AQA

GCSE

MATHEMATICS

8300/2F

Foundation Tier Paper 2 Calculator

Mark scheme

November 2018

Version: 1.1 Final

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 Assessment Writer.

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 $a \leq$ 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.

Question	Answer	Mark	Comments
1	24 cm	B1	
	Additional Guidance		
2	–0.89	B1	
	Additional Guidance		
3	$14x - 3$	B1	
	Additional Guidance		
4	225°	B1	
	Additional Guidance		
5	**Alternative method 1**		
	37 × 0.25 or 9.25	M1	must be working in £
	312.65	A1	condone £312.65p
	Alternative method 2		
	303.4 ÷ 37 + 0.25 or 8.45	M1	must be working in £
	312.65	A1	condone £312.65p
	Additional Guidance		
	Working in pence must be recovered eg1 37 × 25 = 925 eg2 37 × 25 = 925 and used as 9.25 eg3 8.20 + 25 = 33.20 eg4 8.20 + 25 = 8.45		 M0 M1 M0 M1
	Do not accept 7 as a misread of 37		M0

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="8">6(a)</td><td>884.79</td><td>B1</td><td></td></tr>
<tr><td>797.48</td><td>B1ft</td><td>ft their 884.79 – 87.31</td></tr>
<tr><td>2867.23</td><td>B1ft</td><td>ft their 797.48 + 2069.75
or their 884.79 + 1982.44</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Date</th><th>Description</th><th>Credit(£)</th><th>Debit(£)</th><th>Balance(£)</th></tr>
<tr><td>01/09/18</td><td>Starting balance</td><td></td><td></td><td>1140.79</td></tr>
<tr><td>06/09/18</td><td>Car repairs</td><td></td><td>256.00</td><td>884.79</td></tr>
<tr><td>17/09/18</td><td>Gas bill</td><td></td><td>87.31</td><td>797.48</td></tr>
<tr><td>24/09/18</td><td>Salary</td><td>2069.75</td><td></td><td>2867.23</td></tr>
</table>
</td><td>B3</td></tr>
<tr><td colspan="2">Condone £ signs and/ or p</td><td></td></tr>
<tr><td colspan="2">Ignore working in shaded cells</td><td></td></tr>
<tr><td colspan="2">Do not accept 2.867.23 for the final value</td><td></td></tr>
<tr><td colspan="2">Mark the table but be aware of possible transcription errors from other working</td><td></td></tr>
<tr><td colspan="2">Only cell completed is the final one with 2867.23</td><td>B0B0B1</td></tr>
</table>

Question	Answer	Mark	Comments
6(b)	Correct definition eg money that comes out of your account an amount that comes off your balance something that you've paid	B1	accept (amount you) subtract
	Additional Guidance		
	Do not accept a correct response with an incorrect response but you can ignore any description of credit alongside a correct response		
	Money spent / paid / deducted / subtracted / going out / withdrawn	B1	
	Comes out of your account / comes off balance / comes out of the bank	B1	
	Condone description of direct debit eg amount paid regularly / money withdrawn monthly / paid out each month / paid frequently / money that needs to be paid / money you will have to pay	B1	
	Do not accept description of debt or use of the word 'owe' eg something that you owe, money owed for bills, what you owe the bank, how much you spent on debt	B0	
	Do not accept description of cost or discount eg how much it costs, something that is taken off the price, money taken off the cost	B0	
	Other unacceptable answers are eg spending money on a card directly from your bank, borrowed from the bank, your own money that is not borrowed, monthly charge, loss of money	B0	
7(a)	(3, 3.5) or (3, $3\frac{1}{2}$)	B1	
	Additional Guidance		
	A comma used as a decimal point ie (3, 3,5)	B1	
	(03, 03.5)	B1	
	(0,3, 0,3.5)	B0	

