GCSE

Mathematics A

Mark Scheme for the Components

June 2008

CONTENTS

General Certificate of Secondary Education

Mathematics A (J512)

MARK SCHEMES FOR THE COMPONENTS

J512/01 Paper 1 (Foundation Tier)

1	(a)	One thousand three hundred (and) thirty five	**1**	All in words
	(b)	180 000	**1**	
	(c)	608	**1**	
	(d)	(Two) hundred(s)	**1**	Accept 100, 200
2	(a)	(i) 7.4 seen	**1**	*Condone freehand throughout this question* Accept 7.2 to 7.6
		(ii) Midpoint marked on line	**1**	Could be a dot or a *x* or a bisector
		(iii) Perpendicular drawn	**1**	
	(b)	(i) Circle drawn (anywhere)	**1**	3.5cm $\leq$ r $\leq$ 4.5cm
		(ii) Chord marked and labelled for *their* curve	**1**	
		(iii) Tangent marked and labelled for *their* curve	**1**	**SC1** if **both** tangent and chord drawn but neither labelled or labelling reversed
3	(a)	12, 10, 4	**1**	
	(b)	5 correct bars	**B2**	Allow **B1** if 3 or 4 correct **SC1** for 5 correct frequencies indicated but without vertical lines
	(c)	Photos	**1**	
	(d)	4	**1**	
	(e)	36 or FT from *their* frequencies in (a)	**2**	**M1** for 7 + 3 + *their*(12 + 10 + 4)

4	(a)	605	1	
	(b)	484	1	
	(c)	17	1	
	(d)	1170 with working seen	3	Or **M1** for 90(0) + 270 or 104(0) + 130 (at least 1 term correct **and** addition attempted) and **A1** if all digits are correct in their part sums Or **M1** for 800 + 100 + 240 + 30 (ie 4 values added at least two terms correct) **A1** for all digits correct, and 3 terms correct Or if grid ('Chinese' method) used **M1** complete grid, 2 products correct **A1** whole grid correct Or **SC2** if correct and no working
5	(a)	Four squares drawn	1	
	(b)	10, 13, 16	2	Allow 1 if any one correct in right place
	(c)	31 3*n* + 1, keep + 3, etc	1 R1	Reason mark is dependent on 31 correct
	(d)	No, number of matches is always one more than a multiple of 3	2	'No' and good reason = 2 'No' and attempt at reason = 1 'No' without reason, or 'Yes' = 0
6	(a)	36 cao	1	
	(b)	8 cao	1	
	(c)	18 www	2	**M1** for 20/10
	(d)	12 or 12/1 www	2	**M1** for 32/8
	(e)	3 cao	1	
	(f)	29	1	

7	(a)	Third angle ticked	**1**	
	(b)	80	**1**	
	(c)	110	**B3**	Or **M1** for 360 – 80 – 80 – 130 or 70 seen And **M1 dep** for 180 – *their* 70
		"quadrilateral" **with** "angles" **or** "360"	**R1**	'360, 180' can be implied by correct answer/working
		"line" **with** "angles" **or** "180"	**R1**	Accept Interior + Exterior (angle) = 180 Where totals are given with reasons they must be correct
8		4, 4	**1,1**	
		0, 5	**1,1**	
		1, 1 (or 0)	**1,1**	
9		4 www	**4**	Or **B1** for sight of 150 or 1.5(0) and **M1** for 5 – 1.9(0) – multiple of 0.5(0) (or 1.6(0) or 160 seen) And **M1 dep** for *their* 1.60 ÷ 0.40 soi
10	(a)	(i) 34 www	**2**	1 for either 16 or 18 seen
		(ii) 3 www	**2**	1 for either 24 or -21 seen
	(b)	60	**1**	
11	(a)	Correct enlargement	**2**	Allow 1 if wrong SF used (not SF 1) or 4 sides correct
	(b)	Correct construction ± 2mm with arcs visible	**3**	Or **B1** for any line correct length ± 2mm and **M1** for construction arcs seen or **SC2** for correct triangle no arcs
12	(a)	7	**1**	
	(b)	37	**1**	
	(c)	24	**2**	Allow 1 for 23 and/or 25, or **SC1** for figs 2, 4
13	(a)	0.14	**1**	
	(b)	3/10 or 0.3 isw	**2**	Allow 1 for correct working leading to 9/30 or other equivalent fraction eg 270/900 isw

