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GCSE

Mathematics C

GCSE **1966**

Mark Schemes for the Units

June 2006

1966/MS/R/06

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General Certificate of Secondary Education
GCSE Mathematics C - 1966

MARK SCHEMES FOR THE UNITS

Mark Scheme 2331
June 2006

Section A

Question		Full marks		Part marks	
1	**(a)**	3	**W1**		
	(b)	4	**W1**		
2	**(a)**	4 27 7	**W1** **W1** **W1**		
	(b)	9 and 5 only	**W1**		
3	**(a)**	3:10 (or equivalent time format)	**W2**	**W1**	"2:30" or equivalent seen **or** any final answer involving 10 minutes
	(b)	3:20 (or equivalent time format)	**W1**		
	(c)	5	**W1**		
4	**(a)**	7 11 15 37	**W1**		
	(b)	30 40	**W1**		
	(c)	15 30 40	**W1**		
	(d)	15 37	**W1**		
	(e)	11 40	**W1**		
5		6 cm 12(cm) 1.2(m) 6 m	**W2**	**W1**	Correct smallest or largest or totally reversed.
6	**(a)**	(2, 10) (8, 6) (14, 2)	**W1** **W1** **W1**	**SC1**	All coordinates consistently transposed.
	(b)	Mention of "add 3" and "subtract 2"	**W2**	**W1** **W1**	+3 or equivalent -2 or equivalent
7		Correct (4 sides)	**W3**	**W2** **W1** **SC1**	Any 3 sides correct Any 2 sides correct Correct enlargement by SF>1

Section B

Question		Full marks		Part marks	
8	**(a)**	**T S O** **C H P**	**W2**	**W1**	Any three letters correctly matched.
	(b)	136 to 152	**W2**	**W1**	13.6 to 15.2
	(c)	43 to 47 inclusive	**W1**		Must be ruled
9	**(a)**	(i) Kniper (ii) Parry (iii) Norman	**W1** **W1** **W1**		
	(b)	32 to 38 inclusive	**W2**	**W1**	Outside this range but 30 to 40.
	(c)	(i) 1962 (ii) 6212	**W1** **W1**		
	(d)	7 084	**W1**		
10	**(a)**	2	**W1**		
	(b)	12	**W2**	**M1**	26 and 14 seen
	(c)	2001	**W1**		
11		£16.89(p)	**W4**	**W3** **W2** **Or M1**	Digits 1689 seen 8(.)44, 16(.)90, 96(.)89 80 or digits 169/8844 seen
12	**(a)**	A B C **A C B** **B A C** **B C A** **C A B** **C B A**	**W2**	**W1**	4 lines correct
	(b)	(i) Unlikely (ii) Impossible	**W1** **W1**		

Mark Scheme 2332
June 2006

Section A

Question		Full marks		Part marks	
1	**(a)**	anticlockwise	**W1**		clearly indicated
	(b)	NW , Northwest	**W1**	**W0**	WN, westnorth, north then west
2	**(a)**	50	**W1**		not 50/100, 0.5, ½
	(b)	216	**W3**	**M1** **M1**	5 × 18 (=90) soi or 3 × 42 (=126) soi Complete attempt to add their 5 times 18 **and** their 3 times 42.
	(c)	2	**W2**	**M1**	ordered list (can be reversed) (1, 1, 1, 1, 2, 2, 3, 3, 3, 5)
	(d)(i)	music reality soap other	**W2**	**M1**	any 2 correct, ignoring repeats
	(d)(ii)	reality	**W1**	**Ft**	Their d(i)
3	**(a)(i)**	19	**W1**		
	(a)(ii)	+ 4	**W1**		acc equiv
	(b)	+6	**W1**		acc equiv condone +2 +3 +4 +5
4	**(a)**	350 to 450	**W1**		acc 3·5 to 4·5
		180 to 220	**W1**		acc 1·8 to 2·2
		65 to 90	**W1**		acc 0·65 to 0·9(0)
	(b)	1·5	**W1**		acc 1·50, 1·500, 1½, 1m 50 cm
	(c)	3500	**W1**		
5		horizontal line	**W1**		intention
		diagonal line	**W1**		intention
		vertical line	**W1**		intention
6	**(a)**	(0)·7	**W1**		
	(b)	2·05, Yes : both required	**W2**	**M1** **or** **W1**	*x*·*y*5 figs 205 (ignore any ticks)

Section B

Question		Full marks		Part marks	
7	**(a)**	cuboid	**W1**		intention
		sphere	**W1**		intention
	(b)	6	**W2**	**M1**	10 ÷ 1(·)49 *or* 10 ÷ 1(·)5(0) *or* 7, 6·7(1…), 6·6(6…),
8	**(a)**	acute angle indicated	**W1**		
	(b)	70 (± 3) *or* 290 (± 3)	**W1**	**ft**	their (a) **only** **if** no clear choice or no response in(a), acc 70 ± 3
9	**(a)**	64	**W2**		
	(b)	20 c.a.o.	**W1**	**SC1**	**If W0 scored in (a) and (b)** For x 8 ÷ 5 soi or ÷ 5 x 8 soi in either (a) or (b) Or 320 seen in (a) Or 100 seen in (b)
10		£ 71·42 rem 6p cao (on answer line)	**W5**	**M1**	500 ÷ 7 **or** figs 7142(85..) *or* 71·4(3)
				or **W2**	71(·)42
				& W1	(0·0) 6
				or **W1**	For **Ft** their 71.42 x 7 correctly subtracted from 500
				& **W1**	correct units for £(60 to 80) (each) or (1 to 6)p (over)
				OR	
				SC3	£71 (each) and £3 (over).
				SC2	71 (each) and 3 (over) or £71 (each)
				SC1	71 (each)
					MARK TO CANDIDATES ADVANTAGE
11	**(a)**	2 05	**W1**		acc equivalent time forms
		2 50	**W1**		
		40	**W1**		Ft their 2 50
	(b)	1 (hr) 25 (min) 85 mins	**W2**	**or ft**	45 + their 40 *or* their start time to 3:30
				M1	85 seen or attempt to add 45 and their 40
	(c)	6·3	**W1**		
	(d)	22·4	**W2**	**M1**	attempt to add, implied by 20 to 25 **Or** figs 224

Question	Full marks	Part marks
12 (a)	unlikely **W1**	intention
(b)	E **W1**	intention
	I **W1**	intention

Mark Scheme 2333
June 2006

Section A

Question	Full marks		Part marks
1 (a)	2460 o.e.	**W1**	
(b)	8·64 o.e.	**W1**	
(c)	83·5	**W2**	**M1** for 16·7×5 attempted or figures 835
(d)	12·4	**W2**	**M1** for 49·6÷4 s.o.i. or figures 124
2 (a)	20	**W1**	accept embedded answers
(b)	9	**W1**	
(c)	4	**W1**	
3	168	**W2**	**M1** for 840 ÷ 5 s.o.i. or 8.4 or 84 seen or figures 168, accept equivalent methods
4 (a)	(3+5)×2+6	**W1**	only correct brackets in either part
	3+5×(2+6)	**W1**	
(b)	he added before multiplying	**W1**	accept any correct explanation
5	4·2	**W2**	**M1** for 6×700 s.o.i. or figures 42 **SC1** for 4 or 0.7 seen allow trailing zeros at the least significant end
6 (a)	0·25	**W1**	
	0·5	**W1**	
(b)	30	**W1**	
(c) (i)	64	**W1**	
(c) (ii)	15	**W1**	
7	40·73	**W4**	**M1** for attempt at 9·84 + 9·84 (or 19·68 seen) **M1** for adding 18·60 to their '19·68 ' seen at any stage (or 38·28 seen) √**W1** for selecting an appropriate postage (or 2·45 seen)

Section B

8	linear vertical scale all bars correct	**W1** **W2**	 heights closer to the nearest integer and bars of equal width **W1** three correct heights only
9	km m	**W1** **W1**	
10 (a) **(b)**	yes + half of the tokens have a C arrow between quarter and half	**W1** **W1**	allow any correct statement
11 (a) (i) **(a) (ii)** **(b)**	$^{-}5\ ^{-}3\ ^{-}2\ ^{-}1\ 0\ 3\ 4$ $^{-}1$ 5	**W1** **W1** **W1**	 ft their (a) if ordered
12 (a) **(b) (i)** **(b) (ii)**	409·5 162 66	**W1** **W2** **W2**	 **M1** for 27 x 6 seen or figures 162 **M1** for 2x6 + 2x27 seen
13 (a) **(b) (i)** **(b) (ii)**	Only 2 points plotted correctly ruled straight line 58 - 62 34 - 38	**W1** **W1** **W1** **W1**	within one small square at least 6cm long or ft their ruled line if points are wrong or ft their ruled line if points are wrong
14	D C	**W2**	**W1** each answer
15 (a) **(b)**	correct width (6 cm) correct height (3 cm) 64 - 70	**W1** **W1** **W2**	**SC1** correct width and height in a right angled triangle (ft their diagram if **W2** not scored in (a)) **M1** for 6·4 - 7·0(cm)

