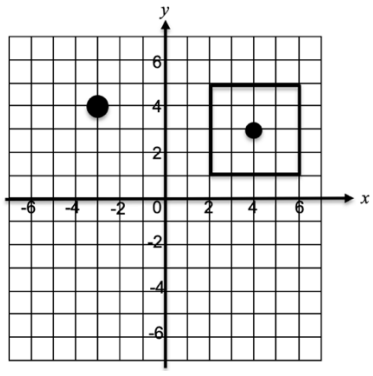
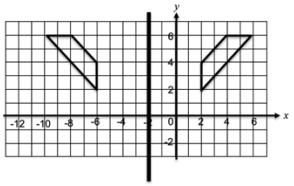
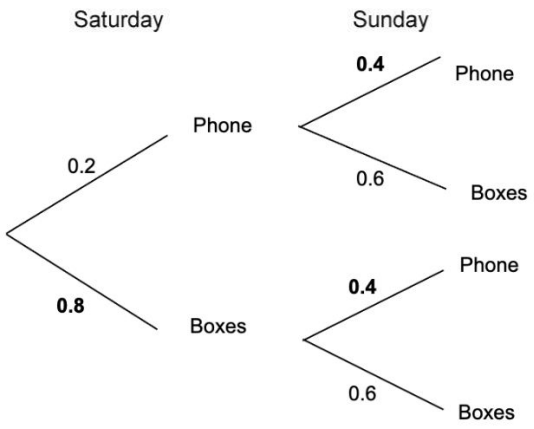
Mark Scheme

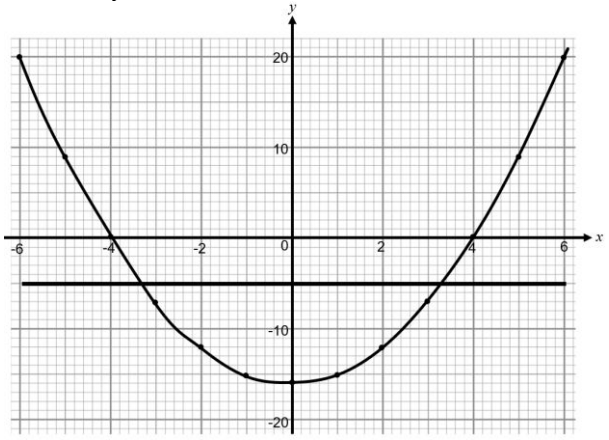
GCSE Mathematics and Numeracy Unit 2: Higher Tier SAMs	Mark	Comments
1. $13d - 5d = -31 - 9$ $8d = -40$ $d = -5$	B1 B1 B1	FT until 2nd error Mark final answer Allow an embedded answer If FT leads to a whole number answer, it must be shown as a whole number, otherwise accept a fraction
2. $\frac{21}{8} \times \frac{8}{3} - \frac{1}{8}$ $6\frac{7}{8}$	M2 A2	M1 for any one of the following: • $2\frac{5}{8} \div \frac{3}{8} = \frac{21}{8} \times \frac{8}{3}$ • $\frac{1}{2^3} = \frac{1}{8}$ A1 for any one of the following: • $\frac{21}{8} \times \frac{8}{3} = 7$ • final answer $\frac{55}{8}$ • 'their $\frac{21}{8} \times \frac{8}{3}$ ' $- \frac{1}{8}$ correctly evaluated and given as a mixed number
3. $a = 42°$ $b = 65°$ $c = 115°$	B1 B1 B1	Answer spaces take precedence FT 180 °– 'their b' provided 'their b' $\neq 0°$, 90° or 180°

4. (Probability of a black or white bead) 0.44 + 0.44 ÷ 2 or equivalent (Probability of a red bead) (1 – 0.44 – 0.44 ÷ 2) ÷ 2 or (1 – 0.66) ÷ 2 or 0.34 ÷ 2 or equivalent 0.17	M1 M2 A1	(= 0.66) FT 'their probability of a black or white bead', provided this ≠ 0, 0.44, or 1 Only allow missing brackets provided not contradicted in further working M1 for appropriate sight of either of the following (probability of a red or yellow bead): • 0.34 • 1 – 'their probability of a black or white bead' correctly evaluated CAO
Organisation and communication Writing	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanations and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means For W1, candidates will be expected to: • show all their working • use correct mathematical form in their working • use appropriate terminology, units, etc.
5(a) Point (-3, 4) indicated  	B1	Must be an unambiguously correct point Ignore any indication of a possible placement of the square