14	(a)	1 : 4	1	
	(b)	50	2	**M1** for $\frac{250}{100}$ (× 20) oe **Or SC1** for answer 200
	(c)	300	3	**M2** for 1.2(0) × 250 oe isw **Or M1** for 0.2(0) × 250 oe soi by 50 **And M1(dep)** for 250 + *their*(20%) **Or SC1** for answer of 200
15	(a)	0.25, ¼, 25%	2	**M1** for 1 – (0.6 + 0.15) soi by 0.79
	(b)	Eg 'May be cloudy'	1	Allow any reasonable answer
16	(a)	(i) C (8,6,0) (ii) F (8,0,4) (iii) G (8,6,4)	1 1 1	
	(b)	(3,0,2)	2	**B1** for two parts correct in correct positions
17	(a)	(i) Two correct *x* and *y* pairs in table or plotted on grid Any 2 correct points plotted Or any 2 of t*heir* points correctly plotted Single, correct ruled line, any length	1 1 1	Ignore any incorrect. Accept any *x* values cao
		(ii) 0.3 to 0.4	1	Accept ⅓. Independent of graph.
	(b)	$\frac{y+1}{3}$ or $\frac{y}{3}+\frac{1}{3}$ oe final answer	2	**M1** for 3*x* = *y* + 1 or $\frac{y}{3}=x-\frac{1}{3}$ **Or SC1** for final answer $\frac{y}{3}+1$ or *y* + 1/3 or *y* + 1 ÷ 3 or $y+\frac{1}{3}$
18	(a)	6*x* – 15 seen	1	Not 6*x* + -15
	(b)	2*a*(2 + *c*) final answer	2	**M1** for 2(2*a* + *ac*) or *a*(4 + 2*c*) Or (*a* + *a*)(2 + *c*) or (2*a* + 0)(2 + *c*)
19	(a)	2^3 (×) 5^2	3	**M1** for any attempt at factor tree or repeated division **Or B1** for correct factor pair of 200 **And A1** for all five correct final factors indicated. No other factors except 1s.
	(b)	(i) y^8	1	
		(ii) y^2	1	

J512/02 Paper 2 (Foundation Tier)

1	(a)	(i) 6 or 20 or 26	1	
		(ii) 9	1	
		(iii) 11 and 26	1	
		(iv) 51 and 26	1	
	(b)	(i) 20	1	
		(ii) It divides by 5 It's in the 5 times table oe	1	Condone it ends in 0 or 5
	(c)	(i) 11	1	
		(ii) 11 goes into 33, 33 is in the 11 times table	1	
2	(a)	20	1	
	(b)	9	1	
	(c)	22 to 26	2	**M1** for evidence of attempting to count squares
	(d)	Use a piece of string, etc	1	
3	(a)	£7.10	1	
		£7.47	1	
		£11.88	1	
		(£0).62 or 62p	1	
		£28.31	FT1	**FT** only if **4** values added
	(b)	6	2	**B1** for sight of 3 Or **M1** for adding 3s or 2.99s together Or **M1** for 20 ÷ 2.99, implied by 6.68
4	(a)	Indian	1	
	(b)	1/3 oe	1	
	(c)	50°	2	**M1** for 360 – (120 + 100 + 90) Or **M1** for sight of 310
	(d)	50	2	**M1** for (180 × 100) / 360 Or **M1** for use of 1 person = 2°
5	(a)	(i) 56	1	
		(ii) 47	2	**M1** for use of 59
		(iii) 168	2	**B1** for sight of any 2 from 56, 44, 68 Or **B1** for 100
	(b)	3	2	**M1** for 120 ÷ 40

6	(a)	(2, 3) and (-3, 4)	1+1	**SC1** for C and D transposed
	(b)	E, F and G correctly plotted at (-5, -4), (1, -5) and (0, -3)	3	**B1** for each point correctly plotted ±2mm
7	(a)	Correct net	3	**B2** for correct **net** with lid or a **net** with four correct rectangles **B1** for two or three correct rectangles
	(b)	(i) 27°	1	
		Angles in a triangle add up to 180	1	
		(ii) 70	FT2	**M1** for sight of *their* 180 – 40 or sight of *their* 140
8				*Accept embedded answers as final answer*
	(a)	(i) 7	1	
		(ii) 3	1	
		(iii) 2.5	2	**M1** for 2*x* = 5 or *x* + 2.5 = 5
	(b)	(i) 41	2	**M1** for inserting 13 into the formula, implied by sight of 39
		(ii) 4	2	**M1** for inserting 12 and -2 into formula or for sight of -8
9	(a)	(i) 81	2	**M1** for (3 × 135) ÷ 5 oe or 3 × 27
		(ii) 32	1	
		(iii) 125	1	
	(b)	5.01 or $5\frac{1}{100}$	1	
	(c)	(i) 5.9488(…)	1	
		(ii) 5.9	FT1	
10	(a)	$\frac{8}{17}$ oe	2	**B1** for sight of 8 or 17
	(b)	There are no red balls oe	1	
11		4.40	4	**M3** for answer 4.4 Or **M1** for 5.5(0) or attempt to calculate same <u>And</u> **M1** for 7.7(0) – *their* 5.5(0) Both of the above implied by sight of 2.2(0) <u>And</u> **M1** for *their* 2.2(0) × 2 oe
12	(a)	30 cm³	2 +1	**M1** for 3 × 2 × 5
	(b)	Correct drawing	2	**B1** for one correct face

13	(a)	60	**1**	
	(b)	180	**1**	
	(c)	60, 24	**1+1**	**FT** *their* (a) for 1st value If 0,0 scored **SC1** for 24 seen in part (c)

14	(a)	Fully correct 2-way table
		
		eg Verses
		        1 2 3 4 5 6
		—————————
		Lines 10
		         11
		         12
		         13
		         14
		         15
		
		or Lines
		     10 11 12 13 14 15
		—————————
		Verses 1
		          2
		          3
		          4
		          5
		          6
			3	**M2** for 2-way table with one of the four demanded entries missing or incorrectly attributed
				
				M1 for 2-way table with two of the four demanded entries missing or incorrectly attributed