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June 2006

Section A

Question	Full marks		Part marks	
1 (a)	45	**W1**		only
(b)	7	**W1**		only
(c)	9	**W1**		only
2	two of: no (vertical) scale one/last/2003 bar wider 1st gap should be smaller than the gaps profits don't shoot up, there's a steady rise	**W2**	**W1**	each, maximum W2 acc clear equivalents
3 (a)	40 (km)	**W1**		
(b)	1·5 (hrs) oe	**W2**	**W1**	10:00 and 11:30 both soi (no contradictory extras) *or* 1·30, *or* 1:30 1,5 etc
(c)	80 (km/hr)	**W2**	**M1**	40 ÷ 0·5 or equivalent
4 (a)	700	**W1**		
(b)	150	**W1**		
(c)	50	**W1**		
5 (a) (i)	$\frac{7}{10}$	**W1**		Accept any equivalent fraction
(a) (ii)	70	**W1**	**W0**	70/100
(b)	0·076, 0·176, 0·7, 0·706, 0·76	**W2**	**W1**	4 correct *or* fully reversed
6	2432 **with working**	**W3**	**M1** **& W1** **or W1**	Complete attempt at long multiplication figs 1152 *or* 38 *or* 152 *or* 2432 seen *or* 4 correct rectangles (grid methods) *or* 1280 (correct), seen from 128 × 10 (note: W0 1280 only) **answer only**
7 (a)	52	**W1**		
	'opposite' *or* 'X ' *or* 'cross'	**W1**		without contradiction
(b)	64	**W1**		
	isosceles	**W1**		
	'angles in a triangle' *or* 'triangle, 180'	**W1**		without contradiction

Section B

Question		Full marks		Part marks	
8	**(a)**	-4, -2	**W1**		
	(b) (i)	C and D correctly plotted	**W1**		both
	(b) (ii)	32 (cm)	**W2**	*or* **ft** **M1** *or* **SC1**	their square **ft**: clear evidence of addition of all dimensions of *their* rectilinear shape if 0 scored in (b)(ii) square correct and 16
9		1·75	**W3**	**M1** *or* **M2** *or* **W1**	9 × 4(·)25 soi [= 38(·)25] or 4-figure 2dp number correctly subtracted from 40 2 × 20 – their 9 × 4(·)25 correctly subtracted **figs 175 (0)**
10		13·9	**W3**	**M2** ***or* W1**	Complete method One correct area: 16·45, 2·55, 9·4, 4·5, 10·5, 3·4, 6
11	**(a)**	Triangle B correct	**W1**		intention
	(b)	Triangle C correct	**W1**	 **SC1**	if 0 scored in (a) and (b) both correct position & orientation but labels B, C incorrect
12		One correct improved trial	**W1**		must be greater than [24, 30]
		One further improved trial	**W1**		
		35 and 41	**W1**		both
13	**(a)**	32	**W2**		If 0 or 1 scored in total in (a) and (b),
	(b)	91·5(0)	**W1**	**M1**	in (a): 17 seen *or* 2×8·5(0) +15 soi *or* in (b): 76·5(0) seen *or* 9×8·5(0) +15 *or* figs 915 (0..)
	(c)	$C = 15 + 8{\cdot}5d$	**W2**	 **W1**	accept equivalents $8{\cdot}5d$ *or* $d8{\cdot}5$ *or* $8{\cdot}5\times d$ seen *or* correct quantities, incorrect variables

Question	Full marks	Part marks
14 (a)	7 **W1**	
(b)	3·75 **W3**	**M2** 26 to 26·4 *or* figs 375 **or M1** addition soi, implied by 25 to 35 *&* **M1** division by 8 shown
(c)	$\frac{3}{8}$ **W1**	accept equivalents, correct forms only eg 0·375, 37·5%, 37%, 6/16

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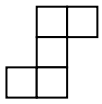
Section A

Question	Full marks				Part marks
1 (a)	49	**1**			cao
(b)	5	**1**			cao
(c)	64	**1**			cao
2 (a)	5, 9, 17, 33	**2**		**M1** **SC1**	For any two correct numbers f.t. their incorrect terms 6, 5, 10, 9
(b)	All terms are odd numbers	**1**			o.e. explanation
3 (a) (i)	RV FR FF FV VR VF VV	**2**			No extras, condone repeats
				M1	For any five correct, (ignore repeats and/or extras)
(a) (ii)	$\frac{5}{9}$ o.e.	**1**			f.t. their list **OR** their list not including the two given combinations e.g. $\frac{3}{7}$
(b)	No **and** 75 or 74 seen	**2**		**M1**	50 × 1·5 **or** 50 x 1.48 **or** 80 ÷ 50 **or** 80÷1.5(0) **or** 74 **or** 75 **or** 1.6 **or** 53(.33…)
4 (a)	11a	**1**			
(b)	11q – 4r	**2**			As final answer
				M1	11q or – 4r seen
(c)	21	**2**		**M1**	30 seen or 6 × 5 – 9
5	Rectangle Kite Parallelogram ✓ × ✓ ✓ × × × × × ✓ × ✓ ✓ ✓ ×	**2**		**W1**	For kite or parallelogram column correct or 3 rows correct. Blank cells are incorrect
6 (a) (i)	12	**1**			cao
(a) (ii)	9	**1**			cao
(b)	$\frac{7}{12}$ $\frac{2}{3}$ $\frac{3}{4}$	**2**		**M1**	For one correct equivalent fraction eg $\frac{8}{12}$ or $\frac{9}{12}$ Could be diagramatic

7	**(a)**	Correct translation	**1**			
	(b)	Reflection in the line $y = 1$	**2**		**M1**	Reflection or check diagram for correct mirror line drawn (min 3cm long)

Section B

8 (a)	14	**3**		**M1**	Attempt to add - either addition seen or implied by answer in range 199 - 221
				M1	their total ÷15 dependent on 1st M1
(b)	Mean is distorted by two large values	**1**			
9 (a)	B	**2**		**W1**	D or views labelled BC, BD, BD all given correct.
(b)		**2**			Accept any orientation
				M1	For extra square anywhere or reflection 
				SC1	Right angled triangle in this position with other squares correct. 
10 (a) (i)	204	**4**		**W2**	510
			or	**M1**	0·6 × 850 or attempt to work out 6 × 10% (of 850) or 50% (of 850) + 10% (of 850) o.e.
			and	**M1**	'their 510' ÷ 5 o.e
			and	**A1**	f.t. 2 × 'their 102'
					Alternative Method
				W2	340
			or	**M1**	850 ÷ 5 x 2 o.e.
			and	**M1**	'their 340' x 0.6
			and	**A1**	f.t. 'their 204'
(a) (ii)	36	**2**		**M1**	522 ÷ 1450 **or** $\frac{522}{1450}$ (x100) **or** figs 36
(b)	3000	**1**			
11 (a)	15	**1**			Accept embedded answers throughout
(b)	5	**1**			
(c)	7·5 or $7\frac{1}{2}$ or $\frac{15}{2}$ o.e.	**2**		**M1**	$2x = 8 + 7$ or better or correct reversed flow diagram

12 (a)	512	**2**		**M1**	8 × 8 × 8 seen or 64x8
	cm^3	**1**			must include a value
(b)	384	**3**		**M1**	8 × 8 or 64 seen
				M1	6 seen

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Section A

1	(a)	Axes scaled consistently	[1]	
		Histogram		
		All heights correct	[1]	Accuracy ± 2 mm
		Bars correctly positioned with no gaps	[1]	
		OR		
		Frequency polygon		
		Heights correct	[1]	Accuracy ± 2 mm
		Points plotted at mid intervals and ruled lines	[1]	
	(b)	$\frac{23}{60}$ i.s.w. (but not subtraction from 1)		
		or 0.38.... or 38....%	[2]	**W1** for 23 seen
2	(a)	The train stops or equivalent	[1]	
	(b)	Ruled line from York(11 00) to London (13 15)	[2]	Allow ± 2 mm at each end **W1** for freehand line **or** **W1** for one end correct **OR** **W1** for ruled line from London to York with both ends correct.
3		0.43[p] or 43[p]	[4]	**W3** for figs 215 seen **or** **W2** for figs 228 seen **or** **W1** for figs 162 **or** figs 66 seen **and** **M1** for (their 215) ÷ 5
4	(a)	– 8	[2]	**W1** for $[(-2)^2 =]$ 4 or –12 seen
	(b)	Final answer $a(a+6)$	[1]	
5	(a)	[×]3 or $\frac{3}{1}$	[1]	
	(b)	(0 , 2)	[1]	

