correct enlarged triangle	B3	B2 for two correct points or for correct enlarged triangle centre the origin, *or correct centre, wrong sf.* B1 correct enlarged triangle, any centre	**3**
12	(a) 28 (b) 3.5	B1 M2 A1	*Condone embedded answer* M2 for $2x = 7$ or $5x - 3x = 5 + 2$ M1 *for one correct step dealing with either x's or numbers.*	**4**
13	(a) $\frac{21}{5}$ or $4\frac{1}{5}$ *isw* (b) $\frac{2}{15}$ *isw*	B1 M1 A1	At least one correct equivalent fraction seen with fifteen (or multiple) as the denominator	**3**

SECTION B

		MARKS	NOTES	
14	Draw one line of symmetry Draw the other line	B1 B1	B1 for both lines plus extras, *B0 for one line and any errors*	**2**
15	Draws correct triangle	M1 A1	Side 2.6 cm $\pm$ 1 mm Right angle $90^o \pm 2^o$ M1 for one of these	**2**
16	(a) i) £9.45 ii) 5.52 or 552p (b) 17	B1 M2 A1 M1 A1	M1 7.88×0.7 (digits 5516 seen) M1 rounding to the nearest penny Special cases £5.51 *or £5.53 (from 79p x 7)* B2 M1 $800 \div 45$ or $8 \div 0.45$ or for 20 cans is £9 Special case B1 answer 18 *or £7.65 seen*	**6**
17	(a) -6^o C (b) Friday (c) (i) 3.46 (ii) 3.38	B1 B1 B1 B1	*condone -5*	**4**
18	B and F A and E C and D	B1 B1 B1		**3**
19	(a) (5, 4) (b) (4, 3)	M1 A1 B1	M1 Putting correct position of remaining vertex on diagram *sc1 for two reversals if zero out of three.*	**3**
20	(a)(i) Completes the table (10), 20, 30, (40), 50, 60, 70, 80 (ii) Draws correct line *c* = 10 *l* (b)(i) Completes the table (15), 30, 45, (50), 55, 60, 65, 70 (ii) Draws correct lines (c) Genthree and 5p	B1 B2 B2 B2 B1	*B2 for full bar chart.* B1 plots *their* points correctly *(‹1mm accuracy)* B1 30 and 45 or 55, 60, 65 and 70 *No marks for bar chart* B1 plot *their* points (must be two straight lines) Ft. from *their* tables or graphs (*reasonable answer only)*	**8**

		MARKS	NOTES	
21	12	4	M1 for 405 or 4.05 for potatoes *or 5.4 x 0.75* M1 for 10 – (1.27 and their 4.05) or 4.68 *(not for negative result)* M1 for their $4.68 \div (0.)39$	**4**
22	(a) (i) $\frac{12}{30}$ (or equivalent) isw (ii) $\frac{11}{30}$ *isw* (b) (i) 0.1 (ii) 3	2 2 2 2	*-1 once only for in/out of* M1 for 12/n or n/30 *provided fraction less than 1* *allow 0.36(66..)* M1 for 6 + 5 or 11. A*lso* $^{6}/_{30}$+ $^{5}/_{30}$ *o.e.* M1 for attempt at 1 – (0.25 + 0.15 + 0.3 + 0.2) *e.g. implied by answer of 0.55* M1 for 0.15×20	**8**
23	(a) 18.09 (b) 7.38 (c) 0.75	B1 B1 B1	*allow rounding if exact answer seen.* *allow ¾*	**3**
24	(a) 3*x* + 15 (b) 2(2*p* + 5)	B1 B1	*allow x3 +15 and similar poor notation.*	**2**
25	12	M1 A1	M1 for $360 \div 30$	**2**
26	£83.44	M2 A1	M2 74.5×1.12 **or** M1 0.12×74.5 (=8.94) M1 74.5 + *their* 8.94	**3**

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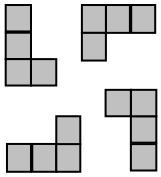
SECTION A

		MARKS	NOTES	
1	all 12 correct squares shaded 	3	B2 two correct Ls, or for rotational symmetry order 4 ignoring grid, or with more than the min. number of squares, (but not just a square) B1 for one correct L or for any shape with rotational symmetry order 2 ignoring grid SC1 for a square smaller than the whole grid	**3**
2	(a) 17 3 more added each time (b) 3, 12, 27	1 1 2	 or mention of $3n + 2$ o.e. B1 one correct in correct place, or two correct 'one term out' or SC1 for 9, 36, 81	**4**
3	35 angle sum of triangle [= 180] isosceles [triangle] or base angles equal 112 allied angles (b) trapezium one pair of parallel sides	1 R1 R1 1 R1 1 R1	 condone omission of 180 if answer correct or if seen in working accept 'two equal sides so two equal angles' or interior [supplementary] angles; condone angles; or unambiguous use of corresponding or alternate angles and angles on a straight line etc 0 for isosceles trapezium accept 'two parallel lines'	**7**
4	(a) 6/25 (b) 13/20	2 3	1 for 12/50 or 24/100 or equiv fraction seen isw wrong cancelling M1 for at least one of 8/20 and 15/20 (or 48/20 and 35/20) seen o.e. with common denominator; and M1 for 1 – 7/20 or other correct handling of both integers eg 12/5 and 7/4 seen	**5**
5	(a) 8 (b) 1050g or 1.05(0) kg or 1 kg 50 g	1 2+U1	 U1 dep on correct figures or method and position of dp, or for g with no change of units attempted. SC2 for digits 105 seen with g/kg or for 1(.1) kg. M1 for 700/4 × 6 o.e.	**4**
6	(a) –5, –4 (b) plotting [tol 1 mm] curve [within 2 mm of correct points] (c) 0.8 or 5.2 approx or ft their curve	1+1 P1 C1 1+1	in table or plotted correctly correct or ft table no ft from wrong points; parabola shape needed tol 1mm of their curve /line segments	**6**