Question	Answer	Mark	Comments
7(b)	(4, 4)	B1	
	Additional Guidance		
	(04, 04)		B1
	(0,4, 0,4)		B0
7(c)	Line from (0, 0) to (4, 2)	B2	B1 line from (0, 0) to (4, 2) with slight inaccuracy or line parallel to *AB* from any point which extends across at least two horizontal squares
	Additional Guidance		
	Parallel line that extends beyond the grid		B1
	Line drawn that is completely off the grid		B0
	Use the full length of the line to judge accuracy – there should be no gap between their line and the relevant integer points		
	Mark intention for straightness		
	Ignore other lines that could be working for parts (a) and (b)		
8(a)	R S T B R S B T R T S B R T B S R B S T R B T S	B2	may be presented vertically B1 4 or 5 correct orders and 0, 1 or 2 incorrect orders or the 6 correct orders and 1 or 2 incorrect orders or 24 possible orders with R in any place or STB, SBT, TSB, TBS, BTS, BST
	Additional Guidance		
	Correct orders start with R		
	Ignore repeated orders for both marks		

Question	Answer	Mark	Comments
8(b)	**Alternative method 1**		
	1.50 + 15 (mins) or 13.50 + 15 (mins) or 2.05 (pm) or 14.05 as end of rowing machine or 2.09 (pm) or 14.09 as start of second piece of equipment	M1	oe condone starting on a different piece of equipment if equipment clearly stated
	their 2.05 (pm) + 4 (mins) + 13 (mins) + 4 (mins) + 35 (mins) + 4 (mins) + 1 (hour) 30 (mins) or their 2.09 (pm) + 13 (mins) + 4 (mins) + 35 (mins) + 4 (mins) + 1 (hour) 30 (mins)	M1dep	oe eg their 2.09 (pm) + 17 (mins) + 39 (mins) + 1 (hour) 30 (mins) calculation(s) shown that would lead to 4.35 if evaluated correctly
	4.35 (pm) or 16.35	A1	SC2 4.39 (pm) or 16.39 from 4 breaks
	Alternative method 2		
	15 (mins) + 13 (mins) + 35 (mins) + 1 (hour) 30 (mins) or 2 (hours) 33 (mins) or 153 (mins) or 15 (mins) + 4 (mins) + 13 (mins) + 4 (mins) + 35 (mins) + 4 (mins) + 1 (hour) 30 (mins) or 2 (hours) 45 (mins) or 165 (mins)	M1	oe eg 19 + 17 + 39 + 1 h 30 implied by 4.23 (pm) or 16.23 condone 2.33 or 2.45
	1.50 (pm) + their 2 (hours) 33 (mins) + 3 × 4 (mins) or 1.50 (pm) + their 2 (hours) 45 (mins) or 4.23 (pm) + 3 × 4 (mins)	M1dep	oe their 153 or their 165 must be correctly converted to hours and minutes calculation(s) shown that would lead to 4.35 if evaluated correctly
	4.35 (pm) or 16.35	A1	SC2 4.39 (pm) or 16.39 from 4 breaks

Additional Guidance continued on the next page

Question	Answer	Mark	Comments

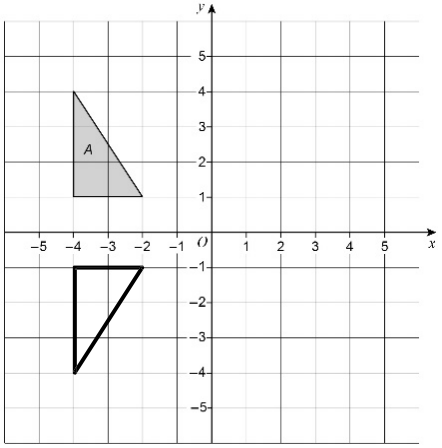
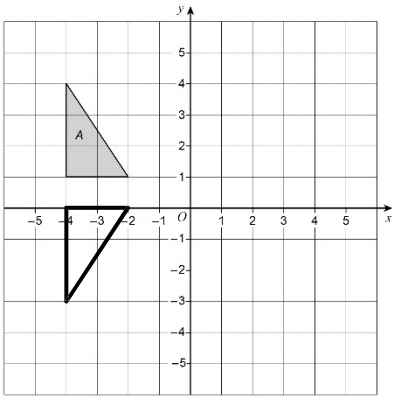
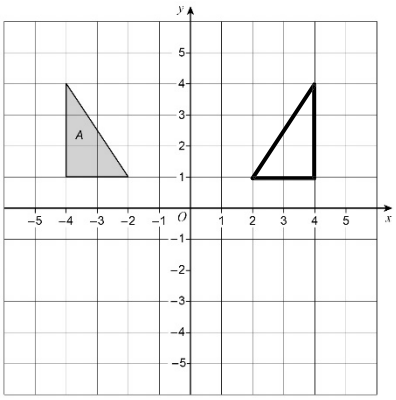
	RSTB	RSBT	RTSB	RTBS	RBST	RBTS
End 1st	2.05	2.05	2.05	2.05	2.05	2.05
Start 2nd	2.09	2.09	2.09	2.09	2.09	2.09
End 2nd	2.22	2.22	2.44	2.44	3.39	3.39
Start 3rd	2.26	2.26	2.48	2.48	3.43	3.43
End 3rd	3.01	3.56	3.01	4.18	3.56	4.18
Start 4th	3.05	4.00	3.05	4.22	4.00	4.22
End 4th	4.35	4.35	4.35	4.35	4.35	4.35