6	(a)	(i) Final answer $\frac{3}{20}$ o.e. or 0.15	[1]	
		(ii) Final answer $\frac{4}{5}$ o.e. or 0.8	[1]	
	(b)	$\frac{21}{25}$ o.e. with one relevant correct change	[2]	**W1** for one relevant correct change
7	145°		[2]	**W1** for 35 seen **or** **M1** for 360 – (83 + 115 + 127) **OR** (exterior angle method). **W1** for two of 97, 65 and 53 seen **or** **M1** for 360 – (97 + 65 + 53) f.t
	[Angles in a] quadrilateral [= 360°]		[1]	Exterior angles [= 360°]
	[Angles on a] straight line [= 180°]		[1]	

Section B

8	(a)	A	[1]	
	(b)	D	[1]	
9	(a)	4.6 o.e.	[1]	
	(b)	11.3	[2]	**W1** for figs 112[7…] or figs 113 seen **or** **W1** for answer – 2.6 **or** **W1** for figs 2401 seen
10	(a)	35	[1]	
	(b)	5.5 or $5\frac{1}{2}$ or $\frac{11}{2}$ i.s.w.	[2]	**M1** for $2x = 6 + 5$ **or** **W1** for answer $\frac{1}{2}$ or 0.5
	(c)	– 2	[3]	**W1** for $8x + 36$ seen **and** **M1** $8x = 20 - 36$ f.t. **OR** **M1** for $2x + 9 = 5$ **and** **M1** for $2x = 5 - 9$ f.t.
11	(a)	£10440	[3]	**M2** for $\frac{100 - 28}{[100]} \times 14500$ implied by figs 1044 **or** **M1** for $\frac{28}{[100]} \times 14500$ implied by 18560 or figs 406
	(b)	26.25	[2]	**W1** for 8.75 **or** **M1** for $\frac{35}{1+3}(\times 3)$ implied by figs 262, 263, 2625

12	(a)	(i)	Angle CBA = 55 to 59° BC = 8.3 to 8.7 cm (Ruled)	[1] [1]	
		(ii)	**If the construction is correct:**		
			14.6 to 15.6 km	[2]	**W1** for 7.3 to 7.8 seen **or** **W1** for 31 + their AC
			If the construction is incorrect:		
			f.t. from their diagram		**W2** for their AC x 2 (Allow ± 0.4km) **or** **W1** for their AC stated (Allow ± 0.2cm) **or** **W1** for 31 + their AC
	(b)		1 h 15 min	[3]	**W2** for 1.25 seen **or** for answer 1 hour 25 minutes **or** 75 minutes **or** **M1** for 14 ÷ 11.2 **or** figs 125
13			20.4 to 20.45	[2]	**M1** for $\pi \times 6.5$ **or** **W1** for answer 40.8 to 40.9

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Section A

1	31, 37	**2**	1 for one omission and/or one extra
2	(a) $C = 360 + 20n$ final answer (b) 30	**2** **2**	1 for $20n$ seen **M1** for $250 = 7n + 40$ or better or for $210 \div 7$
3	(a) 0.1 o.e. (b) 300	**2** **2**	**M1** for sum = 1 s.o.i. **M1** for 0.3×1000, $\frac{300}{1000}$ or 300 seen
4	(a) 7/12 or 14/24 o.e. i.s.w. (b) 3/8	**2** **3**	**M1** for at least one of 9/12, 18/24, 2/12 or 4/24 o.e. seen **W2** for 9/24 o.e. i.s.w. or **M1** for $9/4 \times 1/6$ o.e. and **M1** for ¾ × ½ or M1 **ft** $\frac{\text{their } 9 \times 1}{4 \times 6}$ correctly evaluated
5	both sets of correct arcs ruled perpendicular drawn from P	**1** **1**	Ignore extra arcs tolerance 2° at line **and** line must pass within 1 mm of P and 1 mm of given line.
6	(a) 9 (b) 22 **angle** in **semicircle**[= 90°] [and angle sum of triangle = 180°]	**2** **1** **1**	**M1** for 360 / 40 o.e. If 90° is omitted, this is dependent on answer of 22°, or on 90° seen or used
7	(a) it is increasing o.e. (b) 90	**1** **3**	0 if contradicted **M1** for their $18 \div 12$ or 1.5 seen and **M1 dep**. for their 1.5×60 o.e. or **M1** for their 18 in 1/5 hr [**M2** for their $18 \div 1/5$ o.e. or their 18 × 5 o.e.]

Section B

8	7.2	**2**	**M1** for 2.4 seen or for 12× 3/5 o.e.
9	(a) 6 (b) 7 points plotted, tolerance 2mm smooth curve within 2 mm of at least 6 points (c) answers in range −0.6 to −0.3 and 4.3 to 4.6	**1** **P1** **C1** **1+1**	If table blank, allow this mark for correct plot at 6 on graph correct or ft from table no ft for curve if extra turning points or flat top independent of graph
10	(a) 7 : 8 (b) 48 c.a.o. (c) 76.8 i.s.w.	**1** **2** **4**	allow 7 to 8 **M1** for 120/5 [×2] or 24 seen **M1** for at least 3 of 15, 45, 75 etc seen **M1** for attempt at sum of (freq × their midpts) (in correct range) (at least 3 seen) [3840] **M1** for their sum of (freq × midpts) ÷ 50 [3840 ÷ 50] **dep** on attempt at $\sum fx$ soi **W3** for answer 61.8 or 91.8, otherwise allow last 2 Ms for endpoints used allow full marks for 77 after 3840 seen
11	(a)(i) 30 (a)(ii) $x > 6.5$ (or $x > 6\frac{1}{2}$ or $x > \frac{13}{2}$) c.a.o. final ans. (b) $[x =]\frac{y-8}{4}$ or $\frac{y}{4}-2$ o.e. as final answer	**2** **3** **2**	**M1** for $2x = 60$ or $x/5 = 6$ **W2** for 6.5, $6\frac{1}{2}$ or $\frac{13}{2}$ seen **or M2** for $x - 3 > 3.5$ **or M1** for $2x - 6 > 7$ and **M1** for $2x > 7 + 6$ or correct step ft after wrong first step seen **M1** for $y - 8 = 4x$ or $\frac{y}{4} = x + \frac{8}{4}$ or better
12	(a) 4[.0] www (b) obtuse(or greater than 90°) with attempt to compare lengths.	**3** **1**	**M1** for $2.4^2 + 3.2^2$ or 16 www and **M1** for sq. rt. of sum or difference of 2.4^2 and 3.2^2 answer **must** ft from their (a) **and** must have attempt at comparison of lengths. 0 if Pythagoras not attempted in (a)

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Section A

Question	Full marks		Part marks
1 (a)	$\frac{1}{13}$ and $\frac{12}{13}$ in correct places on three pairs of branches	W2	**W1** for 1 complete correct pair of branches
(b)	$\frac{1}{169}$	W2	**M1** for $\frac{1}{13} \times$ 'their $\frac{1}{13}$' seen
2 (a)	7n – 3 oe	W2	**M1** for 7n seen in linear expression
(b)	$x = \frac{y-6}{4}$ or $x = \frac{y}{4} - \frac{3}{2}$ mark final answer	W3	**W2** for $x = \frac{\pm y \pm 6}{\pm 4}$ **or** **M1** for 1st correct step e.g [y =] $4x + 6$ or $\frac{y}{2} = 2x + 3$ **M1** for 2nd correct step e.g $y - 6 = 4x$ or $\frac{y}{2} - 3 = 2x$ or ft their 1st step **M1** for 3rd correct step ft their 1st/2nd step N.B mark **final answer** for 3rd M1, Incorrect cancelling loses 3rd M1
3	Area none of these length	W3	**1** for each correct answer
4	rotation, 90°[anticlockwise or positive] oe e.g 270°clockwise, ¼ turn clockwise centre (1,1) condone missing brackets	W3	**W2** for rotation 90° [anti-clockwise or positive] or rotation centre (1,1) **W1** for rotation or 90° [anti-clockwise or negative] or centre (1,1), **W0** if any second transformation mentioned If W0 awarded then **M1** for clear final triangle in correct position
5	199.5, 200.5 Condone order reversed	W2	**W1** for 1 correct
6 (a)	3^8 Final Answer	W2	**M1** for $3^9 \div 3$ seen or $3^3 \times 3^5$ or $3^4 \times 3^4$ or 3^8 seen in working
(b)	$\frac{7}{15}$ indicated	W1	
(c)	$0.\dot{5}$ Final Answer	W1	

