GCSE

MATHEMATICS

8300/3F

Foundation Tier

Paper 3 Calculator

Shadow paper based on November 2023 paper

Mark scheme

November 2023

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	24	B1	

Q	Answer	Mark	Comments
2	5000 or (five) thousands(s)	B1	Accept 1000s ignore spelling, mark intention

Q	Answer	Mark	Comments
3(a)	isosceles	B1	ignore spelling, mark intention

Q	Answer	Mark	Comments
3(b)	radius	B1	ignore spelling, mark intention

Q	Answer	Mark	Comments
4	1, 2, 5, 10, 25, 50	B2	any order B1 5 or 6 correct values with up to 2 incorrect values or 4 correct values with 0 or 1 incorrect values or 3 correct values with 0 incorrect values

Additional Guidance	
Allow values given in products or 'coordinates' eg 1 × 50, 2 × 25, 5 × 10 eg (1, 50), (2, 25)	B2 B1
Lists with repeated values cannot score B2, but ignore repeated values in any format for B1 eg 1, 2, 5, 10, 10 eg 1 × 50, 2 × 25, 5 × 10, 50 × 1, 25 × 2, 10 × 5	 B1 B1

Q	Answer	Mark	Comments
5(a)	$13^2 - 3 \times 24$ or 169 or 72	M1	−72 implies M1
	97	A1	

Q	Answer	Mark	Comments
5(b)	$p + r$ or $r + p$	B1	

Q	Answer	Mark	Comments
6(a)	(6, 4)	B1	may be seen on diagram

Q	Answer	Mark	Comments
6(b)	12	B1	may be seen on diagram

Q	Answer	Mark	Comments
7	140.8(0) ÷ 4 × 24 or 35.2 × 24 or 6 × 140.8(0) or 3379.2(0) ÷ 4 or $\frac{4224}{5}$ or 844.8	M2	oe M1 for 140.8(0) ÷ 4 or 35.2 oe or 24 ÷ 4 or 6 or 24 ×140.8(0) or 3379.2(0)
	844.80	A1	
	Additional Guidance		
	(One year of plan cost) 422.4(0) oe implies M1		

Q	Answer	Mark	Comments
8	128.6	B2	B1 $4.2 \times 8.75 \times 3.5$ or $\dfrac{1029}{8}$ or 128.625 or correct rounding of a number to more than 1 dp to 1 dp, other than 8.75
	Additional Guidance		
	$(4.2 + 8.75 + 3.5 =)$ 16.45 and answer 16.5		B1

Q	Answer	Mark	Comments
9	The English representation in the pictogram is incorrect.	B1	eg "English should be 5 triangles not 6". or "English should be 1 and a quarter (squares)" or implied by correction on the diagram.
	Symbols do not follow a pattern so could be misleading.	B1	eg "a group of 4 students should be in a square but in art they are split up". or "the triangles should be next to each other not spread out, as in the key." or implied by correction on the diagram eg Art corrected to 1 square
	Additional Guidance		
	Ignore irrelevant or incorrect statements.		
	"The triangles do not follow the key"		B1
	"Sometimes the triangles are split up and turned, they should be all the same way around".		B1
	"The triangles should be grouped together like the key".		B1

Q	Answer	Mark	Comments
10	1.65 × 2.4 or 3.96 or 165 × 2.4 or 396	M1	oe
	9.86 − their 3.96 or 5.9(0) or 986 − their 396 or 590	M1	oe their 3.96 < 9.86 their 396 < 986 must be in consistent units unless recovered
	their 5.9(0) ÷ 5 or their 590 ÷ 5 or 118	M1dep	oe dep on 2nd M
	1.18	A1	

Additional Guidance	
Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts	
Accept 118 on answer line with £ crossed out and p(ence) added	
9.86 − 1.65 = 8.21	M0M1
9.86 − 1.65 and 8.21 ÷ 5	M0M1M1