		MARKS	NOTES	
7	(a) 3.5 or 3 ½	3	M2 for $2x = 7$ or $5x - 3x = 5 + 2$ or M1 for one correct first step	
	(b) $(x + 5)(x + 2)$	M2	M1 for a sign error or for factors giving 10 or $7x$	
	-5 and -2	A1	or B1; allow A1 ft their factors if M1 earned	
	(c) multn to give xs or ys the same coefft	M1	at least 2 terms correct in each eqn	
	subn to eliminate a variable	M1	at least 2 terms correct ft their eqns, dep on coeffts same	
	$x = 2.5$ or 2 ½ , $y = 0.5$ or ½	1+1	www	**10**
8	(a) 1.2×10^6	2	1 for 12×10^5 or 1 200 000 o.e. seen or correct answer with poor notation	
	(b) 0.43 o.e. isw	2	1 for 0.4 or 0.03 seen	**4**
9	(a) 0.3 on first set and labels on all branches, consistent with probs	1	accept fractions and % throughout; allow inst., not vocal etc	
	0.3, 0.7, 0.3 on second set	1		
	(b) (i) 0.49	2	M1 for 0.7×0.7	
	(ii) 0.91	3	M2 for $1-0.3\times0.3$ or $0.7\times0.7+0.3\times0.7+0.7\times0.3$ or M1 for two of these [may be implied by answer of 0.42] or for the three correct paths clearly identified	**7**

SECTION B

		MARKS	NOTES	
10	12	4	M1 for 5.4 × 7.5 o.e or 405 or 4.05 for potatoes M1 for 10 − (1.27 and their 4.05) or 4.68 M1 for their 4.68 ÷ (0.)39 eg condone 8.73 ÷ (0.)39	**4**
11	40	2	M1 for 360 ÷ 9 or for 140	**2**
12	(a) (i) 12/30 o.e. isw	2	-1 once only in qn for in/out of M1 for 12/*n* or *n* / 30	
	(ii) 11/30 isw	2	allow 0.36(6..); M1 for 6+5 [= 11] or 6/30 + 5/30 o.e. [but 0 for 2/11 without working]	
	(b) (i) 0.1	2	M1 for attempt at 1−(0.25+0.15+0.3+0.2) eg implied by answer of 0.55	
	(ii) 3	2	M1 for 0.15 × 20 or for 3/20	**8**
13	(a) reflection in *y* axis drawn	1	M1 for evidence of *x* = 3 drawn or reflection in other *x* = *k* or in *y* = 3	
	(b) reflection in *x* = 3 drawn	2		
	(c) translation	1		
	$\begin{pmatrix} -4 \\ 3 \end{pmatrix}$	2	1 each 'coordinate'; accept '4 to the left, 3 up'; SC1 for ' 4 to the right, 3 down' o.e. [ie D onto A] or for vector inverted; condone coords; allow only 1 out of 2 if contradiction	**6**
14	circle centre R radius 4 cm	1	tol 2mm; at least part in rectangle, must be compass drawn	
	perp bisector of RT drawn	1	within 2mm where line crosses rectangle	
	correct shading	1	ft their ruled straight line and circle	**3**
15	(a) (i) 5*a* + 6*b*	2	1 for 5*a* or 6*b*; mark final answers in (a)	
	(ii) $30c^5$	2	1 for kc^5	
	(iii) $3d^2 + 2d$	2	1 for $3d^2$ or $2d$; 2 for $d(3d + 2)$ or M1 for $3d^2 - 4d + 6d$ seen or $3d^2 + 2d$ seen and spoilt	
	(b) open circle at 1.5 and line to left	3	2 for $x < 1.5$ or for closed circle at 1.5 and line to left or 1 for 1.5 found or for $2x < 3$; SC1 for correct representation of their inequality soln	**9**

16	(a) (i) 7.38 (ii) 0.75 (b) 231.52(5) or 231.5(0)	1 1 3	allow 7.4 on ans line if 7.38 seen accept ¾ M2 for 200×1.05^2 o.e. or for 210 and 220.5 seen; SC1 for 230 SC2 for one year out: 220.5 or 243.09 to 243.10 as answers	**5**
17	(a) 16.6(...) or 17 (b) 2.1×10^9 (c) 2470(.5..) to 2 or more sf	3 2 2	condone 17 000 000 etc; SC2 for 25 million;M2 for 10 (000 000) ÷ 0.6 o.e.; M1 for 60% = 10 million followed by a correct constructive step or for digits 166.. or 17; eg 10% = 10 million ÷ 6 1 for correct ans with poor 'calculator' standard form notation or M1 for correct equiv seen eg 2100×10^6 or 21×10^8 or 2 100 000 000 M1 for (b) ÷ 850 000 soi or digits 247…	**7**
18	(a) angle between tangent and radius [=90°] angle at centre = 2× angle at circumference [and $144 = 2 \times 72$] (b) 13 or 13.2 cm	1 1 4	 3 for other versions of 13.2(34..) or 13.24 to 13.33 or M2 for $4.3 \times \tan 72°$ or M1 for $\tan 72° = AT/4.3$. Allow A2 for 10 following correct method seen 0 for scale drawing	**6**