Question	Full marks	Part marks
7	80π **W4**	**M3** for $2 \times \pi 4^2 + 6 \times 8\pi$ or $2 \times 16\pi + 48\pi$ **or** **M2** for 32π **or** **M1** each for $[2 \times] \pi \times 4^2$ and $\pi \times 6 \times 8$ oe eg 16π or 48π **or** **SC3** Final Answer 240 to 251.4 or 224π or 64π from $16\pi + 48\pi$ **or** **SC1** for $2\pi \times 8^2 + \pi \times 16 \times 6$ **SC1** for 96π as answer

Section B

Question	Full marks		Part marks
8 (a)	£99.89	**W4**	**M3** for 99.891...**or** 899.89... **or** 99.9[0] **or** **M2** for 800×1.04^2 (or better) soi **or** 865.28.. **or** 899.9[0] **or** 832×1.04 **M1** for 800×1.04 soi **or** 832 **or** 896 **or** 96
9 (a)	2.5×10^{-7}	**W2**	**M1** for figs 25 seen
(b)	0.32	**W2**	**M1** for 1000 mm^3 = 1cm^3 soi
10 (a)	$\frac{1}{2} \times x \times (x-2) \times 2x$ condone lack of brackets in above expression **or** $x \times (x-2) \times 2x$ **or** $\frac{1}{2} \times x \times (x-2)$ Brackets **MUST** be used in both these two expressions	**M1**	
	$x^2(x-2)$ or $x(x^2-2x)$ Condone missing brackets if intention is clear	**A1**	
(b) (i)	$[3^3 - 2\times3^2] = 9$ **and** $[4^3 - 2\times4^2] = 32$ **or** allow any values between 3 and 4 that produce one outcome above and one below 20	**1**	Allow 3 and 4 with working crossed out and then replaced with a more accurate attempt
(b) (ii)	trial of 3.5 to give 18.3[75] trial of 3.6 to give 20.7[36] Allow outcomes rounded or truncated to 1 dp or better ans 3.6 cao independent	**1** **1** **1**	**Or** 3.5 and 3.6 with outcomes in (b)(i) after 0 **SC1** for correct trial with x between 3.1 and 3.9 with outcomes clearly shown

Question	Full marks		Part marks
11 (a)	5x = 10 or 5x = 7 + 3 or complete long method x = 2, y = –3	**M1** **W1**	
(b)	$x^2 - 2x - 35$ cao	**W2**	**M1** for 2 correct terms in 3-term final expression or 3 of $x^2 - 7x + 5x - 35$
(c) (i)	$(x-5)(x+5)$ ISW if attempt to solve	**W1**	
(c) (ii)	[+]5, –5 or ± 5	**W1**	
12	31.2 to 31.3	**W3**	**M2** for [h =] 200 × sin9 **M1** for sin9 used with h and 200 **A1** for 31 if M2 earned **SC3** for sin9 = $\frac{h}{200}$ followed by 31
13	A is better as **median** is higher average/median A =21 to 22 and or average/median B = 17 to 19	**W1** **W1**	Must be **median** not just **average** unless readings given Readings may be on the diagram

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Section A

Question	Full marks		Part marks	
1	Histogram	**W3**	**W1**	Frequency density proportional to 15 / 40 / 120 / 85 / 65 /40
			W1	Axis scaled –dependent on frequency divided by their class width attempted at least twice.
			W1	Bars correct height and width.
2	Explanation	**W2**	**W1**	<ABC = 93 or <ABD = 87
			W1	Tangent and diameter meet at 90°
3	400 or 4×10^2 390 or 3.9×10^2	**W2**	**M1**	Digit 4 or 10^2 or 8/2 Or digits 39
4 (a)	$y = \frac{36}{x^2}$ or equivalent	**W2**	**M1**	$9 = \frac{k}{4}$ or 36 seen or $9 = \frac{k}{2^2}$
(b)	6 and – 6 Or Ft √their k	**W2**	**W1**	One solution Condone √their k not evaluated
5	$\frac{3}{8}$ nww	**W3**	**M1** **M1**	3 8
6 (a)	1 and 10	**W1**		
(b)	Graph	**W2**	**W1**	5 given points plotted
			W1	Smooth cubic curve through any 5 points.
(c) (i)	$y=7x$	**W1**		
(c) (ii)	$y=7x$ drawn -2.8, 0.3, 2.5 (all +/ – 0.1)	**W1** **W2**	**W1**	1 correct solution Condone coordinate form Ft intersection of y = 7x with their cubic curve **SC1** 1 solution from $y=7$ drawn intersecting with cubic curve
7	$\frac{5}{15}$ I.S.W	**W4**	**M1** **AND** **M2** **Or** **M1** **A1**	Tree diagram completed for raining/delayed and not raining/delayed branches $(1/3 \times 3/5) + (2/3 \times 1/5)$ $(1/3 \times 3/5)$ or for $(2/3 \times 1/5)$ ft their probabilities for M2 or M1 $\frac{5}{15}$ or $\frac{1}{3}$ or $\frac{75}{225}$ isw

Section B

Question	Full marks		Part marks	
8 (a)	$6x^2 + 8x + 2$	**W2**	**W1**	3 terms from $6x^2 + 2x + 6x + 2$
(b)	$6x^2 + 8x + 2 - 2x^2 = 142$	**M1**	**M1**	Their algebraic (a) $- 2x^2 = 142$ oe
	$4x^2 + 8x - 140 = 0$	**M1**	**M1**	Rearrange their quadratic =0 Or divide 2 or divide 4
	Divide by 4 or $x^2 + 2x - 35 = 0$	**A1**	**A1**	s.o.i. (n.w.w.)
(c)	$(x - 5)(x+7)$ $x = 5$ *(and -7)*	**M2** **A1**	**M1** If M0 then **W1** for x = 5 only	$(x \pm 5)(x \pm 7)$
9	54	**W2**	**M1**	4.5 seen
10	$d = \frac{5e}{5-c}$ or $d = \frac{-5e}{c-5}$	**W3**	**M1** **M1** **M1** If M0, allow **M1** for multiplying out brackets at any stage. i.e. 5d-5e	1st step eg cd = 5d-5e 2nd step eg cd-5d = -5e rearranged so d and e on separate sides 3rd step ft 1st step eg d = 5e/(5-c)
11 (a)	Tan (BOF) = 8/2 $(\text{Tan}^{-1}4) = 75.8° - 76°$	**W1** **W1**		Or sin (BOF) = 8/8.25 Or cos (BOF) = 2/8.25 Or eg Sin^{-1} 0.97 = 75.9° - 76° eg Cos^{-1} 0.24=76° - 76.1..°
(b) (i)	16.6(…)	**W3**	**M2** **M1** **A1**	$\frac{28 \times \pi \times 8.25^2}{360}$ 28 for <AOB seen in (b) **Or** $\pi\ 8.25^2$ or 213 – 214 seen 16.5 – 16.8… or 17
(b) (ii)	144.6 -144.7	**W2**	**M1** **A1** If M0, **SC1** 144 + their (i)	28×4 and 2×8 or 128 seen 144.5 – 144.8 or 144 or 145 Or A1 128 + their (i)
12 (a)	$\sqrt[3]{2} \times 13.5$ $1.26 \times 13.5 = 17(.0…)$	**M2** **A1**	**M1**	$\sqrt[3]{2}$ seen or 1.25..- 1.26 (not including 1.25)
(b)	31 to 32	**W2**	**M1**	(20×) their 1.26^2 or 1.58 to 1.59

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Section A

Question	Correct answer	Mark	Part marks	
1 (a)	$\frac{8}{33}$	3	**M2**	$\frac{24}{99}$ or $24r = 99$ or
			M1	$100(r) = 24{\cdot}24(\ldots)$
(b)	$28 - 10\sqrt{3}$	2	**M1**	25 **and** ±3 or 28 or $10\sqrt{3}$ seen
2 (a)	$(x + 5)(2x - 1)$	2	**M1**	$(x \pm 5)(2x \pm 1)$
(b)	$\frac{x-5}{2x-1}$, ft if M1 in **(a)** and **(b)**	2	**M1**	$(x + 5)(x - 5)$ or $\frac{x-5}{2x-1}$ seen then spoilt
3 (a)	**Y7 slower o.e.**	1		e.g. Modal time for Y11 is smaller or **Comparison** of one group, etc.
	Y7 bigger range, o.e.	1		**Comparison** of spread
(b)	0·25 × 108 = 27 (b) **and** 0·25 × 92 =23 (g) o.e.	2	**M1** **or** **W1**	25% of boys/108 **and** 25% of girls/92, o.e. or 54% of 50 **and** 46% of 50. Stratified sample
4 (a)	$(x + 3)^2 - 15$	3	**M2**	$(x + 3)^2 + {}^{-}15$ or $(x + 3)^2 - 9 \pm k$ seen or $x^2 + 3x + 3x + 9 - 9$ or $(x - 3)^2 - 15$
			M1	$(x + 3)^2$ seen or ${}^{-}6 - a^2$ (a must be a constant and a^2 evaluated correctly
(b)	${}^{-}15$	1		f.t. **(a)** if of the form $(x + a)^2 + b$, $b \neq 0$
5 (a) (i)	Translation 2 squares left	1		(0,0) to (${}^{-}2$,0) (2,4) to (0,4) and (${}^{-}2$,4) to (${}^{-}4$,4)
(a) (ii)	Translation 3 squares down	1		(0,0) to (0,${}^{-}3$) (2,4) to (2,1) and (${}^{-}2$,4) to (${}^{-}2$,1)
(b)	Translation $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$ o.e.	2	**W1**	Translation or $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$
6 (a) (i)	**r – s** or **– s + r**	1		
(a) (ii)	$\frac{3}{4}$(**r – s**) oe	1		ft **(i)** involving **r** and **s**, must be a vector. Do not ignore incorrect subsequent working.
(b)	$\frac{1}{4}$(3**r** + **s**) or $\frac{3}{4}$**r** + $\frac{1}{4}$**s**	2	**M1**	via R: **r** + $\frac{1}{4}$(**s – r**) or ft **r** – $\frac{1}{4}$**(i)** via S: **s** + $\frac{3}{4}$(**r – s**) or ft **s** + **(ii)** or **s** + $\frac{3}{4}$**(i)**