Question	Answer	Mark	Comments
9(a)	All composite bars with correct widths and heights as Tuesday 8 and 6 Wednesday 10 and 3 Thursday 6 and 6 Friday 12 and 4	B2	B1 one composite bar correct or all four email sections correct at the bottom of composite bars or all four text sections correct at the top of composite bars or four bars with total heights 14, 13, 12 and 16 (no or incorrect divisions) or widths different but all four composite bars correct
	Additional Guidance		
	Bars drawn freehand with clear intention of correct widths and heights		B2
	Mark intention for heights but Wednesday height must be [6.4, 6.6] cm		
	Condone incorrect shading or lack of shading		
9(b)	12 + 8 + 10 + 6 + 12 or 48 or 5 + 6 + 3 + 6 + 4 or 24 or 12 + 8 + 10 + 6 + 12 + 5 + 6 + 3 + 6 + 4 or 72	M1	may be seen near table addition may be implied by a total at the bottom of a column
	$\frac{8}{12}$	A1	oe fraction
	$\frac{2}{3}$	A1ft	ft M1A0 with their fraction < 1 seen, if it can be simplified and it is fully simplified
	Additional Guidance		
	$\frac{2}{3}$ changed to decimal or percentage		M1A1A0
	Do not allow misreads from the table		

Question	Answer	Mark	Comments
10	× 3	B1	
	Additional Guidance		

11(a)	Correct values and units Flour: 180 grams Eggs: 3 (eggs) Milk: 315 millilitres	B3	B2 two or three correct values (ignore units) B1 one correct value (ignore units) or 9 ÷ 6 or 1.5 seen or 6 ÷ 9 or $\frac{2}{3}$ seen
	Additional Guidance		
	Only accept abbreviated units as g and ml		
	Accept incorrect spelling of units if intention is clear		
	Mark the table unless looking for a scale factor for B1		
	Allow 3 in the table even if eg 2 ÷ 6 (= 0.3) × 9 = 2.7 seen in the working		
	Do not allow eg 2.7 in the table or a choice of eg 2.7 and 3 in the table		

11(b)	210 ÷ 28.4 or 7.39…	M1	
	7.4	A1	
	Additional Guidance		
	Only 7.4 seen		M1A1
	Only 7.3 seen		M0A0
	7.40		A0

Question	Answer	Mark	Comments
12		B2	B1 reflection in any horizontal line eg  or reflection in *y*-axis ie  or (–4, –1), (–4, –4) and (–2, –1) plotted with no incorrect points
	Additional Guidance		
	Mark intention		

Question	Answer	Mark	Comments
13(a)	**Alternative method 1**		
	3000 ÷ 2 or 1500	M1	oe
	their 1500 × 8.6(0) or 12 900	M1dep	oe
	their 1500 ÷ 3 or 500	M1dep	oe condone 1500 × 0.3(…) oe dep on 1st mark
	their 500 × 8.6(0) × 0.25 or 1075	M1dep	oe
	their 12 900 + their 1075	M1dep	dep on 2nd and 4th mark
	13 975	A1	accept 14 000 with working
	Alternative method 2		
	3000 ÷ 2 or 1500	M1	oe
	their 1500 ÷ 3 or 500	M1dep	oe condone 1500 × 0.3(…) oe
	(their 1500 – their 500) × 8.6(0) or 8600	M1dep	oe
	their 500 × 8.6(0) × 1.25 or 5375	M1dep	oe dep on 2nd mark
	their 8600 + their 5375	M1dep	dep on 3rd and 4th mark
	13 975	A1	accept 14 000 with working
	Alternative method 3		
	3000 ÷ 2 or 1500	M1	oe
	their 1500 × 8.6(0) or 12 900	M1dep	oe
	their 12 900 ÷ 3 or 12 900 and 4300	M1dep	oe condone 12 900 × 0.3(…) oe
	their 4300 × 0.25 or 1075	M1dep	oe
	their 12 900 + their 1075	M1dep	
	13 975	A1	accept 14 000 with working

