GCSE
MATHEMATICS
8300/2F

Foundation Tier

Paper 2 Calculator

Shadow paper based on June 2022 paper

Mark scheme

June 2022

Version: 1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leqslant$ value $< b$
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles.

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Q	Answer	Mark	Comments
1	15	B1	

Q	Answer	Mark	Comments
2	$9c$	B1	

Q	Answer	Mark	Comments
3	360	B1	

Q	Answer	Mark	Comments
4	circumference	B1	

Q	Answer	Mark	Comments
5(a)	$\frac{12}{7}$	B1	oe improper fraction
	Additional Guidance		
	$\frac{12}{7}$ in working with a decimal on answer line		B0

Q	Answer	Mark	Comments
5(b)	0.6875	B1	accept .6875
	Additional Guidance		
	11 ÷ 16 with incorrect or no decimal		B0
	0.6875 in working with 0.687 or 0.688 or 0.68 or 0.69 or 0.7 on answer line. Treat as further working and ignore		B1

Q	Answer	Mark	Comments
5(c)	4.8	B1	
	Additional Guidance		
	4.80		B0

Q	Answer	Mark	Comments
6	Cost of 7 litres of cleaning fluid $3 \times 20 + 12$ or $60 + 12$ or 72 or $40 + 3 \times 12$ or $40 + 36$ or 76 or $20 + 5 \times 12$ or $20 + 60$ or 80 or 7×12 or 84	M1	oe cost of 3×2 litres $+ 1 \times 1$ litre or cost of 2×2 litres $+ 3 \times 1$ litre or cost of 1×2 litres $+ 5 \times 1$ litre or cost of 7×1 litre
	Cost of machine plus 7 litres of cleaning fluid $35 \times 2 + 3 \times 20 + 12$ or $35 \times 2 + 40 + 3 \times 12$ or 146 or $35 \times 2 + 20 + 5 \times 12$ or 150 or $35 \times 2 + 7 \times 12$ or 154	M1dep	oe
	142(.00p)	A1	SC1 140(.00p)
	Additional Guidance		
	Up to M2 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Special case is for the correct total from using 3.5 bottles at £20		

Q	Answer	Mark	Comments
7	Angle [88°, 92°] at *A*	M1	length ⩾ 1 cm for vertical may be implied by a point marked
	Line parallel to *BA*	M1	mark intention length ⩾ 1 cm may be implied by two points marked
	Quadrilateral *ABCD* with angle *DAB* = [88°, 92°] and *CD* parallel to *BA* and *DC* = [4.8, 5.2] cm and *DA* = [5.8, 6.2] cm	A1	sides must be joined and look straight ignore extra lines and lines extended SC2 reflection of correct shape with right angle at *B* (ignore labels)
	Additional Guidance		
	Lengths of lines (as long as ⩾ 1 cm) irrelevant for up to M2		
	Condone absence of labels *C* and *D*		
	Correct quadrilateral with *C* and *D* labels swapped		M2A0

Q	Answer	Mark	Comments
8	2 (kg) 300 (g) + 850 or 2300 + 850 or 2.3(00) + 0.85(0) or 3150 seen or 3.15(0) seen or 150 seen or 0.15(0) seen	M1	
	3 kilograms 150 grams	A1	SC2 3.15(0) kilograms 3150 grams
	Additional Guidance		
	150 may be seen embedded eg Answer 2.3 kilograms 150 grams		M1A0
	3 kg 150 g seen in working but different answer		M1A0
	2.5 + 650 with no other creditworthy work		M0A0

Q	Answer	Mark	Comments
9(a)	(13 – 8) × 5 or 5 × 5 or 25	M1	oe may be implied
	28 – their 25 or 3	M1	oe 8 ⩽ their 25 ⩽ 28 may be implied by their correct ft answer
	4 (pm)	A1ft	allow 4.00 (pm) or 16.00 (pm) ft 1 (pm) + their 3 with M0M1awarded
	Additional Guidance		
	Allow dot, colon, comma, space or no space in time notation		
	28 – 25 = 3, Answer 3 (pm)		M1M1A0
	5 × 4 = 20, 28 – 20 = 8, Answer 9 (pm)		M0M1A1ft
	4 × 6 = 24, 28 – 24 = 4, Answer 5 (pm)		M0M1A1ft
	(8 – 13) × 5 = 25 (reverse subtraction recovered and could go on to score up to M1M1A1ft)		