Section B

Question	Correct answer	Mark	Part marks	
7 (a)	2000	1		
(b)	46596·…, 46597, 46600, 47000	2	**M1**	(×) $1{\cdot}3^{12}$ or 23·298
8	95° + correct calculation	4	**M2**	$(\sin B =) \dfrac{6{\cdot}05 \sin 28}{2{\cdot}85}$ or 0·99(65…) or
			M1	$\dfrac{\sin B}{6{\cdot}05} = \dfrac{\sin 28}{2{\cdot}85}$ o.e.
			A2	180 – (84·9 to 85·3) or
			A1	84·9 to 85·3
9	Ruled line of best fit drawn	1		Through origin (±2mm) & between (23·5,60) and (25·5,60)
	k = 2·35 – 2·55	1		Can award if no line
10	6·89(…) or 6·9	5	**M2**	Sector $\dfrac{78}{360} \times \pi 6^2$ seen or 24·5(…) seen M1 $\dfrac{78}{360}$
			M1	Triangle ½ × 6^2 sin78 or 17·6(…)
			M1	Their sector – their triangle
	cm^2	1		Indep
11 (a)	(371 + 257 + 296 + 324 + 412)/5	1		Accept a worded description of the 5 values to be added and their total divided by 5. eg Sat week 2 + Tues week 3 etc…
(b)	Audiences peak at the weekends	1		
(c)	Remain fairly steady or			
	Attendances fall off half way through	1		

Question	Correct answer	Mark	Part marks	
12	x = 5·7 or $^-$7·7	7	**M1**	$x^2 + (x + 2)^2$ = 93
	y = 7·7 or $^-$5·		**M1**	$x^2 + x^2 + 2x + 2x + 4$ = 93
			A1	$2x^2 + 4x - 89$ (= 0)
			M1	$\frac{-4 \pm \sqrt{4^2 - 4 \times 2 \times {}^-89}}{2 \times 2}$ ft their quadratic
			M1	$\frac{(-4 \pm 26{\cdot}98)}{4}$
			A1	x = 5·7 and $^-$7·7 from no wrong working
			A1	y = 7·7 and $^-$5·7 from no wrong working
	ALTERNATIVE			
	Completing the square		**M1**	(x =) $^-1 \pm \sqrt{\frac{91}{2}}$
			M1	(x =) $^-1 \pm 6{\cdot}74$
	Trial & Improvement		**W2**	**All four correct answers to 1dp**
			W1	One value of x and corresponding y value

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Section A

Question	Full marks		Part marks	
1 (a)	6	**W1**		accept answer seen anywhere in (a)
(b)	13	**W1**		
(c)	9	**W1**		
(d)	14	**W1**		
2 (a)	**B C A E D**	**W2**		accept @ 27 , 95 , 140 , 215 , 315
			M1	1 error *or* fully reversed
(b)	C	**W1**		accept @ 95
3 (a)	384	**W1**		clear indication throughout
(b)	7 5	**W2**	**W1**	each
(c)	13	**W1**		
(d)	2·35	**W1**		
(e)	7·8	**W1**		
(f)	21	**W1**	**SC1**	63 as final answer and 21 in working
(g)	36	**W1**		
4 (a)	9	**W1**		accept embedded throughout condone eg 9 in working, 18 on answer line condone eg 9*x* throughout
(b)	15	**W1**		
(c)	3	**W1**		condone 7 – 3 but not –3
5	× ✓ × ✓ ×	**W2**		accept clear indication
			M1	3 correct
			SC2	2 correct ✓, rest blank
			or **SC1**	1 correct ✓, rest blank
6 (a)	120	**W2**	**W1**	70 *or* total 85 *or* 160 *or* 140
(b) (i)	5 (hours) 28 (min) ***or*** **… hours 328 min**	**W2**	**W1**	5 (hrs) *or* 28 (min) *or* 328 *or* clear complete attempt to find timespan from 1706 to 2234
(b) (ii)	**Whittington by 3 mins**	**W3**	**M2**	3 mins *or* 27 and 24 both seen
			or **M1**	27 *or* 24
			& **M1**	two times < 30 min found & correctly subtracted
(c) (i)	½, 0·5, 50% oe	**W2**		any correct equivalent, not incorrect form
			M1	evens, 50-50, 6 seen (not as numerator)
(c) (ii)	all 5 ways, only: HH TT EH ET HT	**W2**		ignore repeats
			M1	3 more ways found
7 (a)	cube	**W1**		
(b)	¾	**W1**		oe fraction eg 75/100 not decimals
(c)	36	**W2**	**M1**	multiple of 3 between 10, 50 *or* 16 *or* 25 *or* 49
(d)	rhombus	**W2**	**M1**	square *or* parallelogram *or* diamond
8	correct size	**W2**		mark intention, need not be ruled
			W1	2 lines correct size & relative orientation
			or **M1**	fully correct enlargement using other scale factor

Question	Full marks	Part marks
9 (a) (i)	76 **W1**	
(a) (ii)	'no' + correct reason **W1**	ft their (i) for yes/no awareness that isosceles implies: **2** angles/sides equal/same *or* angles/sides not different *or* other property of isosceles triangle
(b)	19·5 to 20·5 **W3**	**M1** correct length of one side ± 0·2 *&* **M1** correct perpendicular ± 0·2 *or* use of base × <u>height</u> ÷ 2 *&* **W1** correct base × correct height ÷ 2 found correctly **8 7 6** 5 5·7 6·7 20 19·95 20·1
(c)	120 **W2**	**M1** 60 *or* 360 ÷ 6 soi *or* correct use of <u>180</u>(n-2) soi n
10	68 **W4**	**W3** 92 <u>method1</u> **M1** 32 seen *&* **M2** 60 *or* **M1** 20 soi (160 ÷ 8) *&* **W1** 160 – their 32 – their 60 correctly calculated <u>method 2</u> **M2** 23/40 *or* 57·5% *or* **M1** one equiv fraction/% found *&* **M1** subtracting correctly: their fraction from 1 *or* their % from 100 *or* their value from 160

Section B

Question	Full marks		Part marks
11 (a)	neck curve &/or shoulder horizontal only	**W1**	indication may be either /both sides of mirror line, or across it
	figure 1 &/or adjacent spaces only	**W1**	
(b)	correct position shown	**W1**	back above left *or* front above right *or* back below right
12 (a) (i)	1796, 1896, 1998, 2179, 2184	**W2**	condone decimal points, transfer errors **M1** V FG M C N one error *or* fully reversed
(a) (ii)	1998	**W1**	accept Mazda &/or MPV
(b) (i)	one thousand eight hundred (and) ninety six	**W1**	eighteen hundred and ninety six not eighteen ninety six
(b) (ii)	45	**W1**	
(b) (iii)	480	**W3**	**M2** figs 48 **M1** 16, *or* 72 ÷ 4·5 seen *&* **M1** their 16 × 30 seen W0 72 × 30
13 (a)	$4c + 6d$	**W2**	**M1** $4c$ *or* $6d$ (inc $4c6d$) seen
(b)	$8e + 20$	**W1**	
14 (a)	correct position	**W1**	throughout: position clearly indicated
(b)	correct position	**W1**	mark positioning, not notation eg E in correct place, others blank
(c)	correct position	**W1**	in square or 4 corners, not edge or corner
(d)	correct position	**W1**	
15 (a)	**bar drawn to 0·8**	**W1**	± 1mm
(b)	5·6	**W1**	
	lead	**W1**	
	silica	**W1**	**SC1** metal(s)
16 (a)	**(** $4{\cdot}1^2$ + 1·79 **)** ÷ √9·61 = 6	**W2**	no incorrect or contradictory **M1** brackets 16·81 *or* 18·6 *or* 3·1 seen *or* 16 + 2 ÷ √9 *or* √10 *or* 3
(b)	0·96	**W2**	**M1** 8·39 *or* 8·74 *or* figs 95(99…) *or* 96
17 (a)	– 5	**W1**	**acc equivalent, direction and quantity**
(b)	7, 9, 11	**W2**	condone letters eg 7n 9n 11n condone extras if correct **M1** any <u>two</u> correct in correct position **SC1** 5, 7, 9
18 (a)	11	**W1**	
(b)	marked correctly	**W1**	± 1mm
(c)	102 to 103 inc	**W2**	**M1** 14 or 15 or 16 used (implied by 99 to 100, or 95)