Additional Guidance continued on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
13(a) cont	Dependent marks are dep on previous mark unless otherwise stated	
	Use the scheme that awards the most marks and ignore choice	
	Build-up attempts for 25% must show full working or correct values	
	1075 and 12 900 or 5375 and 8600 (unless added)	M4
	1075 **without** 12 900 implies 1st, 3rd and 4th marks in Alt 1	M3
	5375 **without** 8600 implies 1st, 2nd and 4th marks in Alt 2	M3
	8600 implies 1st, 2nd and 3rd marks in Alt 2	M3
	12 900 implies 1st and 2nd marks in Alt 1 and Alt 3	M2
	500 implies 1st and 3rd marks in Alt 1 and 1st and 2nd marks in Alt 2	M2
	£13975p £13975.00p	M5A0 M5A1

Question	Answer	Mark	Comments
13(b)	Ticks 'It should be higher' with correct reason	B1	eg the 25% will be on a higher amount the government will pay more
	Additional Guidance		
	Must tick the correct box or, if the boxes are all blank, state that it will be higher		
	Must refer to the 25% being on a larger amount or the increase in the government's contribution		
	25% of more is more	B1	
	The 25% will be more (condone)	B1	
	The £2.15 will be more	B1	
	Government would have paid more tax (condone)	B1	
	Do not accept any suggestion that the overall average has increased or a repeat of the information that the people with a tax form paid more		
	The people who filled in a tax form paid more	B0	
	The donations from the tax form people have increased	B0	
	The average has increased	B0	
	Tax is usually an increase	B0	
	It's higher so they receive more	B0	
	Because the government adds 25%	B0	

Question	Answer	Mark	Comments
14	The graph only goes from $x = -4$ to $x = 4$ and the graph shown is $y = -x$ up to 0	B2	oe B1 one correct criticism SC1 correct graph drawn from $x = -5$ to $x = 5$
	Additional Guidance		
	For one criticism, accept eg it doesn't reach 5 / 5 not plotted / it doesn't start at –5 only starts at –4 / only reaches 4 it should go to (5, 5) / (5, 5) not plotted / (–5, –5) not plotted it isn't long enough	B1	
	Do not accept eg it isn't finished (– 5, 5) not plotted	B0	
	For the other criticism, accept eg it's the wrong line up to 0 it's the wrong equation for the first part y does not equal x at the beginning it should go through (–4, –4) / (–5, –5) not plotted / (–1, –1) should be plotted it should be / it's not a straight line it shouldn't be a V-shape worked out the negative numbers wrong / no negative y-coordinates he should have plotted … **and** correct table of values	B1	
	Do not accept eg it isn't correctly drawn / it isn't $y = x$ / the points are plotted wrong it should be symmetrical / it shouldn't be symmetrical one line should go below the x-axis	B0	
	NB (–5, –5) should be plotted is valid for either (but not both) criticisms	B1	
	Both criticisms may be in one answer space		
	Ignore irrelevant statements but any additional statements must be correct eg It goes from –4 **to 5** not –5 to 5	B0	