	(b)	3.7..... www OR 4 on answer line with 3.7...www seen in working	**3**	**M2** for *their* ∑ (no. of letters x f) ÷ 28 **M1** for 104 seen or at least 3 correct products
15	(a)	Correct reflection	**2**	**B1** any reflection
	(b)	Correct rotation	**3**	**M1** any rotation **M1** centre O **M1** 180° **MAXIMUM 2 OF THESE**
16		Correct region shaded or clearly indicated, using compass drawn arcs with radii ± 0.2 cm	**3**	**B1** for one or both arcs radius 2cm ± 0.2 centred on A and B **B1** for arc radius 3.5 cm ± 0.2 centred on S If 1 or 0 marks scored and 3 arcs centred on A, B and S and "correct" region(s) identified award an extra **B1**

17	85 www	3	**M2** for (1258 – 680) ÷ 680 x 100 OR 1258 ÷ 680 x 100 -100 **M1** for 1258 - 680 or 578 OR 1258 ÷ 680 or 1.85 **SC2** for answer 185 or 0.85
18	Trial between 1 and 2 Improved trial Two correct trials between 1.75 and 1.85 inclusive that give answers below 8 & above 8 1.8	**M1** **M1** **A1** **A1**	 Improved trial means a further trial which would give an answer closer to 8 Eg trials1.75 and 1.85 OR trials 1.8 and 1.85 OR trials1.8 and 1.84 Dependent on both **M** marks only
19	7.2(...) www	3	**M2** for √(3.2² + 6.5²) or √*their* 52.49 **M1** for 3.2² + 6.5² or 52.49 Scale drawing scores 0 marks

J512/03 Paper 3 (Higher Tier)

1	(a)	1 : 4	1	
	(b)	50	2	**M1** for $\frac{250}{100}$ (× 20) oe **Or SC1** for answer 200
	(c)	300	3	**M2** for 1.2(0) × 250 oe isw **Or M1** for 0.2(0) × 250 oe soi by 50 **And M1(dep)** for 250 + *their*(20%) **Or SC1** for answer of 200
2	(a)	0.25, ¼, 25%	2	**M1** for 1 – (0.6 + 0.15) soi by 0.79
	(b)	Eg 'May be cloudy'	1	Allow any reasonable answer
3	(a)	(i) C (8,6,0)	1	
		(ii) F (8,0,4)	1	
		(iii) G (8,6,4)	1	
	(b)	(3,0,2)	2	**B1** for two parts correct in correct positions
4		4*x* = 32	3	**M2** for *x* + 2*x* + *x* + 10 = 42 or better or **B1** for 2*x* <u>and</u> *x* + 10 seen
		(*x* =) 8 cao	B1	Last two marks available with no algebra
		8, 16, 18 any order cao	B1	
				SC2 for answers 6.4, 12.8, 22.8 oe **Or SC1** for 6.4 seen
5	(a)	3 left , 5 down oe	1	Accept column vector $\begin{pmatrix} -3 \\ -5 \end{pmatrix}$
	(b)	Image at (1,1) (2,1) (2,4)	1	
	(c)	Image at (-1,4) (-1,5) (-4,4)	3	**B2** for correct orientation, wrong position Or for correct 90° clockwise rotation about O **Or B1** for correct image with other attempts Or for two correct vertices

6	(a)	(i) Two correct x and y pairs in table or plotted on grid	1	Ignore any incorrect. Accept any x values.
		Any 2 correct points plotted Or any 2 of *their* points correctly plotted	1	
		Single, correct ruled line, any length	1	cao
		(ii) 0.3 to 0.4	1	Accept ⅓. Independent of graph.
	(b)	$\dfrac{y+1}{3}$ or $\dfrac{y}{3}+\dfrac{1}{3}$ oe final answer	2	**M1** for $3x = y + 1$ or $\dfrac{y}{3} = x - \dfrac{1}{3}$ **Or SC1** for final answer $\dfrac{y}{3}+1$ or $y + 1/3$ or $y + 1 \div 3$ or $y + \dfrac{1}{3}$
7	(a)	$6x - 15$ seen	1	Not $6x + -15$
	(b)	$2a(2 + c)$ final answer	2	**M1** for $2(2a + ac)$ or $a(4 + 2c)$ Or $(a + a)(2 + c)$ or $(2a + 0)(2 + c)$
8	(a)	2^3 (×) 5^2	3	**M1** for any attempt at factor tree or repeated division Or **B1** for correct factor pair of 200 **And A1** for all five correct final factors indicated. No other factors except 1s.
	(b)	(i) y^8	1	
		(ii) y^2	1	
		(iii) $8y^{15}$	2	**B1** for $8y^n$ or term containing y^{15} seen
9	(a)	$5n + 2$ final answer	2	**B1** for $5n$ seen
	(b)	(i) 6, 12	2	**B1** for one correct value
		(ii) $(n + 2)(n + 1)$ isw	2	**M1** for $(n + a)(n + b)$ where $ab = 2$ or $a + b = 3$
10	(a)	1.5 oe www	3	**M1** for $2 \times 3 \times 4$ soi by 24 **And M1** (indep) for $36 \div$ volume
	(b)	36.5 or 36.49(9..) **and** 35.5	2	**B1** for one value correctly placed Or **SC1** for correct answers reversed