<table>
<tr><th colspan="2">Question</th><th>Full marks</th><th></th><th>Part marks</th></tr>
<tr><td>19</td><td>(a)</td><td>105·4 (0)</td><td>W3</td><td>M2 18·6(0) or 105 or 0·85 × 124 oe
or M1 0·15 × 124 oe or 142·6(0)
intention to <u>find %</u> that combine to make 15% (or 85%) <u>& to combine</u> these, eg list or spider diagram – complete method, arithmetic errors</td></tr>
<tr><td></td><td>(b)</td><td>1·4(0), 140p</td><td>W3</td><td>or ft their (a) – 104 for W3
or M2 104
or M1 11 or 99
or subtract their 2 values</td></tr>
<tr><td>20</td><td>(a)</td><td>rectangle 5 by 2 drawn ruled ± 1mm</td><td>W2</td><td>condone internal lines
W1 either dimension, ruled ± 1mm
or M1 intention to draw rectangle 5 by 2 (but outside tolerance and not ruled)</td></tr>
<tr><td></td><td>(b) (i)</td><td>4</td><td>W1</td><td></td></tr>
<tr><td></td><td>(b) (ii)</td><td>50 to 50·3 ft (i)</td><td>W2</td><td>M1 16π soi or ft their (b)(i)
<table><tr><td>2</td><td>8</td><td>16</td></tr><tr><td>4π</td><td>64π</td><td>256π</td></tr><tr><td>12·6</td><td>201</td><td>804</td></tr></table></td></tr>
<tr><td>21</td><td>(a)</td><td>176</td><td>W2</td><td>M1 <u>evidence</u> on diagram or on list of values
or 6</td></tr>
<tr><td></td><td>(b)</td><td>correct diagram
14 | 9
15 | 4 5 9
16 | 1 2 3 6 6 8
17 | 0 1 5 7
18 | 1</td><td>W3</td><td>do not penalise inverted diagrams
M1 use of 4 of stems 14 to 18
& M1 3 correct, 'ordered leafs'
or 4 'leafs' correct but not ordered</td></tr>
<tr><td></td><td>(c)</td><td>any valid comment

must be:
true for this data (bod on stems)
comparing M, F heights directly or by implication</td><td>W1</td><td>comparing max, min, average, range or shape of chart, <u>not</u> sample size
<table><tr><td></td><td><u>boys</u></td><td><u>girls</u></td><td></td></tr><tr><td>max</td><td>192</td><td>181</td><td>tallest boy taller</td></tr><tr><td>min</td><td>164</td><td>149</td><td>shortest boy taller</td></tr><tr><td>median</td><td>176(ft√)</td><td>166</td><td>average boy taller</td></tr><tr><td>range</td><td>18</td><td>22</td><td>girls more spread out</td></tr></table></td></tr>
</table>

Mark Scheme 2342
June 2006

Section A

1	Correct enlargement	**2**	**W1** for 2 sides correct **or** **W1** for correct use of wrong sf. tolerance ± half a square
2	Axes scaled uniformly	**1**	
	EITHER HISTOGRAM		
	All heights correct	**1**	
	All bars of equal width with no gaps	**1**	
	OR FREQUENCY POLYGON		
	All heights correct	**1**	
	Midpoints used and joined with ruled lines,	**1**	condone joining last point to the origin.
3 (a) (i)	76	**1**	
(ii)	No + No two angles or sides equal	**1**	**must f.t** if x = 48 or 56 and then: Yes + two equal angles
(b)	140	**3**	**W1** for 50 seen **and** **M1** for 360-(105 + 65 + their 50)
	[Angles on a] straight line [add up to 180°]	**1**	
	[Angles in a] four sided shape [add up to 360°]	**1**	
4	68	**4**	**W3** for 92 seen **OR** **M3** for 160 – (32+60) **OR** **W2** for 60 seen **or** **W1** for 20 seen **and** **W1** for 32 seen **and** **M1** for 160 – (their 32 + their 60)

Alternative methods

	$\frac{17}{40}$	**W3**	42.5%		**W3**
	$\frac{23}{40}$ seen	**W2**	57.5%	seen	**W2**
or	$\frac{8}{40}$ or $\frac{15}{40}$ seen	**W1**	20% or 37.5% seen		**W1**
and	1 – their $\frac{23}{40}$	**M1**	100 – their 57.5		**M1**
	or 160 – their $\frac{23}{40}$ of 160	**M1**	or 160 – their 57.5% of 160		**M1**

5	(a)	74	**2**	**W1** for $\frac{37}{50}$ or figs74 seen **M1** for 37 × 2
	(b)	(i) 456.4	**3**	**Working must be seen** **W2** for figs 4564 with working **or** **M1** for a complete method **and** **W1** for figs 1304, 489, 326, 168, 448 or 84 seen **Answer only W1**
		(ii) $3\frac{5}{6}$ o.e. or $3.8\dot{3}$ {eg $3\frac{10}{12}$}	**3**	**W2** for $\frac{15}{6}+\frac{8}{6}$ oe or $\frac{23}{6}$ oe or $3+\frac{3}{6}+\frac{2}{6}$ oe or 3.83[3...] **or** **M1** for $\frac{a+b}{6}$ o.e. either *a* or *b* must be correct **or** **W1** for 2.5 and 1.33 or better
	(c)	120	**2**	**W1** for 40 or 90 or 30 seen

6	(a)	20	**2**	**W1** for 25 seen
	(b)	Final answer $[x =]\frac{y+3}{5}$ or $[x =]\frac{y}{5}+\frac{3}{5}$ or $[x =](y+3)\div 5$ or $[x =](y+3)/5$	**2**	**W1** for answer $[x =]\frac{\pm y \pm 3}{\pm 5}$ or $[x =]y+3\div 5$ or $[x =]y+3/5$ or $\frac{x = y+3}{5}$ **or** **M1** for $5x = y+3$ or $\frac{y}{5} = x-\frac{3}{5}$
7	(a)	0.05	**2**	**M1** for $1-(0.25+0.05+0.15+0.4+0.1)$
	(b)	50 [out of 200]	**2**	**M1** for 0.25×200 **or** **W1** for $\frac{50}{200}$ as answer
8	(a)	Final answer $16x-13$	**2**	**W1** for each **or** **W1** for $6x+2+10x-15$ Accept 3 terms correct
	(b)	$(x-5)(x-2)$	**2**	**W1** for $(x\pm 5)(x\pm 2)$

9	(a)	-1, 0, 1, 2, 3, 4	**3**	**W2** for 5 or 6 correct and maximum of 1 extra **or** **W1** for 4 correct and maximum of 1 extra **or** **W1** for -3, 0, 3, 6, 9, 12 **or** **M1** for $\frac{-5}{3} < n \leq 4$
	(b)	$x = 5$ and $y = -2$	**3**	**Dep. on M2** **M1** for Equation [2] × 2 Accept two terms correct **AND** **M1** for Addition of equations **Dep. on first M1** Accept two terms correct **OR** **M1** for Equation [1] × 2 **and** Equation [2] × 3 Accept two terms correct in each equation **AND** **M1** for Subtraction of equations **Dep. on first M1** Accept 2 terms correct **<u>Alternative method</u>** **M1** for $3x - 2(8 - 2x) = 19$ **M1dep** for $3x - 16 + 4x = 19$ allow 1 error in each line **Answer only W1**
10	(a)	$x \times x \times (x + 3)$	**2**	**W1** for $x \times x \times x + 3$ or $x^2 \times (x + 3)$ **or** **W1** for base = x^2 **M1** for use of $V = lbh$ must be algebraic
	(b)	112	**1**	
	(c)	4 points plotted to within 1 small square	**1**	f.t. from table
		Smooth curve within 1 small square of points	**1**	dep on mark for points and through their plotted points
	(d)	2.25 to 2.4	**1**	