Question	Answer	Mark	Comments
15(a)	**Alternative method 1**		
	1.8(0) × 8 or 14.4(0)	M1	implied by 5.6(0) or 18.4(0)
	20 – their 14.4(0) – 4 or 20 – 18.4(0) or 1.6	M1dep	
	1.60	A1	condone £1.60p
	Alternative method 2		
	$b = A – 4 – 1.8m$	M1	oe correct formula with b as the subject
	20 – 4 – 1.8(0) × 8 or 1.6	M1dep	
	1.60	A1	condone £1.60p
	Additional Guidance		
	1.8(0) × 8 may be within an incorrect calculation eg 4 + 1.8(0) × 8 + 20	M1	
15(b)	$C = 3 + 1.9(0)m$	B1	oe formula with C as subject accept $C = 3 + 1.9(0) \times m$ condone + 0 or + 0b
	Additional Guidance		
	$3 + 1.9m$	B0	
	Do not accept eg $A = \ldots$ for $C = \ldots$	B0	
	Allow m to be × mile(s) but not a different letter unless defined eg1 $C = 3 + 1.9(0) \times$ miles eg2 $C = 3 + 1.9(0)$ miles eg3 $C = 3 + 1.9(0)$ per mile or $C = 3 + 1.9(0)$pm eg4 $C = 3 + 1.9(0)x$	 B1 B0 B0 B0	
	Ignore £ inserted in part or all of equation eg $C = 3 + £1.90m$	B1	
	Correct formula followed by substitution (and evaluation)	B1	

Question	Answer	Mark	Comments
16	A and B	B1	
	Additional Guidance		
17	Pi or π	B1	accept a value in range [3.14, 3.142]
	Additional Guidance		
	Accept incorrect spelling if intention is clear eg accept pie		
	Answer $(C =) \pi d$		B0
	Answer $(C =) \pi d$ $(k =) \pi$		B1
18(a)	8	B1	
	Additional Guidance		
	Ignore mention of bulls or cows eg condone 8 cows		B1
	Condone an answer of 8 : 240		B1
	8 : 240 followed by 1 : 30		B0
	8 : 30		B0
	Do not accept 8 from an incorrect method eg 240 ÷ 31 = 7.7… and answer 8		B0

Question	Answer	Mark	Comments
18(b)	**Alternative method 1**		
	[28, 31] × 10 or [280, 310]	M1	appropriate days in 10-month year
	their [280, 310] × 25 or [7000, 7750] or their [280, 310] × 240 or [67 200, 74 400]	M1dep	litres per year per cow milkings per year for 240 cows
	their [7000, 7750] × 240 or their [67 200, 74 400] × 25	M1dep	
	[1 680 000, 1 860 000] with correct working	A1	accept to 1 or 2 sf with correct working SC2 answer of [2 016 000, 2 232 000] with the only error using 12 months and working shown
	Alternative method 2		
	25 × 240 or 6000	M1	litres per day for 240 cows may be seen embedded in a **product** eg 25 × 10 × 240
	their 6000 × [28, 31] or [168 000, 186 000] or 25 × 240 or 6000 **and** [28, 31] × 10 or [280, 310]	M1dep	litres per month for 240 cows litres per day for 240 cows **and** appropriate days in 10-month year
	their [168 000, 186 000] × 10 or 25 × 240 × [28, 31] × 10 or their 6000 × their [280, 310]	M1dep	
	[1 680 000, 1 860 000] with correct working	A1	accept to 1 or 2 sf with correct working SC2 answer of [2 016 000, 2 232 000] with the only error using 12 months and working shown

Alternative methods and Additional Guidance continued on the next two pages

Question	Answer	Mark	Comments
18(b) cont	**Alternative method 3**		
	[28, 31] × 25 or [700, 775]	M1	litres per month per cow
	their [700, 775] × 10 or [7000, 7750] or their [700, 775] × 240 or [168 000, 186 000]	M1dep	litres per year per cow litres per month for 240 cows
	their [7000, 7750] × 240 or their [168 000, 186 000] × 10	M1dep	
	[1 680 000, 1 860 000] with correct working	A1	accept to 1 or 2 sf with correct working SC2 answer of [2 016 000, 2 232 000] with the only error using 12 months and working shown
	Alternative method 4		
	[28, 31] × 240 or [6720, 7440]	M1	milkings per month for 240 cows
	their [6720, 7440] × 10 or [67 200, 74 400] or their [6720, 7440] × 25 or [168 000, 186 000]	M1dep	milkings per year for 240 cows litres per month for 240 cows
	their [67 200, 74 400] × 25 or their [168 000, 186 000] × 10	M1dep	
	[1 680 000, 1 860 000] with correct working	A1	accept to 1 or 2 sf with correct working SC2 answer of [2 016 000, 2 232 000] with the only error using 12 months and working shown