Q	Answer	Mark	Comments
9(b)	Valid explanation or correct calculation	B1	eg she hasn't multiplied 5 by 3 or $3 \times 5 = 15$ or answer is 33
	Additional Guidance		
	A correct calculation may be seen by Sofia's work		
	It should be 3×11		B1
	It should be 33		B1
	$3 \times 11 = 33$		B1
	5 should be 11		B1
	Needs to multiply everything in the brackets (by 3)		B1
	She should have done the brackets first		B1
	She should have added 6 and 5 first		B1
	She did 3×6 but not 3×5		B1
	She didn't use BIDMAS and work out the brackets first		B1
	Accept highlighting the 5 as the error (with no subsequent incorrect calculation seen)		B1
	A correct calculation or answer 33 with any or no explanation		B1
	A correct explanation alongside an incorrect calculation		B0
	She didn't use BODMAS / BIDMAS		B0
	She didn't expand / multiply out the brackets correctly		B0
	5 should be 2		B0
	It should be 45		B0
	The brackets are in the wrong place		B0

Q	Answer	Mark	Comments
10(a)	(4, 6)	B1	x y accept (4, 6)
	Additional Guidance		
	$(4x, 6y)$		B0

Q	Answer	Mark	Comments
10(b)	(9, 3.5)	B1	x y accept (9, 3.5)
	Additional Guidance		
	$(9x, 3.5y)$		B0

Q	Answer	Mark	Comments
10(c)	(2, 1)	B1	x y accept $(2, 1)$
	Additional Guidance		
	$(2x, 1y)$		B0
	If two or more parts have (x, y) as (y, x) then give the first 0 and condone the other(s)		

Q	Answer	Mark	Comments
10(d)	$y = 1$ or $1 = y$	B1	accept $y = 0x + 1$
	Additional Guidance		
	$x = y + 1$		B0
	$x = 1$		B0
	1		B0

Q	Answer	Mark	Comments
11(a)	**Alternative method 1**		
	$\frac{4}{7}$ × 182 or 104	M1	oe eg 182 ÷ 7 × 4 implied by 52 allow 0.57(1…) or 57(.1…)% for $\frac{4}{7}$
	$\frac{2}{3}$ × (182 – their 104) or $\frac{2}{3}$ × 78 or 52 or $\left(1-\frac{2}{3}\right)$ × (182 – their 104) or $\left(1-\frac{2}{3}\right)$ × 78	M1	oe must subtract their 104 from 182 with 10 < their 104 < 150 allow 0.66(6…) or 66(.6…)% for $\frac{2}{3}$ allow 0.33(3…) or 0.33 or 33(.3…)% or 33% for $\left(1-\frac{2}{3}\right)$ 52 is M1M1
	26(.00p)	A1	SC2 69.33 SC1 34.67
	Alternative method 2		
	$\left(1-\frac{4}{7}\right)$ × 182 or 78	M1	oe eg 182 ÷ 7 × 3 allow 0.42(86…) or 0.43 or 42(.8…)% or 43% for $\left(1-\frac{4}{7}\right)$
	$\frac{2}{3}$ × their 78 or 52 or $\left(1-\frac{2}{3}\right)$ × their 52	M1	oe 18 < their 52 < 104 allow 0.66(6…) or 66(.6…)% for $\frac{2}{3}$ allow 0.33(3…) or 0.33 or 33(.3…)% or 33% for $\left(1-\frac{2}{3}\right)$ 52 is M1M1
	26(.00p)	A1	SC2 69.33 SC1 34.67

Additional Guidance is on the next page

	Additional Guidance	
11(a) cont	Up to M2 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
	$\frac{4}{7} \times 182 = 104$, $104 \div 3 = 34.66\ldots$, Answer 34.67	M1M0A0 (or SC1)
	$\frac{4}{7} \times 182 = 104$, $104 \times 2 \div 3 =$, Answer 69.33	SC2
	Alt 1 Allow 0.57(1…) or 57(.1…)% for $\frac{4}{7}$ and 0.66(6…) or 66(.6…)% for $\frac{2}{3}$ eg $0.57 \times 182 = 103.74$ $0.66 \times (182 - 103.74) = 51.6516$, Answer 51.65	 M1 M1A0
	Do **not** allow $\frac{4}{7} = 0.6$ or $\frac{3}{7} = 0.4$ or $\frac{1}{3} = 0.3$ or $\frac{2}{3} = 0.7$ eg $0.6 \times 182 = 109.2$ $0.4 \times (182 - 109.2) = 29.12$, Answer 29.12	 M0 M0A0
	Second mark of Alt 1 is independent eg $0.6 \times 182 = 109.2$ (unacceptable to use 0.6 for $\frac{4}{7}$) $(182 - 109.2) \div 3 \times 2 = 48.53$	 M0 M1A0
	Second mark of Alt 2 is independent eg $0.4 \times 182 = 36.4$ (unacceptable to use 0.4 for $\frac{3}{7}$) $0.66 \times 36.4 = 24.02$	 M0 M1A0
	Calculation shown as eg 57% × 182	M1