Section B

11	(a)	32, -64	**2**	**W1** for each Allow f.t. **W1** for – 2 × their 32
	(b)	7, 9, 11	**2**	**SC1** for 5, 7, 9 **W1** for two correct in correct positions. Condone the inclusion of *n*
	(c)	$4n-1$ oe	**2**	**W1** for 4*n* seen
12	(a)	(i) 121 to 125°	**1**	
		(ii) 37 to 39	**2**	**W1** for 7.5 to 7.7 seen
	(b)	2 hours 45 minutes	**3**	**W2** for 2.75 or 2h 75 min or 3h 15 min seen **or** **M1** for $187 \div 68$
	(c)	(i) 222	**2**	**M1** for 150×1.48 or **W1** for figs 222
		(ii) [-]5	**3**	**W2** for 35 seen **or** **M1** for $51.80 \div 1.48$ **and** **M1** for (their 35) – 30 **Alternative method:** **M1** for 51.80 - 30 × 1.48 **and** **M1** for 'their 7.40'÷1.48 **or** **SC1** for answer 7.4[0]
13	2.5 or $2\frac{1}{2}$ or $\frac{30}{12}$ oe, i.s.w		**3**	**W2** for embedded answer **W1** for $12x-3$ or $4x-1=9$ seen **and** **M1** for 12x = 27 + 3 f.t or 4x = 9 + 1 f.t.
14	(a)	0.96	**2**	**W1** for figs 95[9....] or figs 96 **W1** for 8.39 or 8.74 seen
	(b)	1.25×10^9	**2**	**W1** for figs 125 seen

15	(a)	28.5	**4**	**W3** for answer 23.5 or 33.5 or 28 if 14.5 etc seen or 29 if 15.5 etc seen **or** **M3** for $\frac{\sum ft}{\sum f}$ with four of 15, 25, 35, 45, 55 used for *t* **or** **W2** for 1710 seen or $10\times15+27\times25+16\times35+6\times45+1\times55$ **or** **M2** for $\frac{\sum ft}{\sum f}$ with *t* in range $10 \le t \le 20$ etc **or** **M1** for $\sum ft$ with *t* in range $10 \le t \le 20$ etc **or** **W1** for four of 15, 25, 35, 45, 55 seen or used
	(b)	(i) 27 to 29	**1**	
		(ii) 12 to 14	**2**	**W1** for 46 to 48 seen
16	(a)	105.4[0]	**3**	**SC2** for 105 **or** **M2** for $124\times\frac{85}{100}$ **or** **M1** for $124\times\frac{15}{100}$ or 18.6[0] or 142.6[0]
	(b)	950	**3**	**M2** for $836\div0.88$ **or** **M1** for 88% = 836
17	(a)	3.69 to 3.71	**3**	**M2** for 3.72 **or** **M2** for $h=\frac{186}{\pi\times4^2}$ **or** **M1** for $\pi\times4^2\times h=186$ **or** **W1** for 50.2 to 50.3 seen
	(b)	3999 or 3.999	**2**	**W1** for figs 3999 **or** **M1** for 186×21.5 g
			1	allow kg if attempt to convert eg 3.999 kg

18 (a) 13.8 or 14 **4**

W3 for 13.7 to 13.9
or
M2 for $\sqrt{6.25^2 + 12.3^2}$
or
M1 for $6.25^2 + 12.3^2$
If trigonometry is used:
M1 for $\text{Tan}^{-1}\frac{12.3}{6.25}$ (=63.06) oe
and
M1dep for $\frac{12.3}{\sin 63.06}$ o.e.

After W0 allow **W1** for any answer to 2 or 3 significant figures **after Pythagoras or trig seen**

(b) 14.6 to 14.7 **3**

W2 for answer 15.7 to 15.8 or 28.2 to 28.3
or
M2 for 12.3 ÷ sin 57
or
M1 for CD × sin 57 = 12.3
or
M1 for $\sin 57 = \frac{12.3}{CD}$
alternative method:
M1 BC = $\frac{12.3}{\tan 57}$ [=7.98...]
and
M1dep $\sqrt{12.3^2 + their 7.98^2}$

Mark Scheme 2343
June 2006

1	**(a)**	$2n + 3$ or equivalent	**W2**	**M1** $2n$
	(b)	$16x - 13$	**W2**	**W1** $16x$ or -13 or $16x + -13$ **W1** $6x + 2 + 10x - 15$ (3 terms)
	(c)	$(x - 5)(x - 2)$	**W2**	isw **W1** $(x \pm 5)(x \pm 2)$ **M1** $x - 5$ and $x - 2$ shown in grid or without brackets
2	**(a)**	$3\ 5/6$	**W3**	**W2** $\frac{15}{6} + \frac{8}{6}$ or $\frac{23}{6}$ or $3 + \frac{3}{6} + \frac{2}{6}$ or equivalent **M1** $\frac{a + b}{6}$ or equivalent with either a or b correct. **ALT W3** 3.83 **W2** 3.83… **W1** 2.5 and 1.33…
	(b)	$\frac{1}{7}$	**W1**	condone 0.142857 on answer line
	(c)	$\frac{8}{33}$ isw	**W2**	**M1** 100r = 24.24… or **W1** $\frac{24}{99}$ or equivalent
3		200000 or equivalent (any) isw (accept 207500 or 207000)	**W3**	**M1** 8/4 or 8.28/4 or 8.3/4 or 2 or 8000/0.04 or evidence digits 8/4 **And** **M1** 100000 or equivalent (eg 10^5)
4	**(a)**	-1, 0, 1, 2, 3, 4	**W3**	**W2** for 5 or 6 correct and 1 extra or 1 omission **W1** for 4 correct and 1 extra or $-3,0,3,6,9,12$ (all) **Or** **M1** for $\frac{-5}{3} < n \leq 4$
	(b)	Multiplication of equation 2 by 2 Then Addition of eqn 1 and eqn 2 **Or** Multiplication of equation 1 by 2 & Multiplication of equation 2 by 3 Then subtraction of eqn 2 from eqn1 $x = 5$ and $y = -2$	**M1** **M1** **A1**	 Condone 1 error Condone 1 error **M1** Condone 1 error **M1** Condone 1 error **Or M1** $3x - 2(8 \pm 2x) = 19$ and **M1** $3x - 16 + 4x = 19$ condone 1 error (ft) Answer only **W1**

5	**(a)**	$x \times x \times (x+3)$	**W2**	**M1** for **use** of v = lbh eg $x \times x \times x + 3$ or $x^2 \times x + 3$
	(b)	112	**W1**	
	(c)	4 points plotted to within 1 graph square	**P1**	Points within 1 square
		Smooth curve through 4 points	**C1**	Not ruled Curve through their points within 1 square.
	(d)	2.25 to 2.4	**W1**	No ft
6	**(a)**	$(x =) \frac{y+3}{5}$ or $\frac{y}{5} + \frac{3}{5}$ or $(y+3) \div 5$	**W2**	**M1** $5x = y + 3$ or $\frac{y}{5} = x - \frac{3}{5}$ **or W1** $(x=) \frac{\pm y \pm 3}{\pm 5}$ or **W1** $y+3 \div 5$ or $y+3/5$ or $3+y/5$
	(b)	$(d =) \frac{8c}{c-2}$ or $\frac{-8c}{2-c}$	**W4**	**M1** $cd - 3c$ $(= 2d + 5c)$ **And** **M1** $cd - 2d = 3c + 5c$ ft their 1st step (subtract 2d, add 3c allow 1 error if method clear) **And** **M1** $d(c-2) = 3c + 5c$ ft their 2nd step If M0 scored award **W1** for $cd - 3c = 2d + 5c$ seen
7		<BCA or < BCA = 63 Triangle ABC **isosceles** because **tangents (**from a point to a circle are equal.) <BCA = < ADC alternate segment <ADC = 63	**W1** **W1** **W1** **1**	 or equivalent from **no** incorrect assumptions ft their <BCA
8		$\frac{1}{9}$ or equivalent decimal (0.111)	**W2**	**M1** 9 or $\frac{1}{3}$ or $\frac{1}{729}$ or $\frac{1}{3^2}$ condone -9 nww **or W1** $\frac{-1}{9}$
9	**(a)**	130 230	**W1** **W1**	 Ft 360 – their obtuse 130 (mark worst 2)
	(b)	Graph	**W2**	One complete cycle (0,1) to (120, 1) condone errors after 120. **W1** Graph through (0,1) and attempt to use horizontal stretch. Or graph with period 120, amplitude 3