Additional Guidance continued on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
18b cont	Use the scheme that awards the most marks and ignore choice	
	A value in the range [280, 310] may come from subtracting two months from a year eg uses 303 (may come from 365 – 31 – 31)	M1
	The special case allows 2 marks for those using 12 months or using [336, 372] days	
	Allow **consistent** use of approximations to 1 sf throughout (this leads to an answer in the given range) ie 30 × 10 × 30 × 200 = 1 800 000	M3A1
	Mark inconsistent use of approximations to 1sf as the scheme	
	Their final answer must be in range and correct for their product but may be given to 1 or 2 sf	
	eg 280 days: 28 × 10 × 25 × 240 = 1 680 000 300 days: 30 × 10 × 25 × 240 =1 800 000 310 days: 31 × 10 × 25 × 240 =1 860 000 303 days: 303 × 25 × 240 = 1 818 000 304 days: 304 × 25 × 240 = 1 824 000 305 days: 305 × 25 × 240 = 1 830 000	M3A1
	eg 12 months of 28 days: 28 × 12 × 25 × 240 = 2 016 000 12 months of 30 days: 30 × 12 × 25 × 240 = 2 160 000 12 months of 31 days: 31 × 12 × 25 × 240 = 2 232 000 365 days: 365 × 25 × 240 = 2 190 000 366 days: 366 × 25 × 240 = 2 196 000	SC2

Question	Answer	Mark	Comments
19	**Alternative method 1**		
	$7.2^2 + 9.6^2$ (= 51.84 + 92.16) = 144 and $\sqrt{144}$ = 12 or 12^2 = 144	B2	B1 7.2^2 and 9.6^2 oe
	Alternative method 2		
	$12^2 - 7.2^2$ (= 144 – 51.84) = 92.16 and $\sqrt{92.16}$ = 9.6 or 9.6^2 = 92.16	B2	B1 12^2 and 7.2^2 oe
	Alternative method 3		
	$12^2 - 9.6^2$ (= 144 – 92.16) = 51.84 and $\sqrt{51.84}$ = 7.2 or 7.2^2 = 51.84	B2	B1 12^2 and 9.6^2 oe
	Alternative method 4		
	$\sqrt{7.2^2 + 9.6^2}$ = 12 or $\sqrt{12^2 - 7.2^2}$ = 9.6 or $\sqrt{12^2 - 9.6^2}$ = 7.2	B2	condone $7.2^2 + 9.6^2 = 12^2$ or $12^2 - 7.2^2 = 9.6^2$ or $12^2 - 9.6^2 = 7.2^2$ B1 any two of 7.2^2, 9.6^2 and 12^2 oe
	Additional Guidance		
	$7.2^2 + 9.6^2 = 144$, $x^2 = 144$, $x = 12$		B2
	Do not accept $144 \div 12 = 12$ for $\sqrt{144} = 12$		
	Do not accept incorrect statements for B2 eg $7.2^2 + 9.6^2 = \sqrt{144} = 12$		B1
	Do not accept scale drawing		
	For eg 12^2 accept 12 × 12		

Question	Answer	Mark	Comments
20	**Alternative method 1**		
	$35x + 6x = ax$ or $35 + 6 = a$ or $41x = ax$	M1	
	$a = 41$	A1	
	$40 + 3b = 13$	M1	oe
	$b = –9$	A1	SC3 $a = 41$, $b = –27$ or $a = 41$, $b = \frac{5}{3}$
	Alternative method 2		
	$35x + 40 + 6x + 3b$ or $41x + 40 + 3b$	M1	
	$35x + 6x = ax$ or $35 + 6 = a$ **and** $40 + 3b = 13$	M1dep	oe eg $41x = ax$ and $3b = –27$
	$a = 41$	A1	implies first M1 only
	$b = –9$	A1	SC3 $a = 41$, $b = –27$ or $a = 41$, $b = \frac{5}{3}$
	Additional Guidance		
	$a = 41$ and $b = –9$		M1A1M1A1
	$a = 41$ or $b = –9$		M1A1
	$35x$, 40, $6x$ and $3b$ seen without addition signs shown or implied		M0
	$35x + 40 + 6x +$ ***b*** leading to an answer of $a = 41$ and $b = –27$		SC3
	$35x +$ **8** $+ 6x + 3b$ leading to an answer of $a = 41$ and $b = \frac{5}{3}$		SC3
	$35x +$ **8** $+ 6x +$ ***b*** leading to an answer of $a = 41$ and $b = 5$		M1A1
	$a = 41x$		M0
	For $\frac{5}{3}$ accept 1.66… or 1.67		
	Condone multiplication signs eg $35 \times x$ for $35x$		