Q	Answer	Mark	Comments
11(b)	It is more than the answer to part (a)	B1	

Q	Answer	Mark	Comments
12(a)	26 or 34 or 62	B1	condone 2.6 or 3.4 or 6.2
	Additional Guidance		
	Condone eg multiplication signs or 'by' or commas or 'and' eg 2 × 6 or 3 × 4 or 6 by 2 or 2, 6 or 3, 4 or (6, 2) or 2 and 6 or 3 and 4 or 6 and 2		 B1 B1 B1
	Only 4 × 3 or 4 by 3 or 4, 3 or (4, 3) or 4 and 3		B0
	Any evaluation included in the answer must be correct		
	More than one correct answer eg 26 and 34		B1
	Inclusion of an incorrect answer eg 26 and 36		B0

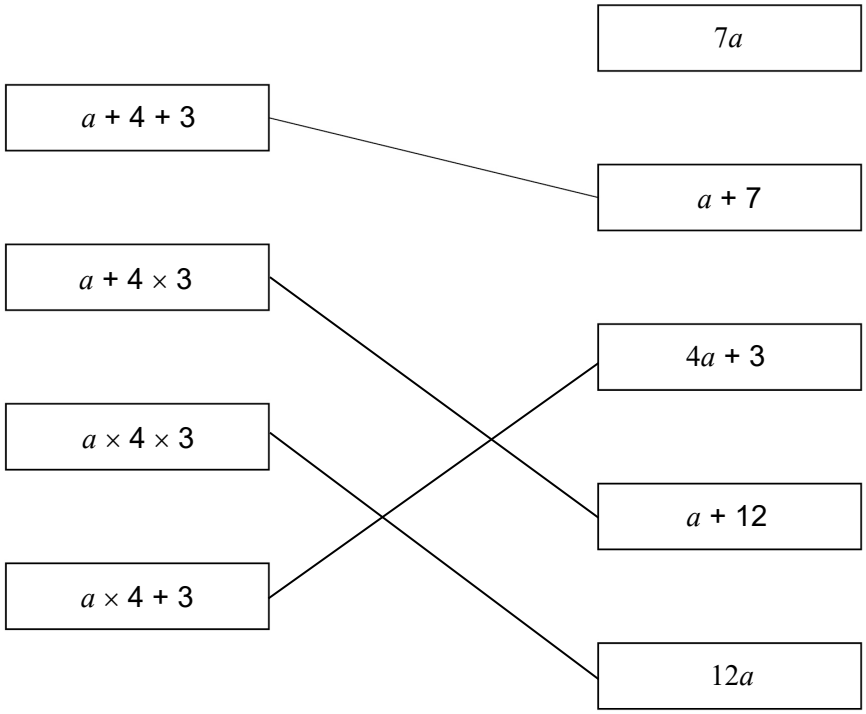
Q	Answer	Mark	Comments
12(b)	11	B1	
	Additional Guidance		
	Condone eg multiplication signs or 'by' or commas or 'and' eg 1 × 1 or 1 by 1 or 1, 1 or (1, 1) or 1 and 1		 B1 B1 B1

Q	Answer	Mark	Comments
12(c)	96 or 69 or 78 or 87	B1	condone 9.6 etc
	Additional Guidance		
	Condone eg multiplication signs or 'by' or commas or 'and' eg 7 by 8 or 7 × 8 or (7, 8) or 7, 8 or 7 and 8		 B1 B1 B1
	Any evaluation included in the answer must be correct		
	More than one correct answer eg 78 and 69		B1
	Inclusion of an incorrect answer eg 78 and 79		B0

Q	Answer	Mark	Comments
13	**Alternative method 1** Compares cost of 420 cans		
	420 ÷ 140 or 3 or 420 ÷ 210 or 2	M1	oe eg 140 + 140 + 140 = 420 may be implied
	420 ÷ 140 × 126 or 3 × 126 or 378	M1	oe cost from small crates eg 126 ÷ 140 × 420 implies first M
	420 ÷ 210 × 178.5(0) or 2 × 178.5(0) or 357	M1	oe cost from large crates eg 178.50 ÷ 210 × 420 implies first M
	21(.00)	A1	
	Alternative method 2 Compares cost of 210 cans		
	210 ÷ 140 × 126 or 1.5 × 126 or 189	M1	oe cost from small crates
	their 189 – 178.50 or 10.50	M1dep	oe
	420 ÷ 210 × their 10.50 or 2 × their 10.50	M1dep	oe
	21(.00)	A1	
	Alternative method 3 Compares cost of 140 cans		
	140 ÷ 210 × 178.50 or 2 ÷ 3 × 178.50 or 119	M1	oe cost from large crates eg $\frac{2}{3}$ × 178.50
	126 – their 119 or 7	M1dep	oe
	420 ÷ 140 × their 7 or 3 × their 7	M1dep	oe
	21(.00)	A1	