5(b) Reflection (in the line) $x = -2$	B2	'Reflection' and '$x = -2$' must be stated B1 for any one of the following: • reflection (in a vertical line) • the correct line of reflection indicated  • ($x =$) -2 • FT for 'their equation' in the form $x = k$ provided $k \neq 0$, from 'their vertical line' indicated on the grid
6. Lowest common multiple of $2 \times 5 \times 7 \times 8$ or 560 seen or implied Table completed correctly, or sight of correct number of boxes in working, e.g. Knives 40 boxes Forks 35 boxes Spoons 56 boxes	M2 A1	M1 for a method looking at factors or multiples, **e.g.** • sight of 2×7, 2×8 and 2×5 • sight of 2×7, 2^4 and 2×5 • sight of 2×7, $2 \times 2 \times 4$ and 2×5 • (14,) 28, 42, 56 and (16,) 32, 48, 64 and (10,) 20, 30, 40 • a common multiple, not LCM, e.g. 1120 Answers in the table take precedence If no marks, award SC1 for an answer with whole numbers of knives, forks and spoons in correct the ratio, e.g. 80 ; 70 : 112
7. $x + x - 23 + x - 23 - 5 > 100$ or equivalent $x > \frac{151}{3}$ or $x > 50\frac{1}{3}$ or $x > 50.3(\ldots)$ (Youngest Rhodri could be) 51 (years-old)	M2 A2 B1	M1 for sight of any one of the following: • $x + x - 23 + x - 23 - 5$ • $x + x - 23$ (+ …….) > 100 Possible FT from M1 for A1 only A1 for any one of the following: • $3x - 51 > 100$ • $3x > 151$ • a simplified inequality for 'their $x + x - 23$ (+ …….) > 100' FT 'their $x > \frac{151}{3}$ ' provided it is not a whole number No marks for trial and improvement or an unsupported answer

8(a) $\frac{9}{200}$ or equivalent	B2	Allow poor notation only if it leads to a correct answer, e.g. $\frac{4}{50} + \frac{0}{50} + \frac{3}{50} + \frac{2}{50}$ B1 for any one of the following: • proper fraction with numerator 9 • proper fraction with denominator 200 • sight of $\frac{4 + 0 + 3 + 2}{4 \times 50}$
8(b) $\frac{9}{200}$ × 5000 or equivalent 225	M1 A1	
9. 7.5	B3	Award B3 only if no inappropriate stages of working or compensating errors B2 for any one of the following: • $\frac{30}{4}$ • $\frac{30}{\text{'their } \sqrt[3]{8^2}'}$ approximated to 2 sig. fig. • $\frac{\text{'their } \sqrt[3]{27000}'}{4}$ approximated to 2 sig. fig. B1 for any one of the following: • $\sqrt[3]{27000} = 30$ • $\sqrt[3]{8^2} = 4$
10(a) Complete tree diagram  	B2	B1 for any one of the following: • 0.8 or equivalent on the boxes Saturday branch • 0.4 or equivalent on **both** the phone Sunday branches
10(b) 0.8 × 0.6 0.48 or equivalent	M1 A1	FT 0.8 × 'their lower branch 0.6' provided 0 < 'their lower branch 0.6 < 1 Mark final answer

11(a) 4100×0.08 (= 328 and) $41 \div \frac{1}{8} = 328$	B2	Answer space takes precedence B1 for sight of any one of the following: • $4100 \times 0.08 = 328$ • $41 \div \frac{1}{8} = 328$ • at least 3 of the 6 evaluations correct
11(b) $8^{\frac{2}{3}}$ (= 4 and) $\frac{1}{0.25} = 4$	B2	Answer space takes precedence B1 for sight of any one of the following: • $8^{\frac{2}{3}} = 4$ • $\frac{1}{0.25} = 4$ • at least 3 of the 6 values correct
12. $(x - 5)(x - 8)$ (=0) $x = 5$ with $x = 8$	B2 B1	B1 for any one of the following: • $(x + a)(x + b)$ (=0) where $ab = (+)40$ • $(x + c)(x + d)$ (=0) where $c + d = -13$ **Strict** FT from 'their pair of brackets'
13. (2312 ÷ 14 =) 165 remainder 2 or $165\frac{2}{14}$ or (*n*th term) $2312 - 14n$ or equivalent $2312 - 14 \times 165$ (= 2) or $2312 - 14 \times 166$ (= -12) (First number in the sequence <0 is) -12 166 (th term)	B1 B1 B1 B1	Allow (2312 ÷ 14 =) 165.(….) or 166 FT 'their (2298 + 14) ÷ 14' The award of B1 may also imply the award of the previous B1 CAO CAO