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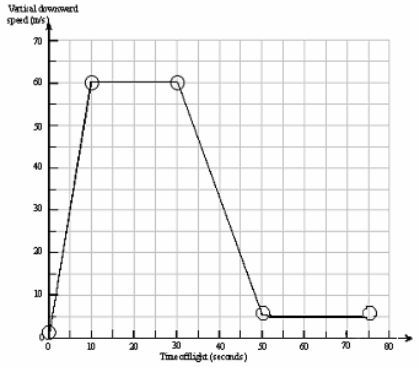
June 2006

SECTION A

1	(a) –5, –4 (b) plotting [tolerance 1 mm] curve [within 2 mm of correct points] (c) 0.8 or 5.2 approx or follow through from their curve	**1+** **1** **P1** **C1** **1+** **1**	correct only, plotted or in table correct or follow through table no ft from wrong points; parabola shape needed Tolerance 1mm of their curve or line segment	**6**
2		**4**	**3** for all points indicated by circles **2** for 4 correct **1** for 3 correct. **1** for all lines sensibly straight, apart from last one allow short curve down to zero.	**4**
3	(a) (i) 30 (ii) 9 (b) If n is odd, n+1 even odd x even = even or if n is even …….. (c) $n(n+1) – (n-1)n$ or better $(= n^2 + n – n^2 + n)$ $= 2n$	**1** **1** **1** **1** **1** **1**	Or equivalent approach from $n^2 + n$ i.e. even squared is even, even + even = even odd squared is odd, odd + odd = even. **No credit** for specific examples, however many Or **W2**	**6**
4	(a) 0.3 on first set 0.3, 0.7, 0.3 on second set labels on all branches, consistent with probabilities (b) 0.49 o.e. (c) 0.91 o.e.	**1** **1** **2** **3**	Allow inst., not vocal etc **M1** for 0.7×0.7 seen **M2** for $1–0.3\times0.3$ or $0.7\times0.7+0.3\times0.7+0.7\times0.3$ or **M1** for two of these $\Rightarrow$ 0.42 or for the correct thee paths clearly identified	**7**

5	$(a =) \frac{102}{999} = \frac{34}{333}$	**3**	**W2** for $\frac{102}{999}$ **or** **M1** for 1000a = 102.102102 …seen	**3**
6	(a) Correct 3rd side in range 87 mm to 92 mm Right angle ± 2^0 Some evidence of construction (b) OR=OS, RT=ST, OT common ORT OST congruent SSS so ∠AOT=∠TOB (corresponding angles)	**1** **1** **1** **1** **1** **1** **1**	Accept as evidence of construction an arc for the third side Must have both results (reason not needed) Must have "common", "same", or eqv. Must have "SSS" and reference to ROT and TOS to gain the mark (condone "all sides equal" for SSS)	**7**
7	(a) (i) $\overrightarrow{HB} = -\boldsymbol{d} + \boldsymbol{a}$ (o.e.) (ii) $\overrightarrow{FD} = -d + a$ (o.e.) (so) $\overrightarrow{FD} = \overrightarrow{HB}$ or $FD=HB$ (b) $\boldsymbol{a - b - c - d}$	**1** **1** **1** **2**	Or similarly for Or BD and HF [BD=b+c=HF] Or BD and HF [HB=d+a=FD] 1 for two terms correct (including sign)	**5**

8	$\frac{2x}{x^2-1}\ \left(=\frac{3}{4}\right)$	**M3**	**M1** for correct numerator or denominator If MO **M1** for $\frac{x+1+x-1}{(x-1)(x+1)}\left(=\frac{3}{4}\right)$ or **M2** for $\frac{2x}{(x-1)(x+1)}\left(=\frac{3}{4}\right)$ **Or** $[x+1]+[x-1]=[\frac{3}{4}(x^2-1)]$ ↑M1 ↑M1 ↑M1	
	$8x = 3(x-1)(x+1)$ or better	**A1**		
	$3x^2 - 8x - 3 \quad = (0)$	**A1**	Or **W2** (i.e, can imply previous A1) or (W)5 for evidence of working	
	$(3x + 1)(x - 3)\ (=0)$	**M1**	**M1** also if clear attempt to use formula	**7**
	$x = 3,\ x = \frac{-1}{3}$	**A1**	Need both, condone $0.\dot{3}\dot{3}$	
9	$p = 4$ $q = 2$ $r = 2$ $s = 3$ $t = -1$	**1** **1** **1** **1** **1**		**5**