Mark scheme and Additional Guidance continue on the next page

13 cont	**Alternative method 4** Compares cost of 1 can		
	126 ÷ 140 or 0.9 **and** 178.50 ÷ 210 or 0.85	M1	oe cost from small and large crates two comparable costs
	126 ÷ 140 – 178.50 ÷ 420 or 0.05	M1dep	oe
	420 × their 0.05	M1dep	oe
	21(.00)	A1	
	Additional Guidance		
	Allow working in pence for M marks		
	Up to M3 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	If comparing cost of eg 350 cans apply the principles of Alt 4		
	In Alt 1 the second and third marks both imply the first mark and can be done in either order		
	Alts 2, 3 and 4 for the second mark allow subtractions in either order		

Q	Answer	Mark	Comments
14	All 3 correct matches	B3	B1 each correct match
	Additional Guidance		
	Two different matches from left hand column is choice for that box		
	Allow any unambiguous indication		
			B3

Q	Answer	Mark	Comments
15	**Alternative method 1** Using the given values		
	5.6 ÷ 7 or 0.8 or 7 ÷ 5.6 or 1.25 or 2.3 ÷ 7 or 0.328… or 0.33 or 7 ÷ 2.3 or 3.04…	M1	implied by 1 → 0.6 or 0.5 → 0.3
	2.3 × 5.6 ÷ 7	M1dep	oe eg 2.3 ÷ (7 ÷ 5.6) or 2.3 ÷ 1.25 or 5.6 ÷ (7 ÷ 2.3) or 5.6 ÷ 3.04… or full build-up eg 0.8 + 0.8 + 0.24
	1.84	A1	oe fraction or decimal SC2 answer with digits 184
	Alternative method 2 Working consistently in centimetres		
	5.6 × 100 ÷ 7 or 80 or 7 ÷ (5.6 × 100) or 0.0125 or 2.3 ÷ 7 or 0.328… or 0.33 or 7 ÷ 2.3 or 3.043…	M1	oe eg 560 ÷ 7 or 7 ÷ 560 implied by 1 → 80 or 0.5 → 40
	2.3 × 560 ÷ 7 or 184	M1dep	oe eg 2.3 ÷ (7 ÷ 560) or 2.3 ÷ 0.0125 or 560 ÷ (7 ÷ 2.3) or 560 ÷ 2.8 or full build-up eg 0.8 + 0.8 + 0.24
	1.84	A1	oe fraction or decimal SC2 answer with digits 184

Additional Guidance is on the next page

15 cont	**Additional Guidance**	
	Up to M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
	Answer 1.84 with no working	M2A1
	184 is M2A0 but Answer 184 cm with m crossed out would be M2A1	
	5.6 : 1.84 or 560 : 184	M2
	For consistent working in millimetres or metres apply the principles of Alt 2	
	Incorrect or inconsistent change of units must be recovered for M2A0 or M2A1, otherwise score 0 or SC2	
	eg1 56 ÷ 7 = 8, 8 × 2.3 = 18.4, Answer 1.84 (units recovered)	M2A1
	eg2 5600 ÷ 7 = 900, 900 × 2.3 = 2070, Answer 2 (arithmetic slip but method shown and units recovered)	M2A0
	eg3 56 ÷ 7 = 8, 8 × 2.3 = 18.4, Answer 18 (units never recovered)	SC2
	NB Correct values from incorrect methods	
	eg1 7 – 5.6 = 1.4 with no other creditworthy work	M0M0A0
	eg2 2.3 ÷ 5.6 = 0.4 (1 dp) with no other creditworthy work	M0M0A0
	If rounded or truncated values are used, the final answer must be exactly 1.84	
	eg1 2.3 ÷ 1.25 Answer 1.84 (may have kept full value on calculator)	M2A1
	eg2 2.3 ÷ 1.3 = 1.769… Answer 1.77 (comes from further rounding)	M2A0