Q	Answer	Mark	Comments
	$13x - 4y - 4$	B3	any order B2 two terms correct B1 one term correct
11(a)	**Additional Guidance**		
	B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Further incorrect work after a B3 response is B2 eg1 $13x - 4y - 4 = 5xy$ eg2 $13x - 4y - 4$ and $13x = 8$		B2
	Further incorrect work after a B2 or B1 response is B1 eg1 $13x + 4y - 4 = 13xy$ eg2 $13x - 4y + 4$ and $13x = 0$		B1
	$13x$ and $-4y$ and -4		B2

Q	Answer	Mark	Comments
11(b)	$\dfrac{3a^3}{2}$	B1	accept any indication

Q	Answer	Mark	Comments
	Thin Pepperoni Mushroom (TPM) Thin Pepperoni Sausage (TPS) Thin Pepperoni Feta (TPF) Thin Onion Mushrooms (TOM) Thin Onion Sausage (TOS) Thin Onion Feta (TOF) Thin Mushroom Sausage (TMS) Thin Mushroom feta (TMF)	B3	any order of subjects and/or rows B2 6 or 7 rows correct B1 4 or 5 rows correct
12	**Additional Guidance**		
	Accept any indication for subject		
	Allow repeats and additional rows for up to B2		

Q	Answer	Mark	Comments	
13(a)	0.11×1200	M1	oe	
	132	A1		
	Additional Guidance			
	M1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts			
	Do not ignore further working after 132 seen			
	$1200 - 132 = 1068$ in working			M1
	$\dfrac{132}{1200}$ in working			M1
	$\dfrac{132}{1200}$ on answer line			M1A0

Q	Answer	Mark	Comments
13(b)	**Alternative method 1**		
	$0.45 + 0.68 = 1.13$ and the sum (of the probabilities) is greater than 1 **or** $0.45 + 0.68 = 1.13$ and 0.13 study both **or** $0.45 + 0.68 = 1.13$ and more than the total number of students at school	B2	oe B1 1.13 oe or the sum (of the probabilities) is greater than 1 or 0.13 oe
	Alternative method 2		
	$540 + 816 = 1356$ and more than the total number of students at the school or $540 + 816 = 1356$ and the total (number of students) is greater than 1200 or 540 and 816 and 156 study both	B2	oe B1 0.45×1200 or 540 and 0.68×1200 or 816 or 1356 or the total (number of students) is greater than 1200 or 156

Additional guidance for Question 13 (b) is on the next page

Q	Answer	Mark	Comments
	Additional Guidance		
	B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$540 + 816 = 1356$ and $1356 > 1200$		B2
	$540 + 816 = 1356$ and students doing both as more than the total		B2
	$0.45 + 0.68 = 1.13$ and $1.13 > 1$		B2
	$45 + 68 = 113$ and students doing both as over 100		B2
13(b) cont	$45 + 68 = 113$ and 13% doing both		B2
	$45 + 68 = 113$ and 13 doing both		B1
	$0.45 + 0.68 = 1.13$ and need to add to one		B1
	$45 + 68 = 113$		B1
	$0.45 + 0.68 = 1.13$ and students doing both as over 100 (must be in consistent form for comparison)		B1
	$\dfrac{540}{1200}$ and $\dfrac{816}{1200}$		B1
	$0.45 + 0.68$ is more than 1		B1

Q	Answer	Mark	Comments
	Alternative method 1		
	$4.6 + 4.6 + 4.9 + 8.1 + 6.2$ or 28.4	M1	oe condone one missing length
14	their 28.4×2.5 or 71	M1dep	
	their $71 \times 0.45 + 3 \times 2.15$ or $31.95 + 6.45$ or 38.4	M1dep	oe working in pence
	38.40	A1	SC2 19.23