SECTION B

10	(a) Correct x-movement Correct y-movement (b) rotation 90^0 (or equivalent) anti-clockwise about (2, 5)	**1** **1** **1** **1** **1**	(no movement) (4 down) SC for wrong and rotation seen	**5**
11	(a) 16.6(6...) (b) 2.1×10^9 (c) 2470(.5..) to 2 or more s.f.	**3** **2** **2**	Condone 17 000 000 etc.**SC2** for 25 million, **M2** for 10(000 000) ÷ 0.6 **M1** for 60% = 10 million followed by a constructive step or for digits 166.. or 17 **1** for correct answer with poor notation (i.e. not standard form) or cal. notation. **M1** for (b) ÷ 850 000 seen or implied	**7**
12	Angle between tangent and radius (= 90^0) Angle at centre = 2 x angle at circumference	**1** **1**	Tangent and radius must be mentioned Do not accept "edge of circle" for circumference.	**2**
13	Evidence of one correct trial another correct trial 11 metres (which can "count" as a trial)	**1** **1** **1**	d | % 2 | 42.250 3 | 27.463 4 | 17.851 5 | 11.603 6 | 7.542 7 | 4.902 8 | 3.186 9 | 2.071 10 | 1.346 11 | 0.875 12 | 0.569 13 | 0.370 14 | 0.240 15 | 0.156 16 | 0.102 17 | 0.066 18 | 0.043 (Accept rot to 1 sf) Clearly indicated as **the** answer Or **W3** (**W2** for $10 \leq h < 11$)	**3**
14	(a) (a =) b - 120 or equivalent (b) a = 110 – 120 which means that a takes a negative value	**3** **1**	**M1** for sight of 720 **M1** for sight of $3a + 3(360 - b)$ or better **or M1** for "b" **and M1** for (-120) See LIST after coordination e.g. "b would be negatice"	**4**

15	(a) 8 (b) 1.45 and -3.45	**1** **3**	Correct answer only **SC2** for 1.45 **and** 3.45 **or** -1.45 and 3.45 or 1 for 1.45 or 2 for -3.45 **Or** Attempt to substitute into the quadratic equation formula: **M1** $\frac{-2 \pm \sqrt{2^2 - 4 \times -5}}{2}$ or better (i.e. a=1, b=2 and c=-5) **M2** $\frac{-2 \pm \sqrt{24}}{2}$ **A1** 1.45 and -3.45 or **W3**	**4**
16	(a) $(m =)\frac{p-0}{0-q}$ o.e. (b) $y = \pm\sqrt{40 - x^2}$ isw (c) $c = \frac{b^2}{4}$ o.e. $3b = a + 1$ $b = \frac{a+1}{3}$ $c = \frac{(a+1)^2}{36}$ or better	**2** **2** **1** **1** **1** **1**	1 for correct numerator or denominator **or** 1 for either of these expressions (or better seen) $mq+c=0$ **or** $c = p$ **M1** for $y = \sqrt{40 - x^2}$ seen isw Or any <u>correct</u> attempt to substitute for *b* or *c*. << if total zero SC1 for a correct piece of constructive algebra >> **Alternatives:** $3b = a + 1$ (1) $b = \frac{a+1}{3}$ (1) $4c = (\frac{a+1}{3})^2$ (1) $c = ...(1)$ $b = 2\sqrt{c}$ or $\sqrt{4c}$ (1) $a = 6\sqrt{c} - 1$ or $3\sqrt{4c} - 1$ (1) **Or** $\sqrt{c} = \frac{a+1}{6}$ (1) $c = ...$ $c = \frac{(a+1)^2}{4\times3^2}, \frac{a^2+2a+1}{36}, \frac{(a+1)^2}{6^2}, \frac{(\frac{a+1}{3})^2}{4}$ or equivalents	**8**
17	(a) 0.73(20 …) oe (b) 0.26(790…) oe (c) 0.23(7435 …) or equivalent	**2** **2** **3**	**M1** for 0.925^4 or 92.5^4 seen **M1** for 1 – (a) seen or implied For sight of: **M1** $(0.925)^3$ x 0.075 or better **M2** $(0.925)^3$ x 0.075 x 4 oe	**7**

18	Clear attempt **to use** cosine rule Correct substitution to give cosineθ Correct angle: 60 or 81.7(867…) or 38.2(1321…) Attempt **to use** "$\frac{1}{2}ab\sin\theta$" Correct area: 17(.3205…)	**M1** **A1** **A1** **M1** **A1**	Such as $\frac{1}{2}8\times5\sin17^0$ i.e. even when unclear of origin of angle If and only if evidence of relevant working **W5** **CARE:** as (7 x 5) ÷ 2 = 17.5!	**5**
19	25 to 26 m 2500 to 2600 cm	**5**	**W4** for the "number" and **U1** for "m" Similarly for answer in cm In essence marks awarded for this: [25] x [.85 or 85] x [tan(50.5)] **M1** **M1** **M1** = [25 or 25.8 / (2500 – 2580)] [m or cm] **A1** **U1** Need at least M2 to get U1 – (usually omission of 25) **SC3** for ***consistently*** and clearly calculating the upper bound and final answer	**5**

Mark Scheme 2318
June 2006

MARKING GUIDE This guide gives some of the many examples of evidence that candidates may produce. It indicates possible lines of development that may allow the award of each mark, depending on the supporting context.

Matchstick Patterns [Ao1]

MARK FOR EACH STRAND		Strategy	Communication	Reasoning
1	Works on single width of rectangle.	• **Candidates try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results.** Counts and records the other matchstick patterns correctly (14, 26)	• **Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.** Counts and records the other matchstick patterns correctly (14, 26)	• **Candidates show that they understand a general statement by finding particular examples that match it.** Correctly constructs a further, correct, matchstick pattern.
2		• **Candidates are developing their own strategies for solving problems and are using these strategies both in working within mathematics and applying mathematics to practical contexts.** Finds one more total from a correct matchstick pattern	• **Candidates present information and results in a clear way, explaining the reasons for their presentation.** Records drawings and results in an orderly manner.	• **Candidates search for a pattern by trying out ideas of their own.** Records three related results for one series of matchstick patterns.
3	Works on a series of matchstick patterns → one case solved	• **In order to carry through tasks and solve mathematical problems, candidates identify and obtain necessary information; they check their results, considering whether these are sensible.** Systematically finds three or more related matchstick totals, linking these to the width of the pattern.	• **Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams.** Records drawings and results utilising tables and a minimum of text to annotate the work.	• **Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.** Makes a general statement about the results obtained. E.g. the number of matchstick in a "two high" series is 4w+2, OR "The number of matches increases by 4 each time".
4		• **Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks.** Provides an algebraic generalisation for one system of matchstick patterns.	• **Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams.** Records drawings and results utilising tables and a clear commentary that links and annotates the work.	• **Candidates are beginning to give a mathematical justification for their generalisations; they test them by checking particular cases.** Tests the generalisation made in R3 on new data, showing the predicted result and the derived result from the associated diagram.