Question	Answer	Mark	Comments
21	$4n + 3$	B1	
	Additional Guidance		

22(a)	2.5 × 12 or 30 and 7.5 × 7 or 52.5 and 12.5 (× 1) or 95	M1	allow one incorrect midpoint or [2, 3] × 12 and [7, 8] × 7 and [12, 13] (× 1) ignore $t \geqslant 15$ row
	$\frac{\text{their } 30 + \text{their } 52.5 + \text{their } 12.5}{12 + 7 + 1}$ or 95 ÷ 20	M1dep	$t \geqslant 15$ product must be 0 if seen condone bracket error seen eg 30 + 52.5 + 12.5 ÷ 20
	4.75	A1	accept 4.8 or 5 if full working shown using **correct** midpoints
	Additional Guidance		
	Two correct from 30, 52.5 and 12.5 implies the first mark and could be used to score up to M2		M1
	Midpoints used in the ranges [2, 3], [7, 8] and [12, 13] must be seen eg 2.5 × 12 and 7 × 7 and 12 (× 1) or 3 × 12 and 7 × 7 and 13 (× 1) NB These could be used to score up to M2		M1
	Correct products seen in the table but a different method shown in the working lines eg 20 ÷ 4 = 5		M0

22(b)	Lower than part (a)	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
23	12×6 or 72	M1	oe area of rectangle
	$\pi \times 6^2$ or 36π or [113, 113.112]	M1	oe may be implied eg $\pi \times 6^2 \div 4$ or 9π or [28.2, 28.3]
	$\pi \times 6^2 \div 2$ or 18π or [56.4, 56.6]	M1dep	oe dep on 2nd M1
	[15.4, 15.5] or $72 - 18\pi$	A1	
	Additional Guidance		
	$72 - 18\pi = 54\pi$		M1M1M1A0
	$\pi \times 6^2 \div 2$ scores 2nd and 3rd M1		
	$12 \times 6 = 72$ $72 \div 2 = 36$ (unless identified as half of rectangle)		(1st) M0
	$\pi \times 6^2$ scores 2nd M1 even if subsequently used incorrectly eg $\pi \times 6^2 = 36\pi$ $36\pi \times 2 = 72\pi$		(2nd) M1
	Ignore units throughout		

Question	Answer	Mark	Comments
24	**Alternative method 1** comparing with 7.5 minutes		
	180 ÷ 135 or 180 ÷ 14 or 79.8 ÷ 14 or 79.8 ÷ 135	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5 or $\frac{79.8 \times 180}{135}$ or 106.4	M1dep	oe or reciprocals
	$\frac{79.8 \times 180}{14 \times 135}$ or 7.6	M1dep	oe eg 79.8 ÷ 10.5 or 106.4 ÷ 14
	No and 7.6 (and 7.5)	A1	oe eg No and 7 minutes 36 seconds (and 7 minutes 30 seconds)
	Alternative method 2 comparing with 79.8 litres		
	135 ÷ 180 or 14 ÷ 180 or 7.5 × 14 or 7.5 ÷ 180	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5 or $\frac{7.5 \times 135}{180}$ or 5.625	M1dep	oe or reciprocals
	$\frac{7.5 \times 135 \times 14}{180}$ or 78.75	M1dep	oe eg 10.5 × 7.5 or 5.625 × 14
	No and 78.75	A1	