Mark scheme for Question 14 continue on the next page

Q	Answer	Mark	Comments
	Alternative method 2		
	4.6×2.5 or 11.5 or 4.9×2.5 or 12.25 or 8.1×2.5 or 20.25 or 6.2×2.5 or 15.5	M1	
	$4.6 \times 2.5 + 4.6 \times 2.5 + 4.9 \times 2.5 + 8.1 \times 2.5 + 6.2 \times 2.5$ or $11.5 + 11.5 + 12.25 + 20.25 + 15.5$ or 71	M1dep	oe condone one missing or incorrect distance.
	their $71 \times 0.45 + 3 \times 2.15$ or $31.95 + 6.45$ or 38.4	M1dep	oe working in pence
	38.40	A1	SC2 19.23
14 cont	**Alternative method 3**		
	4.6×2.5 or 11.5 or 4.9×2.5 or 12.25 or 8.1×2.5 or 20.25 or 6.2×2.5 or 15.5	M1	
	$4.6 \times 2.5 \times 0.45$ or 5.17(5) or $4.9 \times 2.5 \times 0.45$ or 5.51(25) or $8.1 \times 2.5 \times 0.45$ or 9.11(25) or $6.2 \times 2.5 \times 0.45$ or 6.97(5)	M1dep	oe working in pence.
	$4.6 \times 2.5 \times 0.45 + 4.9 \times 2.5 \times 0.45 + 8.1 \times 2.5 \times 0.45 + 6.2 \times 2.5 \times 0.45 + 3 \times 2.15$ or $5.175 \times 2 + 5.5125 + 9.1125 + 6.975 + 3 \times 2.15$ or $31.95 + 6.45$	M1dep	oe working in pence condone one missing or incorrect distance rounded values for money is not accepted at this stage.
	38.40	A1	SC2 19.23

Additional Guidance for Question 14 is on the next page

Q	Answer	Mark	Comments
	Additional Guidance		
14 cont	Units must be consistent unless recovered		
	All correct except for missing the return from A scores M1M1M1A0 eg $4.6 + 4.9 + 8.1 + 6.2$ or 23.8 $23.8 \times 2.5 = 59.5$ $59.5 \times 0.45 + 3 \times 2.15 = 33.22(5)$		M1M1M1A0
	$4.6 + 4.9 + 6.2$ (CD missing)		M1M1

Q	Answer	Mark	Comments
15	$5 \times 4 + 3$ or $20 + 3$	M1	
	23	A1	may be on diagram
	$5 \div 5 + a =$ their 23 or $1 + a =$ their 23 or their $23 - 5 \div 5$ $(= a)$ or their $23 - 1 (= a)$	M1	
	22	A1ft	ft $23 -$ their 1
	Additional Guidance		
	Answer 22		M1A1M1A1
	$1 + 22 = 23$ shown in working without 22 on answer line		M1A1M1A0
	For the ft marks allow BIDMAS errors eg $5 \times 4 + 3 = 35$ $35 - 1 = 34$		M1A0M1A1ft

Q	Answer	Mark	Comments
	Alternative method 1		
	$\left(\dfrac{9}{10}=\right)0.9$ or $\left(2\dfrac{1}{9}=\right)2.125$	M1	
	$2.125 - 1.5$ or 0.625 and $1.5 - 0.9$ or 0.6	M1dep	
	$\dfrac{9}{10}$ with 0.625 and 0.6 seen	A1	
	Alternative method 2		
16	$\left(2\dfrac{1}{8}=\right)\dfrac{17}{8}$ or $\left(1.5=\right)\dfrac{3}{2}$	M1	
	$\dfrac{9}{10}=\dfrac{36}{40}$ **and** $\left(2\dfrac{1}{8}=\right)\dfrac{85}{40}$ **and** $\left(1.5=\right)\dfrac{60}{40}$ **and** $85 - 60 = 25$ **and** $60 - 36 = 24$	M1dep	oe with common denominators may be seen as numerators with common denominator 40
	$\dfrac{9}{10}$ with 25 and 24 seen	A1	oe with common denominators

Q	Answer	Mark	Comments
17	$1000 - 865$ or $1135 - 1000$ or $(1135 - 865) \div 2$ or 135	M1	oe
	$1135 +$ their 135 or 1270 or $1135 + 2 \times$ their 135 or 1405	M1dep	oe
	Addition or correct total of their Level 1 to Level 5 scores	M1	their Level 4 and Level 5 scores must not be zero or blank 5675 implies M3
	4675	A1	SC2 405
	Additional Guidance		
	SC2 405 is for using Level 5 score 1405 as the highest possible score		
	Embedded answer eg $4675 + 1000 = 5675$ without 4675 as their answer.		M1M1M1A0

Q	Answer	Mark	Comments
18	75 in R only 37 in the intersection 92 in M only 46 outside the circle	B4	B1 for each
	Additional Guidance		
		B4	