5	Changes a variable/ broadens the task → working with algebra → two variables.	• **Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.** Generates sufficient data to be able to generalise another pattern. Further patterns may be generalised but, if the same counting and "pattern spotting" techniques are employed the assessment stops here.	• **Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.** C4 AND produces an algebraic formula into which values are substituted and the formula is evaluated.	• **Candidates justify their generalisations or solutions, showing some insight into the mathematical structure of the situation being investigated. They appreciate the difference between mathematical explanation and experimental evidence.** Explains WHY a formula works, relating the solution to the shape of the patterns. E.g. Uses the geometry of the pattern … "Each vertical contains two matches and will always be one more vertical than the width because… " to reason out the formula.
6		• **Candidates develop and follow alternative approaches. They reflect on their own lines of enquiry when exploring mathematical tasks; in doing so they introduce and use a range of mathematical techniques.** Applies an algebraic method to analyse the relationships within the patterns and, hence, generate further formulae. E.g., sets the height at h matches and the width as w, deriving a formula for the number of matches as 2w + h(w+1). Solves the cube lattice case.	• **Candidates convey mathematical meaning through consistent use of symbols.** Uses algebraic manipulation, with clearly defined variables and logical reasoning, in pursuit of the formula(e) sought in S6.	• **Candidates examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic employed, and make further progress in the activity as a result.** Considers a series of formulae with varying heights (for example) to determine a formula for patterns of any height and width, oe.
It is regarded as unlikely that candidates at Foundation/Intermediate tier will generate evidence to allow the award of 7 or 8 marks. However, it is the responsibility of the examiner to judge whether the work submitted justifies such an award.				
7	Three or four variables, well explained, [3D], clear methods, variables defined, and symbols used to present their argument.	• **Candidates analyse alternative approaches to problems involving a number of features or variables. They give detailed reasons for following or rejecting particular lines of enquiry.** The same techniques as S6 employed to research the number of matchsticks in 3D structures, such as lattices in the form of cuboids, or to explore triangular or tessellating arrays and make significant progress.	• **Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.** Construction of formulae to give the total number of matchsticks in cuboid lattices using variables for length (l) width (w) and height (h), showing clear reasoning.	• **Candidates' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.** Construction of formulae to give the total number of matchsticks in cuboid lattices using variables for length (l) width (w) and height (h), showing clear reasoning and not mere statement of cases.

8		• **Candidates consider and evaluate a number of approaches to a substantial task. They explore extensively a context or area of mathematics with which they are unfamiliar. They apply independently a range of appropriate mathematical techniques.** The candidate uses algebraic means only to explore their chosen S7 development.	• **Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.** Clear concise algebraic reasoning for at least one development into 3D completely solved, or a tessellating lattice.	• **Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.** Algebraic proof for the formula presented for the S8 case.

MARKING GUIDE This guide gives some of the many examples of evidence that candidates may produce. It indicates possible lines of development that may allow the award of each mark, depending on the supporting context.

Spiral Bound [Ao1]

MARK FOR EACH STRAND		Strategy	Communication	Reasoning
1	Works on the given spiral.	• **Candidates try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results.** Finds the length of any spiral, most likely to (-3, 3) [30].	• **Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.** Records the working for the length of one spiral.	• **Candidates show that they understand a general statement by finding particular examples that match it.** Finds the correct length of the spiral to any point.
2		• **Candidates are developing their own strategies for solving problems and are using these strategies both in working within mathematics and applying mathematics to practical contexts.** Finds the correct length of a different portion of the spiral.	• **Candidates present information and results in a clear way, explaining the reasons for their presentation.** Sets out the work of S2 neatly with a clear drawing, lengths indicated and totals shown.	• **Candidates search for a pattern by trying out ideas of their own.** Finds three related results for lengths of spirals.
3	Works on a series of related portions of the spiral → one case solved	• **In order to carry through tasks and solve mathematical problems, candidates identify and obtain necessary information; they check their results, considering whether these are sensible.** Finds the length of any three related spirals. Eg to consecutive turning points on the spiral.	• **Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams.** Records drawings and results utilising tables and minimum text to annotate the work.	• **Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.** Makes a general statement that is correct for the results obtained. Eg The spiral is made up of pairs of consecutive whole numbers, the sum of horizontals are triangular numbers, $\frac{n(n+1)}{2}$ etc
4		• **Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks.** Makes a correct general statement about the length of any part of the spiral. Eg the sum of n horizontal components are $\frac{n(n+1)}{2}$	• **Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams.** Records diagrams of spirals, tables of results and calculations in an orderly way. These are linked with a commentary that clearly explains the work that has been done.	• **Candidates are beginning to give a mathematical justification for their generalisations; they test them by checking particular cases.** Tests the generalisation made in R3 on new data, showing the predicted result and the derived result from the associated diagram.