11	(a)	Eg 'Add the next value to the last total'	**1**	No wrong statements Accept 2 + 18 = 20, 20 + 11 = 31, etc (minimum of two numerical examples)
	(b)	(i) 360 to 367	**1**	
		(ii) 54 **or** 55 only	**2**	**M1** for using A = 250 and graph, soi by 25 to 26 or answer between 54 and 55
12	(a)	(i) 8.45×10^5	**1**	
		(ii) (0).000193	**1**	
	(b)	$0.\dot{2}$ or 0.222(2…)	**2**	**M1** for 2 ÷ 9 correctly attempted oe
13		$7x - 3 = 2(2x + 9)$ or $3.5x - 1.5 = 2x + 9$	**M1**	Or $7x - 3 = 4x + 18$
		Correctly collecting x in *their* equation	**M1**	Dependent on 1st **M1** scored
		Correctly collecting numbers in *their* equation	**M1**	Dependent on 1st **M1** scored
		7 cao	**B1**	Last mark available with no algebra
14	(a)	70 Equal <u>tangents</u> **or** <u>tangents</u> from same point (are equal) cao	**1** **1**	Condone 'symmetry of <u>tangents</u>'
	(b)	20 or 90 – *their* (a) Tangent **and** perp. **and** radius	**1** **1**	FT from (a) Allow diameter for radius, 90 or right angle symbol for perp
	(c)	70 or *their* (a) or 90 – *their* (b)	**2**	**B1** for (AOB =) 140 seen
15	(a)	160π cm³	**2** **1**	**M1** for π × 4² × 10 oe Allow in working if not contradicted
	(b)	28π	**3**	**M2** for 112 ÷ 4 oe seen Or **B1** for 2²
16	(a)	(i) $y = \dfrac{36}{x}$ or $xy = 36$ or $x = \dfrac{36}{y}$ Final answer	**3**	**M1** for $y = \dfrac{k}{x}$ or $xy = k$ or $x = \dfrac{k}{y}$ **And B1** for 36 seen **OR SC1** for answer $y = 2.25x$ oe
		(ii) 72	**1**	
	(b)	(±)6	**2**	**M1** for y^2 or $x^2 = 36$

17	(a)	A10, B13, C17	3	**B2** for **one** of 10, 13, 17 <u>**or**</u> for **one** of 9.8(0), 12.9(0), 17.3(0) or **M1** for 4000 ÷ 40
	(b)	$\dfrac{48}{90}$ oe isw	4	**M3** for $\dfrac{3}{10} \times \dfrac{2}{9} + \dfrac{7}{10} \times \dfrac{6}{9}$ oe **Or M2** for $\dfrac{3}{10} \times \dfrac{2}{9}$ or $\dfrac{7}{10} \times \dfrac{6}{9}$ oe **Or SC2** for $\dfrac{42}{90}, \dfrac{58}{100}$ or $\dfrac{48}{100}$ oe isw **Or M1** for $\dfrac{3}{10}$ or $\dfrac{7}{10}$ oe seen
18		Correct answer www scores 4 <u>**Either**</u> **AC** = t (**b** − **a**) soi (**OC** =) **a** + **AC** soi $p = 1 - t$ $q = t$ <u>**Or**</u> **BC** = (1 − t) (**a** − **b**) soi (**OC** =) **b** + **BC** soi $p = 1 - t$ $q = t$	 2 M1 A1 2 M1 A1	Choose method to candidate's advantage **B1** for (AB=) **b** − **a** seen **Or SC1** for **AC** = t(**a** − **b**) **AC** as letter pair or *their* expression for **AC** **B1** for (BA =) **a** − **b** seen **Or SC1** for **BC** = (1 − t) (**b** − **a**) **BC** as letter pair or *their* expression for **BC**
19	(a)	(i) 10	2	**M1** for √100 or √4√5√5 or √(4×5)√5 or 2√25 or 2√5√5
		(ii) 4√5	2	**M1** for $\left(\dfrac{20}{\sqrt{5}} \right) \times \dfrac{\sqrt{5}}{\sqrt{5}}$ oe
	(b)	$\dfrac{403}{999}$ isw	2	**M1** for 1000x = 403.403(403…) oe
20		142.55 **and** 142.5 oe seen **and** No oe	2	Condone 142.49(9…) **B1** for 142.55 **or** 142.5 seen

J512/04 Paper 4 (Higher Tier)

1	(a)	(i) 1.3(3...)	1	1⅓ oe (allow *their* notation for recurring)
		(ii) 156.25	2	**M1** for 12.5² or 25/0.16
	(b)	(i) 2.370021(097)	1	
		(ii) 2.4	1	ft *their* answer to b(i) correct to 2 sig figs provided *their* b(i) given to at least 3 sig figs
2		8 www, allow 7.8	3	**B2** for 7.7(7....) or 7.78 or $7\frac{7}{9}$ **B1** for (46 – 32) x 5/9 or 14 x 5/9
3	(a)	60	1	
	(b)	180	1	
	(c)	60, 24	1+1	ft *their* (a) for 1st value If 0,0 scored **SC1** for 24 seen in part (c)

4	(a)	Fully correct 2-way table
		
		eg Verses
		                1 2 3 4 5 6
		          10
		Lines 11
		          12
		          13
		          14
		          15
		or Lines
		          10 11 12 13 14 15
		Verses 1
		          2
		          3
		          4
		          5
		          6
			3	**M2** for 2-way table with one of the four demanded entries missing or incorrectly attributed
				