10	$4x^2 - 2x - 30 = 0$ or $2x^2 - x - 15 = 0$	**W4**	**M1** $2(4x-5) + 5(x+4) = (x+4)(4x-5)$ may be later **And** **W1** $8x - 10 + 5x + 20$ **W1** $4x^2 + 16x - 5x - 20$ condone 1 error **And** **W1** $4x^2 - 2x - 30 = 0$ ft their 2nd step involving quadratic, dependent on M1 scored
	3 and –2.5 (-5/2)	**W3**	**And then** **M2** $(2x+5)(x-3)$ or $(4x+10)(x-3)$ $(2x+5)(2x-6)$ ft their 3rd step **Or M1** $(2x \pm 5)(x \pm 3)$ ft their 3rd step **Alt M2** $\frac{1 \pm 11}{4}$ or $\frac{2 \pm 22}{8}$ **Or M1** $\frac{1 \pm \sqrt{(1+8\times15)}}{4}$ or $\frac{2 \pm \sqrt{(4+16\times30)}}{8}$ condone 1 error **A1** 3 and –2.5

Section B

11 (a)	12.5%	**W3**	**M2** 1.125 or 112.5 or 0.125 **M1** 202500/180000 or 22500/180000
(b)	202500×1.125^8	**M1**	or Ft their (a) Condone either value $\times 1.125^9$ or $\times 1.125^8$ Or clear intent for 8/9 years with first 3 evaluated.
	519571	**W1**	Condone 519500 to 519600
12 (a)	28.5	**W4**	**W3** 23.5 or 33.5 (**SC3** for 29 if 15.5 etc seen and used, or 28 if 14.5 etc seen and used) **M3** for $\frac{\sum ft}{\sum f}$ (their $\sum f$ if shown) with 4 of 15/25/35/45/55 used for t **Or W2** for 1710 seen or $\sum ft$ with 4 midpoints used. **Or M2** for $\frac{\sum ft}{\sum f}$ with t in range $10 \leq t \leq 20$ etc (may be inconsistent) **Or M1** for $\sum ft$ with t in range $10 \leq t \leq 20$ etc (may be inconsistent) **Or W1** for 4 of 15/25/35/45/55 seen or used.
(b) (i)	27 to 28	**W1**	
(ii)	12 or 13	**W2**	**W1** for 47 to 48 (or 12 **to** 13)
13 (a)	3.69 to 3.71	**W3**	**M2** $h = \frac{186}{\pi \times 4^2}$ (evidenced by 3.72) **or M1** $\pi \times 4^2 \times h = 186$ **Or** If M0, **W1** 50.2 to 50.3
(b)	3999	**W2**	**M1** 186 ×21.5 **A1 or W1** 4000

14 (a)	13.8 or 14 (not 13.80)	**W4**	**W3** for 13.7 to 13.9 **M2** for $\sqrt{(6.25^2 + 12.3^2)}$ **Or M1** $6.25^2 + 12.3^2$ **A1** 13.7 to 13.9 After A0 allow **W1** for any answer to 2 or 3 significant figures after Pythagoras/Trig used. (10.6 or 11 from Pythag sub'n) **ALT** **M1** <DAB $=\tan^{-1}(12.3/6.25)$ or 63.06 Or <ADB = 26.94 Then **M1** AD = 12.3/sin 63 or 12.3/cos26.9
(b)	14.6 to 14.7	**W3**	**M2** 12.3 ÷ sin 57 **Or M1** for sin 57 =12.3 ÷ CD or CD sin57 = 12.3 **ALT M1** BC = 12.3/tan57 **and M1** CD=$\sqrt{(12.3^2+\text{their BC}^2)}$ **W2** grad 15.7 to 15.8 or rad 28.2 to 28.3
15 (a)	Circle radius 4 centre (0,0)	**W2**	**W1** for freehand circle in 3 sectors to include intersection with axes or circle drawn with compasses using centre (0,0) and any radius.
(b)	x + y = 2 drawn	**W1**	Ruled, cutting axes
	x = 3.6 to 3.7 y = -1.6 to -1.7 x = -1.6 to –1.7 y = 3.6 to 3.7	**W1** **W1**	or Ft from their attempt at circle and correct line
16 (a)	210 500 (499)to 216 500 and 209 500 to 217 500 (499)	**W1** **W1**	**M1** two values from the 4
	6000 or 6001 8000 or 7999	**A1**	
(b)	66	**W2**	**M1** $\frac{29}{217}$ or .13… or equivalent **A1 or W1** for 67 or 68
17 (a)	$(x - 7)^2 + 11$	**W3**	**M1** $(x - 7)^2$ **And M1** 60 – their $(-7)^2$
(b)	11	**W1**	ft their (a)

18 (a)	0.064 or equivalent isw	**W2**	**M1** 0.4×0.4×0.4
(b)	0.352	**W3**	**M2** 0.288 or $0.4^2\times0.6\times3$ or $0.4^2\times0.6\times2 + 0.4^3$ or 0.256 **Or M1** $0.4^2\times0.6$ Award 2 in (b) for consistent use of 0.6 instead of 0.4 and vv. (Also 0.3 instead of 0.4 if clear) If M0, **W1** for indication of 4 winning ways. **SC2** 0.648
19 (a)	e.g. sinBOC =1.2/2.5 BOC = 28.7 or 28.6 BOA = 180 –2×28.7	**M1** **M1** **A1**	Can be implied by 28.7 Verification method scores 1 or 2.
(b)	46.4 to 46.8	**W4**	**M2** $AB=\frac{123}{360}\times \pi \times 5$ **Or M1** $AB=\frac{123}{360}\times \pi \times 2.5$ **Or M1** $\pi \times 5$ or 15.7 **And** **M1** their AB × 6 + 1.2 × 6 (× 2) (Their AB must use π)

Mark Scheme 2345
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. 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.	▪ 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				❖ 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 C –Graduated Assessment) (1966)

June 2006 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a*	a	b	c	d	e	f	g	p	u
2331	Raw	50								27	13	0
	UMS	35								24	12	0
2332	Raw	50							36	20	12	0
	UMS	42							36	24	(18)	0
2333	Raw	50							30	15		0
	UMS	47							36	24		0
2334	Raw	50						37	21	13		0
	UMS	54						48	36	(30)		0
2335	Raw	50						27	14			0
	UMS	59						48	36			0
2336	Raw	50					27	13				0
	UMS	71					60	48				0
2337	Raw	50				30	15					0
	UMS	83				72	60					0
2338	Raw	50			26	13						0
	UMS	95			84	72						0
2339	Raw	50		28	13							0
	UMS	107		96	84							0
2340	Raw	50	31	14								0
	UMS	120	108	96								0

Notes

The above table shows the raw marks and the corresponding key uniform scores for each unit (module test) available in the June 2006 session.

Raw marks falling between two raw marks in the appropriate row above are converted, by a linear map, to a uniform score between the uniform scores that correspond to the two raw marks.

The grade shown in the above table as ‘p’ indicates that the candidate has achieved at least the minimum raw mark necessary to access the uniform score scale for that unit but gained insufficient uniform marks to merit a grade ‘g’. This avoids having to award such candidates a ‘u’ grade. Grade ‘p’ can only be awarded to candidates on 2331 (M1) and 2332 (M2). It is not a valid grade within GCSE Mathematics and will not be awarded to candidates when they aggregate for the full GCSE (1966).

General Certificate of Secondary Education

(Mathematics C – Graduated Assessment) (1966)

June 2006 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a*	a	b	c	d	e	f	g	u
2341	Raw	100					67	55	43	31	0
	UMS	239					200	160	120	80	0
2342	Raw	100			66	43	33	23			0
	UMS	319			280	240	200	160			0
2343	Raw	100	74	56	38	21					0
	UMS	400	360	320	280	240					0
2344	Raw	48	43	37	31	26	22	18	14	10	0
	UMS	160	144	128	112	96	80	64	48	32	0
2345	Raw	48	43	37	31	26	22	18	14	10	0
	UMS	160	144	128	112	96	80	64	48	32	0

Specification Aggregation Results

Foundation Tier

	A*	A	B	C	D	E	F	G
Overall Threshold Marks					388	308	228	148
Percentage in Grade					9.3	31.1	34.4	17.6
Cumulative Percentage in Grade					9.3	40.4	74.8	92.4

The total entry for the examination was 23920

Intermediate Tier

	A*	A	B	C	D	E	F	G
Overall Threshold Marks			548	468	388	308		
Percentage in Grade			15.6	41.3	26.2	11.4		
Cumulative Percentage in Grade			15.6	56.9	83.1	94.5		

The total entry for the examination was 32346

Higher Tier

	A*	A	B	C	D	E	F	G
Overall Threshold Marks	708	628	548	468				
Percentage in Grade	15.6	35.5	37.6	10.4				
Cumulative Percentage in Grade	15.6	51.1	88.7	99.1				

The total entry for the examination was 14999

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	3.3	7.5	15.0	20.9	15.0	15.6	11.5	5.9
Cumulative Percentage in Grade	3.3	10.8	25.8	46.7	61.7	77.3	88.8	94.7

The total entry for the examination was 71265

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