5	Changes a variable/ broadens the task → working with algebra → two variables.	• **Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.** Extends spiral systematically and records spiral lengths to related corners, breaking down lengths to component parts. Eg to points on odd numbered corners, y = -x, etc	• **Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.** Following the award of C4, an algebraic formula is stated and a clear substitution into this is shown.	• **Candidates justify their generalisations or solutions, showing some insight into the mathematical structure of the situation being investigated. They appreciate the difference between mathematical explanation and experimental evidence.** Explains WHY a formula works, using the geometry of the pattern. Eg. Shows that the series of lengths may be rearranged to form two series of triangular numbers, because of the geometry of the spiral.
6		• **Candidates develop and follow alternative approaches. They reflect on their own lines of enquiry when exploring mathematical tasks; in doing so they introduce and use a range of mathematical techniques.** Uses algebraic method to determine a formula for a further series of lengths to related corners. Eg as a pair of added triangular numbers or by applying difference method.	• **Candidates convey mathematical meaning through consistent use of symbols.** The algebraic method employed in the extension (S6 or better) utilises variables that are clearly defined and some manipulation is employed. This may be part of a "leading diagonal" method to determine a formula.	• **Candidates examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic employed, and make further progress in the activity as a result.** Eg. Examines work on original spiral and extends this to a spiral in which the spaces are twice as large.
7	[Two or] three variables, well explained, [complex relationships], clear methods, variables defined, and symbols used to present their argument.	• **Candidates analyse alternative approaches to problems involving a number of features or variables. They give detailed reasons for following or rejecting particular lines of enquiry.** Applies well-explained algebraic methods to explore all spiral lengths within one quadrant. May achieve such formula(e) in terms of coordinates.	• **Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.** Algebraic methods used on [at least] the S6 development to convey clear meaning and make progress. The work is annotated and demonstrates clear thinking about the task.	• **Candidates' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.** Provides thorough reasoning for why some results are valid for the S7 development, referring to the geometry of the spiral.
8		• **Candidates consider and evaluate a number of approaches to a substantial task. They explore extensively a context or area of mathematics with which they are unfamiliar. They apply independently a range of appropriate mathematical techniques.** Fully generalises given spiral by extending work to all four quadrants OR by constructing rectangular (or triangular) spirals and applies algebraic methods to derive further formulae.	• **Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.** Algebraic methods used on [at least] the S7 development. The work is annotated, succinct and conveys clear meaning and understanding of the task.	• **Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.** Clear algebraic reasoning for the complete S7 development and attempts to extend this reasoning to work in other quadrants or to formulae obtained within the new spiral(s) considered.

SPECIFY and PLAN [S] **OCR Set Task 2006 Marking Guide "Rich World, Poor World"**

This guide contains examples of some evidence candidates might produce in response to the task

Notes: 1. In these criteria there is an intended approximate link between 7 marks and grade A, 5 marks and grade C and 3 marks and grade F.
2. Candidates must provide evidence of their plan being implemented.
3. If secondary data is provided it must be in sufficient quantity to allow sampling to take place.

			Minimum requirements	Examples
1	Simple task, no plan	Candidates choose a simple well-defined problem. Their aims have some clarity. The appropriate data to collect are reasonably obvious. An overall plan is discernible and some attention is given to whether the plan will meet the aims. The structure of the report as a whole is loosely related to the aims.	Candidates show they understand a simple task. There is an implicit plan.	❖ Attempts the question. Eg Records some data for African/European countries.
2				❖ Identifies some relevant data and makes an extended attempt to answer the question. Eg Records some data for some African/European countries and draws graph(s).
3	One dimensional, simple plan and aims.	Candidates choose a problem involving routine use of simple statistical techniques and set out reasonably clear aims. Consideration is given to the collection of data. Candidates describe an overall plan largely designed to meet the aims and … …structure the project report so that results relating to some of the aims are brought out. Where appropriate, they use a sample of adequate size.	▪ Candidates set out reasonably clear aims (or the purpose). ▪ Their planning is largely designed to meet the aims/purpose. ▪ They use data appropriate to the problem.	❖ Writes one relevant aim and produces a minimal plan to meet the aim. Eg Intent to use data to find mean incomes for chosen countries.
4				❖ Writes one or more aims and produces a clear plan that will allow one aim to be met. Eg. Intends selecting data from some African/European countries, comparing GDPs and drawing comparative graphs.
5	Two (+) areas, planning, aims, justified sample	Candidates consider a more complex problem. They choose appropriate data to collect and state their aims in statistical terms with the selection of an appropriate plan. Their plan is designed to meet the aims and is well-described. Candidates consider the practical problems of carrying out the survey or experiment. Where appropriate, they give reasons for choosing a particular sampling method. The project report is well structured so that the project can be seen as a whole.	▪ Candidates consider a **substantial** problem stating their initial aims clearly at the beginning of the report. ▪ Their plan is explicitly stated to meet those aims. ▪ They choose an appropriate sample.	❖ Writes two or more aims in general terms. A written plan that allows at least two aims to be tested. Relevant data is used. Eg. Intends to compare GDP with life expectancy, wealth with birth rate … using appropriate graphs and calculations.
6				❖ Writes one or more aim in statistical terms and constructs an efficient plan to test the aims. Data is carefully selected. Eg. As S5 but aims in the form"… showing negative correlation between GDP and death rate" with a clear structure drawing all components of the task together.
7	Sophisticated specification and aims	Candidates work on a problem requiring creative thinking and careful specification. They state their aims clearly in statistical terms and select and develop an appropriate plan to meet these aims giving reasons for their choice. They foresee and plan for practical problems in carrying out the survey or experiment.	▪ Candidates work on a **demanding** problem. ▪ They state their aims clearly in statistical terms and give valid reasons for their choice of planning. ▪ They explain and act upon limitations of their chosen sample (eg bias), where appropriate.	❖ An overall structure incorporates individual tasks. Each task stated in statistical terms and carefully specified. The tasks are brought together within the overall hypothesis. Eg. Intends to show that life in Europe is better than in Africa. Explains how the data used will define "life" and "better".
8		Where appropriate, they consider the nature and size of sample to be used and take steps to avoid bias. Where appropriate, they use techniques such as control groups, or pre-tests or questionnaires or data sheets, and refine these to enhance the project. The project report is well structured and the conclusions are related to the initial aims.		❖ S7 is expanded to involve justification for choice of data, possibly whole populations. Specific aims and components stated in correct statistical language. Clear justification, in statistical terms, for how each aim will be met. Methods justified and relevant to the tasks.