				M1 for 2-way table with two of the four demanded entries missing or incorrectly attributed

	(b)	3.7..... www OR 4 on answer line with 3.7...www seen in working	3	**M2** for *their* ∑ (no. of letters x f) ÷ 28 **M1** for 104 seen or at least 3 correct products
5		62.4	2	**M1** for ½ (3.3 + 8.7) x 10.4 oe

6	(a)	37.5	**4**	**B3** for (*w*) (=) 225 ÷ 6 **M2** for 6*w* (=) 225 or *w* + 5*w* = 225 OR (360 – 106 - 29) ÷ 6 **M1** for *w* + 5*w* + 106 + 29 = 360 or 225 seen
	(b)	(i) 4 x 180 ÷ 6 or 8 x 90 ÷ 6 or 180 – (360 ÷ 6)	**2**	**B1** for just 720 ÷ 6 or 180 – 60 or 4 x 180 or 8 x 90 or 360 ÷ 6
		(ii) 88	**3**	**M2** for 360 – (120 + 2 x *their* 76) [provided ½ (180 – 28) seen] **M1** for 76 seen or ½ (180 – 28)
7		Correct region shaded or clearly indicated, using compass drawn arcs with radii ± 0.2 cm	**3**	**B1** for one or both arcs radius 2cm ± 0.2 centred on A and B **B1** for arc radius 3.5 cm ± 0.2 centred on S If 1 or 0 marks scored and 3 arcs centred on A, B and S and "correct" region(s) identified award an extra **B1**
8		Trial between 1 and 2 Improved trial	**M1** **M1**	Improved trial means a further trial which would give an answer closer to 8
		Two correct trials between 1.75 and 1.85 inclusive that give answers below 8 and above 8	**A1**	Eg trials 1.75 and 1.85 OR trials 1.8 and 1.85 OR trials1.8 and 1.84
		1.8	**A1**	Dependent on both **M** marks only
9		7.2(...) www	**3**	**M2** for √(3.2² + 6.5²) or √*their* 52.49 **M1** for 3.2² + 6.5² or 52.49 Scale drawing scores 0 marks
10	(a)	(i) *x* < 3½ or *x* < 3.5 final answer	**2**	**M1** for 4*x* < 9 + 5 or better or (*x* =) 3 ½ oe
		(ii) solution shown on number line and extends below 0 with no lower end indicated	**1**	**FT** (i) provided answer to (i) was an inequality
	(b)	(i) 5*x* + 16	**3**	**M2** for 8*x* + 10 - 3*x* + 6 **M1** for 8*x* + 10 or - 3*x* + 6
		(ii) *x*² + 4*x* – 21	**2**	**M1** for *x*² - 3*x* + 7*x* - 21 allow for 3 terms correct

11	(a)	85 www	**3**	**M2** for (1258 – 680) ÷ 680 x 100 OR 1258 ÷ 680 x 100 -100 **M1** for 1258 - 680 or 578 OR 1258 ÷ 680 or 1.85 **SC2** for answer 185 or 0.85
	(b)	750 www	**3**	**B2** for 840 ÷ 1.12 oe **B1** for just 112% oe soi
12	(a)	Fully correct and points joined with straight lines	**2**	**M1** for all heights correct in correct class interval OR all midpoints correct OR at least 2 points correct
	(b)	Sim: Modal class same	**1**	Comment about modal class allow both highest frequency 5 – 10 Condone mode but NOT median or mean or average
		Diff: Range August greater or July smaller	**1**	Comment about range
13	(a)	504	**2**	**B1** (72 =) 2 x 2 x 2 x 3 x 3 oe and (42 =) 2 x 3 x 7 oe Or evidence of using multiples of both numbers
	(b)	14	**2**	**B1** for evidence of factors of both numbers
	(c)	(i) 6.9×10^{20}	**1**	
		(ii) 2.106×10^{-2}	**2**	**M1** for figs 2106 seen **SC1** for 2.1×10^{-2}
14		Correct method to eliminate *x* or *y*	**M1**	eg $6x – 9y = 42$ seen and clear attempt to subtract or subtract from $6x + 4y = 3$ OR eg $2x = 3y + 14$ oe and attempt to substitute into $6x + 4y = 3$
		x = 2.5 *y* = -3	**A1** **A1**	**SC1** for **both** answers correct from non-algebraic method or if no working seen
15	(a)	Answers in range 16.78 - 16.8 or 17 www	**3**	**M2** for (*h* =) 20 tan 40 **M1** for tan 40 = *h*/20 *Alternative:* **M2** for (h=) $\dfrac{20\sin40}{\sin50}$ **M1** for $\dfrac{h}{\sin40} = \dfrac{20}{\sin50}$ oe
	(b)	Answers in range 27.67 - 27.7 or 28 www	**3**	**M2** for (*x* =) $\tan^{-1}$ (*their h* from part (a)) /32 **M1** for tan *x* = (*their h* from part (a)) /32 OR tan *x* = 0.524.....