14(a) 77° AND a reason, e.g. the sum of the opposite angles in a cyclic quadrilateral is 180° ‘	B2	Allow 77° with ‘cyclic quadrilateral’ B1 for 77°
14(b) ($Y\hat{P}Q$ =) 20º	B2	Do not penalise missing unit (º) B1 for any one of the following: • ($Y\hat{P}Q$ =) 90º – 20º • $O\hat{P}Q$ = 70º • $O\hat{P}Y$= 90º
15. Method leading to a fraction, e.g. $100x$ = 42.4242… and x = 0.4242… with an attempt to subtract or equivalent OR sight of $99x$ = 42 $(x) = \frac{42}{99}$ or $\frac{14}{33}$ $\left(\left(\frac{7}{4\frac{1}{2}+2^6}\right)^{-1} =\right)$ $\frac{66}{7}$ $\left(\frac{42}{99}\times\frac{66}{7}\right.$ or $\left.\frac{14}{33}\times\frac{66}{7}=\right)$ 4	M1 A1 B1 B1	 ISW CAO
16. $y \leq -\frac{1}{2}x + 5$ and $y > x - 5$	B3	Accept equivalents for B3, B2 or B1 B2 for one of the following: • $y \leq -\frac{1}{2}x + 5$ • $y > x - 5$ • y …. $-\frac{1}{2}x + 5$ and y … $x - 5$, where the inequalities have an **incorrect** symbol (<, >, ≥ , ≤, =) B1 for one of the following: • y …. $-\frac{1}{2}x + 5$ or y … $x - 5$, where the inequality has an **incorrect** symbol, i.e. (<, >, ≥, ≤, =)
17. Scale factor -2 Centre of enlargement (-4, -2)	B1 B1	Answer space takes precedence Answer space takes precedence
18. Line $y = -5$ drawn  Solutions x = – 3.3 to – 3.4 with x = 3.3 to 3.4	B3 B2	The line must be of sufficient length to intersect the graph given at 2 points B2 for any one of the following: • line $y = -5$ drawn but of insufficient length to intersect at the 2 points • line required is $y = -5$ stated or implied • sight of $(x + 4)(x - 4) = -5$ or equivalent B1 for any one of the following: • $((x + 4)(x - 4) =)$ $x^2 - 16$ • $(x^2 - 11 =)$ $(x + 4)(x - 4) + 5$ or equivalent CAO, no FT B1 for either solution correct

19. $g^3h^3 = 27g^3 + 7$ or $g^3h^3 - 27g^3 = 7$ $g^3(h^3 - 27) = 7$ $g^3 = \frac{7}{h^3-27}$ $g = \sqrt[3]{\frac{7}{h^3-27}}$	 B1 B1 B1 B1	FT until 2nd error for equivalent level of difficulty. Cube No FT from $gh = 3g + \sqrt[3]{7}$ as this is 2 errors Isolating terms in g^3 and factorising Isolating g^3 Must not have '$\pm\sqrt[3]{}$'
20. $((\sqrt{75} - \sqrt{3})^2 =)$ $(5\sqrt{3} - \sqrt{3})^2$ or $(4\sqrt{3})^2$ 48	M2 A1	M1 for sight of $\sqrt{75}$ expressed as one of the following: • $\sqrt{25 \times 3}$ • $\sqrt{5 \times 5 \times 3}$ • $5\sqrt{3}$ CAO
20. Alternative method 1 $75 - \sqrt{75}\sqrt{3} - \sqrt{75}\sqrt{3} + 3$ *48*	*M2* *A1*	*May be shown in stages with $\sqrt{75}\sqrt{3}$ written as $\sqrt{225}$ or $\sqrt{5 \times 5 \times 3 \times 3}$* *M1 for any one of the following or with equivalents:* • *75 ….. + 3 provided 3 or 4 terms are given* • $75 - \sqrt{75}\sqrt{3} - \sqrt{75}\sqrt{3} + \cdots$ • $\ldots - \sqrt{75}\sqrt{3} - \sqrt{75}\sqrt{3} + 3$ *CAO*
20. Alternative method 2 $(\sqrt{3})^2(\sqrt{25} - 1)^2$ $3(5-1)^2$ *48*	*M1* *m1* *A1*	
21. $(4w^2 - 9 =)$ $(2w + 3)(2w - 3)$ $(8w^2 - 12w =)$ $4w(2w - 3)$ $\frac{2w+3}{4w}$	M1 M1 A1	Mark final answer **Strict** FT from 'their factorised expressions' provided either the numerator or denominator is correct, i.e. at least M1 previously awarded