COLLECT, PROCESS and REPRESENT [C]

Notes: 1. In these criteria there is an intended approximate link between 7 marks and grade A, 5 marks and grade C and 3 marks and grade F.

2. The mark awarded to a particular technique should reflect the quality of use and understanding as well as its position within the Level Indicators.

3. The inclusion of statistical techniques outside the National Curriculum does not necessarily justify the award of higher marks.

4. 'Diagrams' include tables, charts and graphs. At 5-6 marks the diagrams used should be appropriate. At 7-8 marks the range of diagrams should be appropriate to the problem chosen and the statistical strategy chosen.

5. 'Redundancy' implies unnecessary and/or inappropriate diagrams or calculations. This includes techniques that are not used for any conclusion.

		Minimum requirements	Examples
1	Candidates collect data with limited relevance to the problem and plan. The data are collected or recorded with little thought given to processing.	▪ Candidates collect or use data and record it.	❖ Evidence haphazardly recorded from S1.
2	Candidates use calculations of the simplest kind. The results are frequently correct. Candidates present information and results in a clear and organised way. The data presentation is sometimes related to their overall plan.		❖ One technique, (grade G) used. Eg bar chart, tally chart… ❖ Some organisation shown in the work
3	Candidates collect data with some relevance to the problem and plan. The data are collected or recorded with some consideration given to efficient processing. Candidates use straightforward and largely relevant calculations involving techniques of at least the level detailed in the handling data paragraph of the grade description for grade F. The results are generally correct. Candidates show understanding of situations by describing them using statistical concepts, words and diagrams. They synthesise information presented in a variety of forms. Their writing explains and informs their use of diagrams, which are usually related to their overall plan. They present their diagrams correctly, with suitable scales and titles.	▪ Candidates collect or use data with some relevance to the problem. ▪ They utilise statistical techniques/diagrams (see note 1 above) to process and represent the data. ▪ Their results are generally correct..	❖ Two techniques (one grade F) used. Eg Tabulated results, comparative bar chart to show incomes, mean incomes… ❖ Results contain few obvious errors.
4			❖ The results of C3 are linked with a commentary. ❖ Grade E and D techniques used appropriately.
5	Candidates collect largely relevant and mainly reliable data. The data are collected in a form designed to ensure that they can be used. Candidates use a range of more demanding, largely relevant calculations that include techniques of at least the level detailed in the handling data paragraph of the grade description for grade C. The results are generally correct and no obviously relevant calculation is omitted. There is little redundancy in calculation or presentation. Candidates convey statistical meaning through precise and consistent use of statistical concepts that is sustained throughout the work. They use appropriate diagrams for representing data and give a reason for their choice of presentation, explaining features they have selected.	▪ Candidates collect/sample largely relevant data. ▪ They utilise appropriate calculations/techniques/ diagrams (see note 1 above) within the problem. ▪ Their results are generally correct..]	❖ Two techniques (one grade C) used. Makes own hypothesis and plans to test this by Eg Scatter graph to link GDP to life expectancy (D), [type of correlation discussed (C)] ❖ At least 25 data items chosen. ❖ Results contain few obvious errors
6			❖ As C5 but with grade B techniques and little redundancy in their use. ❖ Statistical language used accurately.
7	Candidates collect reliable data relevant to the problem under consideration. They deal with practical problems such as non-response, missing data or ensuring secondary data are appropriate. Candidates use a range of relevant calculations that include techniques of at least the level detailed in the handling data paragraph of the grade description for grade A. These calculations are correct and no obviously relevant calculation is omitted. Numerical results are rounded appropriately. There is no redundancy in calculation or presentation.	▪ Candidates collect/sample largely relevant data. ▪ They utilise appropriate and necessary calculations/techniques/ diagrams (see note 1 above) consistently within the problem. ▪ Their results are correct. [***Some minor errors may be condoned provided they do not detract from the quality of the argument.***]	❖ At least S5 awarded. ❖ Statistical language used accurately and consistently. ❖ Three techniques (two at least grade B) used. Eg Compares life expectancies of two + countries with cf curve, draws box and whisker plots and comments, scatter graphs interpreted.
8	Candidates use language and statistical concepts effectively in presenting a convincing reasoned argument. They use an appropriate range of diagrams to summarise the data and show how variables are related.		❖ Presents multifaceted argument using data, grade A and B techniques and statistical language efficiently and effectively.