16	(a)	14, 18	**1+1**	
	(b)	Each bar correct $\pm$ ½ small square on height only	**1+1**	If 0, 0 then **SC1** both fd 1.4 & 0.5 seen
		Correct scale	**1**	Award for a correct value other than 0 marked on vertical axis OR award for correct area scale shown
17		114.8(…) or 115 www	**3**	**B2** for cos x = answer which rounds to -0.42 **B1** for 12.6² = 9.5² + 5.2² - 2 x 9.5 x 5.2cos$x$ oe
18	(a)	2^{3p}	**2**	**B1** for $(2^3)^p$ or $(2 \times 2 \times 2)^p$ or $2^p \times 2^p \times 2^p$
	(b)	2/3 or 0.$\dot{6}$	**2**	Decimal answer must be exactly as given **M1** for $2^{4 + 3p} = 2^6$ or 4 + 3p = 6 or 3p = 2 or $2^{3p} = 2^2$ or $2^{3p} = 2^6 \div 2^4$ or $8^{\frac{2}{3}}(= 4)$
19	(a)	$\dfrac{8 \pm \sqrt{20}}{2}$ or $\dfrac{8 \pm \sqrt{64 - 44}}{2}$ or $(x - 4)^2 = 5$ or $x - 4 = \pm\sqrt{5}$	**M1**	
		1.76	**A1**	Each answer provided algebraic method used
		6.24	**A1**	
				If **M1 A0 A0** and both answers seen as surds or correctly rounded to 1dp or not rounded award **M1 & SC1** eg For answers 4±√5 OR 1.8 or 1.764 or 1.7639... & 6.2 or 6.236...
				SC1 for both 1.76 & 6.24 from non-algebraic method
	(b)	a = 3 and b = -23	**3**	**B1** for a = 3 **M1** for $(x + 3)^2$ - 9 – 14 OR $6x$ - 14 = $2ax + a^2 + b$ **and A1** for b = -23
20		$\dfrac{x(x + 7)}{(x - 7)(x + 7)}$	**M1** **M1**	$x^2 + 7x$ factorised correctly $x^2 - 49$ factorised correctly
		$\dfrac{x}{x - 7}$ www	**A1**	

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21	Height of small cone = 3 soi www	2	**M1** for $\dfrac{1}{5} = \dfrac{x}{x+12}$ oe
	389.56 – 389.6 or 390 www or124π	4	**M3** for ⅓ π5² x (12+*their* 3) **-** ⅓ π 1² x *their* 3
			M2 for ⅓ π5² x (12+*their* 3) **and** ⅓ π1² x *their*3
			M1 for ⅓ π5² x (12+*their* 3) **or** ⅓ π1² x *their* 3

J512/06 Internal Assessment (OCR marked tasks)

AO1: Mirrors

MARKING GUIDE
This guide gives **some** of the examples of evidence that candidates **may** produce. The examples are not exhaustive neither are they minimum requirements.
In the examples stated a = length and b = width of mirror, t = thickness of the border

MARK FOR EACH STRAND	Strategy	Communication	Reasoning
1	• **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 correct result for any mirror Eg F/H 5 by 5 = 24	• **Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.** Records the result for any mirror	• **Candidates show that they understand a general statement by finding particular examples that match it.** Finds the result for a mirror OTHER than 5 by 5.
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 a further, correct, result for any mirror OTHER than 5 by 5	• **Candidates present information and results in a clear way, explaining the reasons for their presentation.** Produces a clear set of drawings showing related mirrors and borders and/or a list of number of tiles needed.	• **Candidates search for a pattern by trying out ideas of their own.** Produces a list of three or more related results and intends to find a pattern. Eg 1 by 1, 2 by 2, 3 by 3, …..
3	• **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 ALL (must be more than 2) related results from which a generalisation may be made. Any non algebraic generalisation may be made. Eg F/H The numbers of tiles goes up in fours.	• **Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams.** Records the work in tables, with headings, or in organised lists with comments such as "I have done…" "I found that …"	• **Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.** Makes a (simple) generalisation that is correct for their results. This may be in words or symbols. Eg F/H The numbers of tiles goes up in fours. $T_a = 4a + 4$
4	• **Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks.** Systematic production of related results leading to a correct algebraic generalisation for one situation. Eg F/H $T_a = 4a + 4$	• **Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams.** Candidate links the methods of presentation (diagrams and tables) through using a commentary that tells the story of the work that has been done and unites the forms of presentation and recording.	• **Candidates are beginning to give a mathematical justification for their generalisations; they test them by checking particular cases.** Candidate tests the generalisation in R3 with new data. Eg Predicts (using the generalisation) the number of tiles for any sized mirror, not used for the generalisation, and checks this by drawing the mirror and counting tiles.

5	• **Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.**
	
	The candidate changes a variable and generates sufficient evidence so that a further generalisation may be made. Eg Changes to a rectangular mirror.
	    Changes the thickness of the border.
	    Considers number of different coloured tiles such as in alternating patterns.
	    Changes to a triangular mirror with triangular tiles.
	