22. (1 – P(no Sp, no Sp, no Sp)) $1 - \frac{12+3}{28} \times \frac{12+3-1}{27} \times \frac{12+3-2}{26}$ or $1 - \frac{15}{28} \times \frac{14}{27} \times \frac{13}{26}$ OR (P(1 Sp) + P(2 Sp) + P(3 Sp)) $3\left(\frac{13}{28} \times \frac{15}{27} \times \frac{14}{26} + \frac{13}{28} \times \frac{12}{27} \times \frac{15}{26}\right) + \frac{13}{28} \times \frac{12}{27} \times \frac{11}{26}$ $\frac{31}{36}$ or equivalent	M2 A1	M1 for sight of any one of the following: • (P(0 Sp)=) $\frac{15}{28} \times \frac{14}{27} \times \frac{13}{26}$ • (P(3 Sp)=) $\frac{13}{28} \times \frac{12}{27} \times \frac{11}{26}$ • (P(2 Sp)=) (3 ×) $\frac{13}{28} \times \frac{12}{27} \times \frac{15}{26}$ • (P(1 Sp,)=) (3 ×) $\frac{13}{28} \times \frac{15}{27} \times \frac{14}{26}$ ISW

How to read the mark scheme

- ‘M' marks are awarded for any correct method applied to appropriate working, even though a numerical error may be involved. Once earned they cannot be lost.
- ‘m’ marks are dependant method marks. They are only given if the relevant previous ‘M’ mark has been earned.
- ‘A' marks are given for a numerically correct stage, for a correct result or for an answer lying within a specified range. They are only given if the relevant M/m mark has been earned either explicitly or by inference from the correct answer.
- 'B' marks are independent of method and are usually awarded for an accurate result or statement.
- ‘S’ marks are awarded for strategy
- ‘E’ marks are awarded for explanation
- ‘U’ marks are awarded for units
- ‘P’ marks are awarded for plotting points
- ‘C’ marks are awarded for drawing curves
- ‘OC’ marks are awarded for ‘organising and communicating’, a strand of OCW (organising, communicating and writing accurately)
- ‘W’ marks are awarded for ‘writing accurately’, a strand of OCW (organising, communicating and writing accurately)
- ‘SC’ marks are awards for special cases
- CAO: correct answer only
- ISW: ignore subsequent working
- FT: follow through

Assessment mapping

Q.	Topic	Max mark	AO1	AO2	AO3	Common Qn (FT)	Common marks (FT)	OCW
1	Solve linear equation with variable both sides	3	3			13	3	
2	Number machine with fractions and indices	4	4			14	4	
3	Parallel lines	3	3			15	3	
4	Probability problem, including use of 1 - P(a)	6			6			*
5	Line of reflection, anticlockwise rotation	3	1	2				
6	Wooden cutlery factor and LCM problem	3			3	16	3	
7	Family business age inequality	5		5		17	5	
8	Relative frequency of rotten oranges	4	4					
9	Estimation of calculation to 1 sig fig including cube root	3	3					
10	Tree diagram cycle to and from work	4	4			18	4	
11	Pairs of equal calculations	4	4					
12	Factorise then solve a quadratic equation	3	3					
13	Decreasing linear sequence to less than zero	4			4			
14	Circle theorems	4	4					
15	Recurring decimal and indices	4	4					
16	Describe an inequality region	3	3					
17	Negative enlargement	2	2					
18	Graph to solve a quadratic	5			5			
19	Change the subject, term twice and cube root	4	4					
20	Squaring a bracket containing difference with surds	3	3					
21	Simplify algebraic fraction including difference of 2 squares	3	3					
22	Venn diagram probability of language spoken by students	3		3				
		80	**52**	**10**	**18**		**22**	