Q	Answer	Mark	Comments
16	120 seen or [118°, 122°] drawn on pie chart	M1	allow missing or incorrect label
	$\frac{30}{120} \times 360$ or 90 seen or [88°, 92°] drawn on pie chart	M1	oe eg $360 \div 4$ allow missing or incorrect label
	Fully correct pie chart with unambiguous labels and all angles $\pm 2°$	A1	
	Additional Guidance		
	All three labels (or a key) needed for the A1 but accept eg No, Yes, Maybe or No, Yes, Rest or N, Y, M or N, Y, R eg for No do not accept 40 (people) or $\frac{1}{3}$ or 120 as the label		
	Not using the given radius will score a maximum of M2		

Q	Answer	Mark	Comments
17(a)	$x \leq 8$	B1	

Q	Answer	Mark	Comments
17(b)	$18pq + 12p$ or $18qp + 12p$ or $12p + 18pq$ or $12p + 18qp$	B2	B1 fully simplified first term ie $18pq$ or $18qp$ or correct expansion not fully simplified eg $18 \times pq + 12p$ or $6p \times 3q + 6p$ ($\times 2$) or $6p3q + 6 \times p \times 2$
	Additional Guidance		
	Further incorrect work after a B2 response is B1 eg $18pq + 12p = 30pq$		B1
	Further incorrect work after a B1 response is still B1 eg $18pq + 2 = 20pq$		B1

Q	Answer	Mark	Comments
17(c)	$11(2x + 3)$	B1	
	Additional Guidance		
	Condone missing final bracket ie $11(2x + 3$		B1
	Allow multiplying back out to check their answer		
	Further incorrect work after a correct response is B0 eg $11(2x + 3) = 11(5x)$		B0
	$11(x2 + 3)$		B0
	$11 \times (2x + 3)$		B0

Q	Answer	Mark	Comments
18(a)	$\frac{14}{11+14}$ or $\frac{14}{25}$ or 0.56 or $100 \div 25 \times 14$ or 4×14 or 44 : 56	M1	oe eg $14 \div 25$
	56	A1	SC1 44
	Additional Guidance		
	Allow eg $\frac{14}{25}$ seen with further incorrect work eg $\frac{14}{25} \times 11$		M1A0
	14 out of 25 with no other creditworthy work		M0
	Build-up method must be a fully correct method		

Q	Answer	Mark	Comments
18(b)	$\frac{100-36}{2}$ or $\frac{64}{2}$ or 32(%) or $\frac{1-0.36}{2}$ or $\frac{0.64}{2}$ or 0.32	M1	oe
	36 : 32 or $\frac{36}{32}$ or 36 ÷ 32 or 1.125	A1	oe ratio not in form n : 1 eg 36% : 32% or 9 : 8 or 0.36 : 0.32 oe fraction or division or decimal implied by 1.125 : 1 oe
	1.125 : 1 or $1\frac{1}{8}$: 1	B1ft	oe ratio in form n : 1 eg $\frac{9}{8}$: 1 ft any **ratio** not in form n : 1 ft values must give n to 2 dp or better
	Additional Guidance		
	$\frac{100-36}{2} = 34$ 36 : 34 = 1.0588… : 1		M1 A0B1ft
	36 : 64 = 0.5625 : 1 or 64 : 36 = 1.777… : 1		M0A0B1ft
	36 ÷ 64, Answer 0.5625 : 1 (no ratio seen to ft)		M0A0B0ft
	Correct ratio with subsequent truncation or rounding to < 2 dp eg1 1.125 : 1, Answer 1 : 1 eg2 36 : 64 = 1.777… : 1, Answer 1.8 : 1		M1A1B0 M0A0B0
	1.125n : 1		M1A1B0
	32 : 1 with no other creditworthy work		M1A0B0

Q	Answer	Mark	Comments
19(a)	$(2, -1)$	B1	

Q	Answer	Mark	Comments
19(b)	(0, 10)	B1	x y accept (0, 10)
	Additional Guidance		
	$(0x, 10y)$		B0

Q	Answer	Mark	Comments
19(c)	4	B1	
	Additional Guidance		
	$\frac{4}{1}$		B1
	$\frac{12}{3} = 4$		B1
	$\frac{12}{3}$		B0
	$4x$		B0
	$y = 4$		B0

Q	Answer	Mark	Comments
20(a)	0.3 on Jesse not pass	B1	oe fraction, decimal or percentage
	0.6 on Martin pass and 0.4 on Martin not pass (twice)	B1	oe fraction, decimal or percentage
	Additional Guidance		

Q	Answer	Mark	Comments
20(b)	0.42 or $\frac{42}{100}$ or $\frac{21}{50}$ or 42%	B1	oe fraction, decimal or percentage
	Additional Guidance		
	Ignore simplification or conversion if correct answer seen eg1 $\frac{42}{100}$ seen Answer $\frac{4}{10}$ eg2 $\frac{42}{100}$ seen Answer 4.2%		B1 B1
	Ignore words if correct answer seen eg1 $\frac{42}{100}$ seen Answer 42 out of 100 eg2 0.42, unlikely		B1 B1
	Answer given as ratio (even if correct answer also seen) eg 42 : 100		B0
	Answer only in words eg 42 out of 100		B0
	Only 42 (without %)		B0