	The candidate's intention must be clear.
		• **Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.**
		
		Shows C4 and then uses algebra to represent a generalisation, which must then show substitution Eg;
		➢ C4 and T_a = 4a + 4 and substitutes a = 13 to find T_a **OR**
		Decides to improve presentation in a way which is followed through to improve understanding
		Eg;
		Deduces formula by plotting results on a graph **and** uses this to find gradient 4 and intercept 4; hence (t_a=) 4a + 4. NOT JUST A GRAPH FOR DECORATION.
			• **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.**
			
			Clearly explains;
			
			(F/H) The number of tiles along any edge = length of edge (=a) and that there are 4 edges, hence 4a. Also that there are only four corners with one tile each. Hence, 4a+4. OR
			(H/F) The number of tiles in each "double row" on one edge = a, hence 2a. There are four edges, hence 8a and there are 4 corners, hence 8a + 4

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 techniques (represents mirror length and thickness of border by variables and deduces the number of tiles for any border on mirror <u>for their chosen development</u>. **Demonstrates understanding of the methods used.** **GOES BEYOND COUNTING.** OR applies difference method to achieve a formula for the sum of the diagonals leading to a quadratic.	• **Candidates convey mathematical meaning through consistent use of symbols.** Candidate uses algebra with **two, clearly defined variables**, and manipulation of these, to find an answer. (Links to S6) Eg. Shows manipulation and simplification associated with the formulae for… Square mirrors with borders of any uniform thickness, OR With limited, tapering, thicknesses OR Rectangular mirrors with the uniform thicknesses	• **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 related set of results and deduces (with reasoning) a general formula or predicts the algebraic coefficient of an overall formula. Eg Considers rectangular mirrors with set widths (1 by …, 2 by …, 3 by ….) and deduces an overall formula by observing the change in coefficient. OR Considers formulae for square mirrors with borders of thickness1, 2, 3, 4, … and deduces an overall formula.
7	• **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.** **Uses appropriate** algebraic methods to find a formula for **a three variable** situation. Eg; ➢ Rectangular mirrors (a by b) and triangular borders ➢ Cubes with borders of thickness.	• **Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.** Presents clear working, with annotation, to support their development that goes **beyond S5**.	• **Candidates' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.** **Deduces correct result for S7, outlining their understanding of the problem**.

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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.** **Uses appropriate** algebraic methods to find a formula for **a three variable** situation. Eg; ➢ Rectangular mirrors (a by b) and trapezoidal borders ➢ Cuboids (boxes) with pyramidal stacks on each face.	• **Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.** Presents a clear, elegant construction of the formula, properly annotated, to **support the S8 development, or very good S7. Concise algebra, without significant error.**	• **Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.** **S7 or better achieved**. This draws upon the same evidence as S8 and C8. If C8 is awarded then this mark will probably be awarded as well. Look for understanding of proof offered within the work.

J512/06 Internal Assessment (OCR marked tasks)

AO4: Reaction Timer

SPECIFY and PLAN

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 of sufficient quantity to allow sampling to take place.

		Minimum requirements	Examples
1	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.	• The candidate shows they understand a simple problem. • There is an implicit plan	**Implicit** plan and some further work. eg ➢ May select some of the data and attempt to average. ➢ May add up some the data or rank it. ➢ May draw a frequency diagram for some of the data
2			As for S1 but gives some structure to the write up. May aim to compare two simple samples possibly by finding two averages or drawing bar charts.
3	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 a very brief outline plan and may intend calculation of the average reactions for two (or more) different groups. (Male, female or age 12 and age 15). States one simple aim. Eg ➢ Compare the average (or spread) of the reaction times, or ➢ Tally the data into groups and draw a frequency diagram so that the most common time may be seen.
4			S3 and a clear structure to meet the stated aim. Indicates how the aim may be met through the way techniques will be used.
5	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.	• 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.	States a clear plan with one or more aims in general terms (may involve design of an experiment). ➢ Aims to compare two or more RELATED factors that may affect reaction times (age, hand, time, area…) ➢ Selects appropriate data to complete the task.
6	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.		S5 and the plan is well structured, with some reasoning for the plan, and uses statistical terms to state each subtask's aims. ➢ Eg Compare Medians and IQRs for different genders with a view to determining more than a simple average comparison. The data is chosen with some thought to the avoidance of bias.

7	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	Chooses three or more RELATED subtasks that explore Reaction times. (May involve design of an experiment) ➢ Eg Gender, Age, Time of day (type of stimulus). The strategy is well planned and utilizes appropriate techniques and choice of data. Statistical terms are used to state each subtask's aims. Plans to draw the results together.
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 and there is an efficient plan to achieve the aims in each subtask. These are all designed to explore one, overarching, hypothesis. Eg "People react differently to different stimuli", OR "People react differently at different times of day". Choices and plans are justified and statistical language is consistently and accurately used

COLLECT, PROCESS and REPRESENT

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 use calculations of the simplest kind. The results are frequently correct. Candidates present information and results in a clear	• Candidates collect or use data and record it.	Shows some working towards achieving a mean or mode or range from some the given data or some tally.
2	and organised way. The data presentation is sometimes related to their overall plan.		As C1 but with well organised working or drawing of a tally table for one subset of the data, with a "correct" result. May include one (or two) bar chart(s).
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 meeting 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	• 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.	Carries out their plan, showing table(s) and calculation(s), finding one (or more) of mean, mode or range for at least one subset of the data. May represent the subset of data in a frequency diagram, including some comment(s) to indicate what has been done.
4	their use of diagrams, which are usually related to their overall plan. They present their diagrams correctly, with suitable scales and titles		C3 and there is a clear linking commentary that **synthesises** their results.
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 meeting 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	• Candidates collect/sample largely relevant data. • They utilise appropriate calculations/diagrams/ techniques (see note 1 above) within the problem. • Their results are generally correct.	Uses appropriate techniques linked to their S4 (at least) plan. These are likely to include mean and range for at least two subsets of data (given and collected). At least 30 reaction times considered. Data may be grouped, estimated mean may be calculated, comparative frequency diagrams or scatter charts may be used, spreadsheets may be used to perform calculations and generate appropriate graphs.
6	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.		As C5 but may include ogive, IQ range, box and whisker plots and these are used consistently and appropriately. Clear understanding is shown and there is some justification for the choice of diagrams and calculations.