Q	Answer	Mark	Comment
19	14.5 cm $\leqslant$ length $<$ 15.5 cm	B2	B1 one side correct SC1 15.5 cm $\leqslant$ length $<$ 14.5 cm
	Additional Guidance		
	Accept 14.4$\dot{9}$ for 14.5		

Q	Answer	Mark	Comments
20	mean of **grouped** data	B1	

Q	Answer	Mark	Comment
21	Method to calculate the increase on the salary or the decrease to the bonus or decimal multiplier 1.03 or 0.93	M1	eg $24\,000 \times 0.03$ or 720 or 3000×0.07 or 210 oe fraction
	Method to calculate the value of the increased salary or the decreased bonus or Method to calculate the difference between the increase on the salary and the decrease to the bonus	M1dep	eg $24\,000 \times 1.03$ or $24\,720$ or $3\,000 \times 0.93$ or 2790 eg their $720 -$ their 210 or 510 27510 implies M2
	Method to calculate the decimal multiplier or percentage of the total annual pay or 1.018… or 101.8…(%) or 1.019 or 101.9(%) or Method to calculate the decimal multiplier or percentage change in the total annual pay or 0.018… or 1.8…% or 0.019 or 1.9%	M1dep	eg $\dfrac{27\,510}{27\,000}$ oe eg $\dfrac{\text{their } 720 - \text{their } 210}{24\,000 + 3\,000}$ or $\dfrac{510}{27\,000}$ ($\times 100$) oe
	1.8… or 1.9(%) increase	A1	

Additional guidance for Question 21 is on the next page

Q	Additional Guidance	
21 cont	For first M mark do not accept a misread of increase for decrease eg 1.07	M0
	$24000 \times 1.03 = 24720$ and $3000 \times 1.07 = 3210$ $24720 + 3210 = 27930$ and $\dfrac{27\,930}{27\,000}$	M1M1M1A0
	$23280 + 3210 = 26490$ and $\dfrac{26\,490}{27\,000}$	M0M0M1
	$100 + 3 = 103\%$	M0
	$24000 \times 1.03\%$	M1M0

Q	Answer	Mark	Comment
22	25	B1	Accept 5^2 for 25 throughout
	Three different prime numbers in the boxes on the right side of calculation	M1	
	$25 = 3 + 5 + 17$ or $25 = 5 + 7 + 13$	A1	numbers on rhs can be in any order SC2 $25 = 3 + 3 + 19$ or $25 = 11 + 11 + 3$ or $25 = 7 + 7 + 11$
	Additional Guidance		
	SC2 is for using a repeated prime number		
	$25 = 5 + 7 + 11$		B1M1A0
	$25 = 5 + 9 + 11$		B1M0A0
	$25 = 1 + 11 + 13$		B1M0A0
	List of prime numbers with right side boxes empty or incorrect		M0

Q	Answer	Mark	Comment
	Alternative method 1		
	cos identified	M1	
	$\cos w = \dfrac{6.9}{10.3}$ or $\cos^{-1}\dfrac{6.9}{10.3}$	M1dep	any letter or symbol for w accept 0.669(…) or 0.67 for $\dfrac{6.9}{10.3}$
	[47.8, 48]	A1	
	Alternative method 2		
	$\sin x = \dfrac{6.9}{10.3}$ or $\sin^{-1}\dfrac{6.9}{10.3}$ or [42, 42.1]	M1	any letter or symbol other than w accept 0.669(…) or 0.67 for $\dfrac{6.9}{10.3}$
	90 – their [42, 42.1]	M1dep	
	[47.8, 48]	A1	
	Alternative method 3		
23	$\sqrt{10.3^2 - 6.9^2}$ or $\sqrt{106.09 - 47.61}$ or [7.64, 7.65] **and** $\sin^{-1}\dfrac{\text{their }[7.64,\ 7.65]}{10.3}$ or $\tan^{-1}\dfrac{\text{their }[7.64,\ 7.65]}{6.9}$	M2	full method to work out the missing length and use it correctly to work out the value of w any letter or symbol for w
	[47.8, 48]	A1	