Q	Answer	Mark	Comments
21	64 and 19 or 4^3 and 19 or 4 and 4 and 4 and 19	B2	together in any order eg 64 × 19 or 19 × 4^3 or 4, 4, 4, 19 or 1216 ÷ 19 = 64 or 1216 ÷ 64 = 19 B1 at least three of 8, 27, 64, 125, 216, 343, 512, 729, 1000, 1331, 1728, 2197 etc (allow 2^3, 3^3, 4^3 etc) or all four of 11, 13, 17, 19 (ignore any numbers not between 10 and 20) or (cube number > 1) × (prime number between 10 and 20) or 1216 ÷ (cube number > 1) or 1216 ÷ (prime number between 10 and 20)

Additional Guidance	
B1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
B2 responses may be seen on a factor tree	
B1 for three cube numbers given in index form – evaluations can be ignored eg 4^3 5^3 6^3 scores B1 with no evaluations or with incorrect evaluations	
B1 for multiplications or divisions – evaluation can be ignored eg1 2^3 × 13 scores B1 with no evaluation or evaluated incorrectly eg2 1216 ÷ 27 scores B1 with no evaluation or evaluated incorrectly eg3 1216 ÷ 11 scores B1 with no evaluation or evaluated incorrectly	
64 and 19 seen in multiple attempts is B2 if 1216 included eg 64 × 19 = 1216 or 1216 ÷ 19 = 64 or 1216 ÷ 64 = 19 seen amongst multiple attempts	B2
64 and 19 seen in multiple attempts is B1 if 1216 not included eg 64 × 19 seen amongst multiple attempts	B1
11 13 15 17 19 does not score B1 unless 11 13 17 19 selected	
Incomplete list eg 11 13 19 does not score B1	

Q	Answer	Mark	Comments
22	**Alternative method 1**		
	105 × 5 or 525 or $\frac{92+98+103+112+x}{5}$ or $\frac{405+x}{5}$	M1	oe any letter or symbol
	$105 \times 5 - 92 - 98 - 103 - 112$ or $105 \times 5 - 405$ or $92 + 98 + 103 + 112 + x = 105 \times 5$ or $405 + x = 105 \times 5$	M1dep	oe any letter or symbol equations must have fraction eliminated
	120	A1	
	Alternative method 2		
	Trial of any value with mean correctly evaluated	M1	also allow if given to the next or previous integer eg1 trial of 100 $\frac{92+98+103+112+100}{5} = 101$ eg2 trial of 75 $\frac{405+75}{5} = 96$ ignore trials with mean not evaluated or incorrectly evaluated
	Trial of 120 with mean evaluated to 105	M1dep	eg $\frac{92+98+103+112+120}{5} = 105$ this mark implies M1M1
	120	A1	

Mark scheme and Additional Guidance continue on the next page

22 cont	**Alternative method 3**		
	$\frac{92+98+103+112}{4}$ or $\frac{405}{4}$ or 101.25	M1	oe
	their 101.25 + 5 × (105 – their 101.25) or their 101.25 + 5 × 3.75 or their 101.25 + 18.75	M1dep	oe 105 + 4 × (105 – their 101.25)
	120	A1	
	Alternative method 4		
	$\frac{92+98+103+112}{5}$ or $\frac{405}{5}$ or 81	M1	oe
	5 × (105 – their 81) or 5 × 24	M1dep	oe
	120	A1	
	Alternative method 5		
	(105 – 92) + (105 – 98) + (105 – 103) + (105 – 112) or 13 + 7 + 2 – 7 or 15	M1	oe eg (92 – 105) + (98 – 105) + (103 – 105) + (112 – 105) or 105 × 4 – 92 – 98 – 103 – 112 or –13 – 7 – 2 + 7 or –15
	105 + their 15	M1dep	oe eg 105 – their –15
	120	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Embedded 120 scores M1M1A0 using Alt 2 (even if a different answer is given)		
	Condone eg Alt 3 92 + 98 + 103 + 112 ÷ 4 No further marks unless recovered		M1
	Alt 5 1st M1 Subtractions must be consistent		
	Condone 120% for 120		