INTERPRET and DISCUSS [I]

Notes: 1. In these criteria there is an intended approximate link between 7 marks and grade A, 5 marks and grade C and 3 marks and grade F.
2. The number of marks awarded at this strand is unlikely to exceed the mark at Strand 1 by more than 1.
3. The use of ICT is to be encouraged to allow candidates more time to analyse and interpret the data. (There is no requirement for the diagrams to be drawn by hand).

		Minimum requirements	Examples
1	Candidates comment on patterns in the data. They summarise the results they have obtained but make little attempt to relate the results to the initial problem.	Candidates comment on their data.	❖ Makes a comment based on the data. Eg. "I have found some income figures for African/European countries."
2			❖ Any summary or comparative comment, based on their results. Eg "People in Luxembourg are the wealthiest."
3	Candidates comment on patterns in the data and any exceptions. They summarise and give a reasonably correct interpretation of their graphs and calculations. They attempt to relate the summarised data to the initial problem, though some conclusions may be incorrect or irrelevant.	▪ Candidates summarise some of their data. ▪ They make a statement based on their diagrams or calculations, which is relevant to the problem.	❖ Evidence of processing data. ❖ Relevant comment made based on the processed data. Eg "Most of the European countries have a higher GDP than the African countries."
4	They make some attempt to evaluate their strategy.		❖ I3 AND S3 ❖ **One** comparison made within the task. ❖ Summary of findings, related back to the aim.
5	Candidates comment on patterns in the data and suggest reasons for exceptions. They summarise and correctly interpret their graphs and calculations, relate the summarised data to the initial problem and draw appropriate inferences. Candidates use summary statistics to make relevant comparisons and show an informal appreciation that results may not be statistically significant.	▪ Candidates summarise **and** correctly interpret their diagrams or calculations. ▪ They relate these interpretations back to the original problem. ▪ They evaluate their strategy.	❖ Makes **two** comparisons of results within the context of their task Eg GDP and life expectancy for Europe and Africa AND GDPs of both continents. ❖ Some evaluation of strategy Eg "I should have taken data from more countries", OR "The scale on my graphs was too small to see the patterns clearly."
6	Where relevant, they allow for the nature of the sampling method in making inferences about the population. They evaluate the effectiveness of the overall strategy and make a simple assessment of limitations.		❖ I5 and … ❖ Evaluation is more sophisticated and includes comments on the limitations of their data and the implications of their findings. Eg Assesses how "current" the data is and discusses whether the results will be true for ALL inhabitants of the countries. ❖ Reasons are beginning to be given for the evaluative statements. ❖ Techniques are interpreted clearly.
7	Candidates comment on patterns and give plausible reasons for exceptions. They correctly summarise and interpret graphs and calculations. They make correct and detailed inferences from the data concerning the original problem using the vocabulary of probability. Candidates appreciate the significance of results they obtain.	▪ Candidates summarise and correctly interpret their results. ▪ They show an appreciation of the significance of these results. ▪ They recognise possible limitations in their strategy and suggest improvements (where appropriate)	❖ S6 awarded (no lower than S5) ❖ A correct and detailed evaluation, in statistical terms, of their strategy and use of techniques is made. ❖ Valid improvements are suggested (see generic criteria) and some reasons for suggestions will be given. ❖ Most techniques are interpreted correctly using accurate statistical language and some are related to the task.
8	Where relevant, they allow for the nature and size of the sample and any possible bias in making inferences about the population. They evaluate the effectiveness of the overall strategy and recognise limitations of the work done, making suggestions for improvement. They comment constructively on the practical consequences of the work.		❖ I7 and… ❖ Fully justifies improvements that may have been suggested and/or offers clear commentary showing an understanding of how the conclusions could be used (for example) by Aid agencies. ❖ All techniques are interpreted correctly using accurate statistical language and all findings related to the task.

General Certificate of Secondary Education
Mathematics B (MEI) (1968)
June 2006 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a*	a	b	c	d	e	f	g	u
2311	Raw	72	-	-	-	-	54	43	33	23	0
	UMS	71	-	-	-	-	60	48	36	24	0
2312	Raw	72	-	-	51	39	28	17	-	-	0
	UMS	95	-	-	84	72	60	48	-	-	0
2313	Raw	72	56	43	30	17	-	-	-	-	0
	UMS	120	108	96	84	72	-	-	-	-	0
2314	Raw	100	-	-	-	-	71	55	40	25	0
	UMS	119	-	-	-	-	100	80	60	40	0
2315	Raw	100	-	-	65	47	34	21	-	-	0
	UMS	159	-	-	140	120	100	80	-	-	0
2316	Raw	100	67	51	35	19	-	-	-	-	0
	UMS	200	180	160	140	120	-	-	-	-	0
2317	Raw	48	43	37	31	26	22	18	14	10	0
	UMS	80	72	64	56	48	40	32	24	16	0
2318	Raw	48	43	37	31	26	22	18	14	10	0
	UMS	80	72	64	56	48	40	32	24	16	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
1968	400	360	320	280	240	200	160	120	80	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
F	-	-	-	-	3.9	29.3	62.3	86.6	100	607
I	-	-	14.7	49.9	84.7	95.6	-	-	100	1874
H	33.4	66.3	91.4	99.4	-	-	-	-	100	1559
All tiers	13.6	27.1	43.7	62.3	77.9	86.7	91.9	95.7	100	4040

4040 candidates were entered for aggregation this series
For a description of how UMS marks are calculated see;
www.ocr.org.uk/OCR/WebSite/docroot/understand/ums.jsp

Statistics are correct at the time of publication

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