Alternative methods and Additional Guidance continued on the next two pages

Question	Answer	Mark	Comments
24 cont	**Alternative method 3** comparing with 14 litres per minute		
	180 ÷ 135 or 180 ÷ 7.5 or 79.8 ÷ 135 or 79.8 ÷ 7.5	M1	oe or reciprocals
	$\frac{7.5 \times 135}{180}$ or 5.625 or $\frac{79.8 \times 180}{135}$ or 106.4	M1dep	oe or reciprocals
	$\frac{79.8 \times 180}{7.5 \times 135}$ or [14.18, 14.19]	M1dep	oe
	No and [14.18, 14.19]	A1	
	Alternative method 4 comparing new rate of flow with rate required		
	135 ÷ 180 or 14 ÷ 180	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5	M1dep	oe
	79.8 ÷ 7.5 or 10.64	M1	oe
	No and 10.5 and 10.64	A1	
	Alternative method 5 comparing with 135 degrees		
	180 ÷ 14 or 180 ÷ 7.5 or 79.8 ÷ 14 or 79.8 ÷ 7.5	M1	oe or reciprocals
	180 ÷ 14 **and** 79.8 ÷ 7.5 or 180 ÷ 7.5 **and** 79.8 ÷ 14	M1dep	oe or matching reciprocals
	$\frac{79.8 \times 180}{7.5 \times 14}$ or 136.8	M1dep	dep on M2
	No and 136.8	A1	

Additional Guidance continued on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
24 cont	No may be implied eg It takes more	
	7.3(0) used for 7.5 may score up to M3	
	$7\frac{1}{2}$ minutes converted to 7.3(0) or 7 minutes 50 seconds	A0
	Ignore incorrect conversion of 7.6 to minutes and seconds if 7.6 seen	
	Use the scheme that awards the most marks and ignore choice	

Question	Answer	Mark	Comments
25	$4x + 5 = 6x - 10$ or $4x + 5 = 10(x - 4)$ or $6x - 10 = 10(x - 4)$	M1	oe eg $4x + 5 + 6x - 10 = 2 \times 10(x - 4)$ condone $10x - 4$ for $10(x - 4)$
	$4x - 6x = -10 - 5$ or $-2x = -15$ or $4x - 10x = -40 - 5$ or $-6x = -45$ or $6x - 10x = -40 + 10$ or $-4x = -30$	M1dep	oe collection of terms eg $4x + 6x - 20x = -80 - 5 + 10$ or $-10x = -75$ condone $10x - 4$ for $10(x - 4)$ eg $4x - 10x = -4 - 5$ or $6x - 10x = -4 + 10$
	$(x =)$ 7.5	A1	oe may be implied by (side length =) 35 or (perimeter =) 105
	(6 × their 7.5 – 10) × 3 or (4 × their 7.5 + 5) × 3 or 10 × (their 7.5 – 4) × 3 or 35 × 3 or 6 × their 7.5 – 10 + 4 × their 7.5 + 5 + 10 × (their 7.5 – 4) or 20 × their 7.5 – 45 or 105	M1dep	oe dep on M1M1 condone $10x - 4$ for $10(x - 4)$ must show working if M1M1A0
	105 and Yes	A1	oe eg 1.05 and Yes
	Additional Guidance		
	$4x + 5 = 6x - 10 = 10(x - 4)$		M1
	Condone $10x - 4$ for $10(x - 4)$ for up to M3		

Question	Answer	Mark	Comments
26	3.041…	M1	condone 3.042
	3.14 – 3.041… = 0.09… or 3.041… + 0.1 = 3.141… or 3.041… and 3.14 – 0.1 = 3.04	A1	oe condone 3.042 for 3.041…
	Additional Guidance		
	Must see calculation for the A mark		
	Do not allow use of a more precise value of π for the A mark		
27	2.85×10^6	B2	B1 correct value not in standard form eg 2 850 000 or 28.5×10^5 or 2.9×10^6
	Additional Guidance		
	Condone different spacing or commas eg 2850000 or 28,50,000	B1	
	$2.85.10^6$	B1	
	2.85×10^6 in working with 2.9×10^6 on answer line	B2	
	2.85×10^6 in working with 3×10^6 on answer line	B2	
	2.9×10^6 in working with 3×10^6 on answer line	B1	
	3×10^6 only	B0	
	2.85×10^6 in working with 2 850 000 on answer line	B1	
	2 850 000 in working with 2 900 000 on answer line	B1	
	2 900 000 only	B0	
	2 850 000 in working with 2.8×10^6 on answer line	B1	
	2.8×10^6 only	B0	