Q	Answer	Mark	Comments
23	**Alternative method 1** Computer chips per minute or computer chips per second		
	520 ÷ 12 or 43.3333	M1	oe eg 520 ÷ (12 × 60) or 520 ÷ 720 or $\frac{13}{18}$ or [0.72, 0.73] or 0.72
	2366 ÷ their 43.3333 or (2366 – 520) ÷ their 43.333.. + 12 or 54.6	M1dep	oe eg 2366 ÷ their [0.72, 0.73] or (2366 – 520) ÷ their [0.72, 0.73] + 12 × 60 or 3276
	54 minutes 36 seconds	A1	SC2 54 minutes 60 seconds or 55 minutes 0 seconds
	Alternative method 2 Minutes per computer chip seconds per computer chip		
	12 ÷ 520 or $\frac{3}{130}$ or [0.023, 0.0231] or 0.02	M1	oe eg 12 × 60 ÷ 520 or 720 ÷ 520 or $\frac{18}{13}$ or [1.38, 1.39] or 1.4
	2366 × their [0.023, 0.0231] or (2366 – 520) × their [0.023, 0.0231] + 12 or 54.6	M1dep	oe eg 2366 × their [1.38, 1.39] or (2366 – 520) × their [1.38, 1.39] + 12 × 60 or 3276
	54 minutes 36 seconds	A1	SC2 54 minutes 60 seconds or 55 minutes 0 seconds

Mark scheme and Additional Guidance continue on the next page

23 cont	**Alternative method 3**		
	$2366 \div 520$ or 4.55 or $4\frac{11}{20}$ or $(2366 - 520) \div 520$ or 3.55 or $3\frac{11}{20}$	M1	oe
	$12 \times$ their 4.55 or $12 \times$ their $3.55 + 12$ or 54.6	M1dep	oe eg $12 \times 60 \times$ their 4.55 or $12 \times 60 \times$ their $3.55 + 12 \times 60$ or 3267
	54 minutes 36 seconds	A1	SC2 54 minutes 60 seconds or 55 minutes 0 seconds
	Additional Guidance		
	M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Answer 54.6 minutes 3276 seconds		M1M1A0
	Build-up method must be a fully correct method that would lead to 54.6		

Q	Answer	Mark	Comments
24	y is 80% of x	B1	

Q	Answer	Mark	Comments
25(a)	$\frac{192}{240}$ or $\frac{96}{120}$ or $\frac{80}{100}$ or 0.8 or 80%	B1	oe fraction, decimal or percentage
	Additional Guidance		
	Correct answer seen with an answer of 192		B0
	Ignore simplification or conversion if correct answer seen eg1 $\frac{96}{120}$ seen Answer $\frac{9}{10}$ eg2 $\frac{32}{40}$ seen Answer 75		B1 B1
	Ignore words if correct answer seen eg1 $\frac{192}{240}$ seen Answer 32 out of 40 eg2 $\frac{192}{240}$, likely		B1 B1
	Answer given as ratio (even if correct answer also seen) eg 192 : 240		B0
	Answer only in words eg 192 out of 240		B0
	Only 80 (without %)		B0

Q	Answer	Mark	Comments
25(b)	$\frac{28}{240} \times 900$ or 3.75×28 or or 4×28 or 112 or 105 : 900 or $\frac{105}{900}$	M1	oe eg 0.11666… × 900
	105	A1	
	Additional Guidance		
	Working and value may be seen by table		
	25200 = 240, Answer 105		M1A1
	Embedded but not selected as answer eg 720 + 75 + 105 = 900		M1A0
	Working for Answered and fully resolved or Answered and not resolved is **not** choice eg ignore 720 and 75 seen		
	105 followed by answer 77		M1A0
	If rounded or truncated values are used, the final answer must be exactly 105 eg1 900 ÷ 240 = 3.75, 3.8 × 28 Answer 105 (may have kept full value on calculator) eg2 900 ÷ 240 = 3.75, 3.8 × 28 Answer 106 (comes from further rounding)		 M1 A1 M1 A0

Q	Answer	Mark	Comments
26	160 × 0.9 or 144 or 35 × 1.4 or 49 or 160 × 0.1 **and** 35 × 0.4 or 16 **and** 14 or –16 **and** 14	M1	oe eg 60 × (1 – 0.1) or 35 + 35 × 0.4 or 35 + 14 implied by 193 or 2 or –2
	No and correct valid amount(s)	A1	eg no and 195 and 193 or no and 2 or no and –2 or no and 16 and 14 or no and –16 and 14