| 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 meeting 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 use language and statistical concepts effectively in presenting a convincing reasoned argument. | • Candidates collect/sample largely relevant data.
• They utilise appropriate and necessary calculations/diagrams/ techniques (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*) | The candidate selects or gathers data that is reliable and relevant to the designated subtasks so that they may meet the aims of their S7 (or well structured S6) hypothesis. TWO or more grade B techniques have been appropriately applied and the outcomes of these correctly interpreted, in the light of the problem. Presentation justified. |
| 8 | They use an appropriate range of diagrams to summarise the data and show how variables are related. | | As C7 but with **efficient** and also correct use a grade A technique and language to present an **argument**, in statistical terms, based upon the data analysis. |

INTERPRET and DISCUSS

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 in this strand is unlikely to exceed the mark in strand 1 by more than 1 mark

		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.	Very limited comments such as "The slowest reaction time is…..."
2			Makes a comment based upon their results "The ten year olds were slower than the fifteen year olds."
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. They make some attempt to evaluate their strategy.	• Candidates summarise some of their data. • They make a statement based on their diagrams or calculations, which is relevant to the problem.	Most likely linked to S3. May produce a table showing all the averages for two groups and writes a general comment related to these. "My results show that the fifteen year olds have lower average reaction times than the ten year olds."
4			I3 and more specific statements that relate directly to the aims. Eg. "The mean for the fifteen year olds was 0.1 seconds lower than the mean for the ten year olds. This shows that …."
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. 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.	• Candidates summarise **and** correctly interpret their diagrams and calculations. • They relate these interpretations back to the original problem. • They evaluate their strategy	**Provides a clear interpretation for their calculations and diagrams**. **Makes simple evaluative statements** that recognise strengths or weaknesses in **their** strategy. May clearly compare different groups through their means and ranges. May comment about the shape of grouped frequency (comparative) diagrams and link these to the means calculated.
6			I5 and makes statements that involve reference to measures calculated within the task that relate to their aims. Makes statements of evaluation and begins to give reasons for WHY these would improve their strategy and the outcomes of the work.

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. 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.	- 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.	**Most likely S7 but a good case of S6 may be considered**. Correct statements of interpretation of the findings from techniques applied to their subtasks. These subtasks are drawn together and are not a series of separate components. Some statements of evaluation, relating to improvements that could be made, are included and these are justified.
8			**S7 is expected but you may award on a good S6.** I7 and further analysis of the strategy. Suggests realistic improvements to the work and justifies these. Accounts for any bias in sampling. Sophisticated statements of interpretation and evaluation are made. Statistical language is used concisely to convey meaning.

Grade Thresholds

General Certificate of Secondary Education
Mathematics A (Specification Code J512)
June 2008 Examination Series

Component Threshold Marks

Component	Max Mark	A*	A	B	C	D	E	F	G
1	100				64	53	43	33	23
2	100				68	56	45	34	23
3	100	83	66	49	33	20	13		
4	100	76	60	44	28	17	11		
5	48	43	37	31	26	22	18	14	10
6	48	43	37	31	26	22	18	14	10

Specification Options

Foundation Tier

FA

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	378				300	250	200	150	100
Percentage in Grade					25.8	22.1	17.2	15.7	11.4
Cumulative Percentage in Grade					25.8	47.9	65.1	80.8	92.2

The total entry for the option was 9660.

FB

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	378				300	250	200	150	100
Percentage in Grade					29.4	24.6	18.9	13.5	8.5
Cumulative Percentage in Grade					29.4	54.0	72.9	86.4	94.9

The total entry for the option was 7851.

FC

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	378				300	250	200	150	100
Percentage in Grade					23.2	29.0	18.5	12.9	8.5
Cumulative Percentage in Grade					23.2	52.2	70.7	83.6	92.1

The total entry for the option was 882.

Higher Tier

HA

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	500	450	400	350	300	250	200		
Percentage in Grade		7.8	19.3	27.9	26.5	12.6	3.2		
Cumulative Percentage in Grade		7.8	27.1	55.0	81.5	94.1	97.3		

The total entry for the option was 7001.

HB

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	500	450	400	350	300	250	200		
Percentage in Grade		8.7	23.9	29.8	24.7	9.7	2.0		
Cumulative Percentage in Grade		8.7	32.6	62.4	87.1	96.8	98.8		

The total entry for the option was 10113.

HC

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	500	450	400	350	300	250	200		
Percentage in Grade		2.8	10.5	20.6	31.5	12.1	13.3		
Cumulative Percentage in Grade		2.8	13.3	33.9	65.4	77.5	90.8		

The total entry for the option was 250.

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	4.0	10.7	14.1	26.4	17.4	10.5	7.5	5.1
Cumulative Percentage in Grade	4.0	14.7	28.8	55.2	72.6	83.1	90.3	95.7

The total entry for the examination was 35757.

Statistics are correct at the time of publication.

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