Additional Guidance		
Use of sine rule follows Alt method 2		
$\sin w = \dfrac{6.9}{10.3}$ without $\sin^{-1}\dfrac{6.9}{10.3}$ or [42, 42.1]		M0
$\cos w = 0.669$		M1M1
$\cos^{-1} w = \dfrac{6.9}{10.3}$ or $\cos = \dfrac{6.9}{10.3}$ unless recovered		M1M0

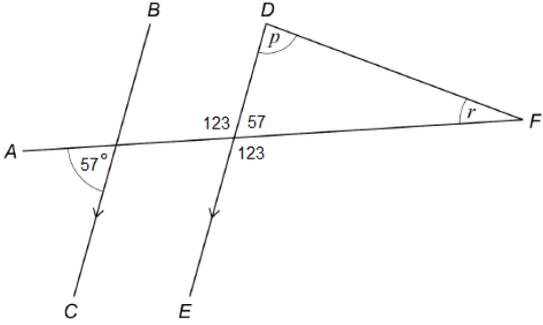| Q	Answer	Mark	Comment
24(a)	$\dfrac{2}{5}$ (Green) and $\dfrac{3}{5}$ (Yellow) for Bag A	B1	oe fractions, decimals or percentages
	$\dfrac{1}{10}$ (Green) and $\dfrac{9}{10}$ (Yellow) on both sections for Bag B	B1	oe fractions, decimals or percentages

Q	Answer	Mark	Comment
24(b)	$\dfrac{3}{5} \times \dfrac{9}{10}$	M1	oe fractions or decimals ft their tree diagram with $0 <$ both probabilities for Yellow < 1
	$\dfrac{27}{50}$ or 0.54 or 54%	A1ft	oe ft their tree diagram with $0 <$ both probabilities for Yellow < 1

Additional Guidance	
Ignore incorrect simplification or conversion after correct answer seen	
27 out of 50 or 27 : 50 without working for M1	M0A0

Q	Answer	Mark	Comment
25	Any correct method that would lead to an equation in x or an equation in y	M1	eg $10x - x = 117 - 18$ or $117 - 10x = 18 - x$ or $10x + 5\left(\dfrac{18-x}{5}\right) = 117$ or $x + 5\left(\dfrac{117-10x}{5}\right) = 18$ or $9x = 99$ or $50y - 5y = 180 - 117$ or $10(18 - 5y) + 5y = 117$ or $\left(\dfrac{117-5y}{10}\right) + 5y = 18$ or $45y = 63$
	$x = 11$ or $y = 1.4$ or $y = 1\dfrac{2}{5}$ or $y = \dfrac{7}{5}$	A1	
	$x = 11$ and $y = 1.4$ or $y = 1\dfrac{2}{5}$ or $y = \dfrac{7}{5}$	A1	
	Additional Guidance		
	$(10x + 5y) - (x + 5y) = 117 - 18$		M1
	One correct value with one incorrect value (or no second value)		M1A1A0
	Embedded correct values in both equations		M1A1A0
	Embedded correct values in one equation only		M1A0A0

Q	Answer	Mark	Comments
26(a)	2 × 2.4 × π or 4.8π or [15, 15.1]	M1	oe
	2 × 2.4 × π × 10.5 or 4.8π × 10.5 or their [15, 15.1] × 10.5	M1dep	oe
	[158, 159]	A1	SC1 [190, 190.1]
	Additional Guidance		
	SC1 is from using the area of the circle		

Q	Answer	Mark	Comments
26(b)	It is equal to the area of the rectangle	B1	

Q	Answer	Mark	Comments
26(c)	It is more than the perimeter of the rectangle	B1	

Q	Answer	Mark	Comment
27	Angle labelled as 57 for the correct interior angle of the triangle or Angle labelled as 123 for a correct exterior angle of the triangle or $2r + r + 57 = 180$ or $3r = 180 - 57$ or $3r = 123$	M1	oe
	$\dfrac{180 - 57}{2 + 1}$ or $\dfrac{123}{3}$ or 41 or $123 \times \dfrac{2}{3}$ or $\dfrac{3p}{2} = 123$	M1dep	oe
	82	A1	