Additional Guidance	
If neither box is ticked, No may be implied eg neither box is ticked and Eloise paid 2 less	M1A1
Working and values may be seen by the table	
No and 193 with M1 not seen	M0A0
No and 16 with M1 not seen	M0A0
No and 14 with M1 not seen	M0A0
Condone No and 14 and 16 with arithmetic error(s) seen eg 144 so 16 less 49 so 14 more 93 and 95 No (error in omitting 1(hundred))	M1A1
Do not condone No and 16 and 14 with process error(s) seen eg 160 – 16 = 144 35 – 14 = 21 (process error, should be 35 + 14) 144 and 21 No	M1A0

Q	Answer	Mark	Comments
27	**Alternative method 1**		
	7^2 or 49 and 24^2 or 576	M1	oe implied by 625
	$\sqrt{7^2+24^2}$ or $\sqrt{49+576}$ or $\sqrt{625}$ or 25	M1dep	oe eg $\sqrt{7^2+24^2-2\times7\times24\times\cos 90}$
	37 × their 25 or 925	M1dep	oe if M1M0 their 25 can be any value other than 7, 24 or 37 dep on 1st M
	0.5 × 24 × 7 or 84	M1	oe eg 0.5 × 24 × 7 × sin 90
	1009	A1	SC3 1093
	Alternative method 2		
	$\tan^{-1}\frac{7}{24}$ or [16.2, 16.3] or $\tan^{-1}\frac{24}{7}$ or [73.7, 73.8]	M1	oe may be on diagram
	$\frac{24}{\cos(\text{their}\,[16.2,16.3])}$ or $\frac{7}{\cos(\text{their}\,[73.7,73.8])}$ or 25	M1dep	oe eg $\frac{7}{\sin(\text{their}\,[16.2,16.3])}$ or 24 cos (their [16.2, 16.3]) + 7 cos (their [73.7, 73.8])
	37 × their 25 or 925	M1dep	oe if M1M0 their 25 can be any value other than 7, 24 or 37 dep on 1st M
	0.5 × 24 × 7 or 84	M1	oe eg 0.5 × 24 × 7 × sin 90
	1009	A1	SC3 1093

Additional Guidance is on the next page

27 cont	**Additional Guidance**	
	Up to M4 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
	The 4th mark in Alts 1 and 2 is not dependent on any other marks	
	25 or 925 or 84 may be on the diagram	
	SC3 is for using 24 × 7 for the area of the triangle	
	Ignore units	

Q	Answer	Mark	Comments
28	**Alternative method 1**		
	$8x - 4$	M1	may be seen in a grid
	their $8x - 6x = 5 +$ their 4 or $2x = 9$ or $9 \div 2$	M1	oe eg their $-4 - 5 = 6x -$ their $8x$ or $2x - 9 = 0$ collecting two terms in x and two constant terms correctly
	$\frac{9}{2}$ or $4\frac{1}{2}$ or 4.5	A1ft	oe ft M1M0 or M0M1 with exactly one error
	Alternative method 2		
	$\frac{6x}{2} + \frac{5}{2}$	M1	oe two terms eg $3x + 2.5$
	$4x -$ their $\frac{6x}{2} =$ their $\frac{5}{2} + 2$ or $\frac{2x}{2} = \frac{9}{2}$	M1	oe eg $-2 -$ their $\frac{5}{2} =$ their $\frac{6x}{2} - 2x$ or $\frac{2x}{2} - \frac{9}{2} = 0$ collecting two terms in x and two constant terms correctly
	$\frac{9}{2}$ or $4\frac{1}{2}$ or 4.5	A1ft	oe ft M1M0 or M0M1 with exactly one error

Additional Guidance is on the next page

	Additional Guidance	
28 cont	Ignore simplification or conversion if correct answer seen	
	Correct answer from trial and improvement	M1M1A1
	Correct equation with terms collected or division with no or incorrect answer	M1M1A0
	Embedded 4.5 with no or incorrect answer	M1M1A0
	$8x - 4 = 6x + 5$ $8x - 6x = 5 - 4$ $x = 0.5$ (exactly one error in line 2)	M1 M0 A1ft
	$6x - 4 = 6x + 5$ $6x - 6x = 5 + 4$ $0 = 9$ (exactly one error in line 1 but no answer)	M0 M1 A0ft
	$8x - 4 = 6x + 5$ $8x + 6x = 5 - 4$ $x = \frac{1}{14}$ (two errors in line 2)	M1 M0 A0ft
	$8x - 2 = 6x + 5$ $8x - 6x = 5 + 2$ $x = 7$ (exactly one error in line 1 but answer does not ft)	M0 M1 A0ft
	Any ft answer must be rounded or truncated to 1 dp or better	
	The last two marks can be implied without the collection of terms seen eg $8x - 2 = 6x + 5$ and $x = 3.5$	M0M1A1ft
	Collecting terms before the bracket has been expanded	M0M0A0ft