

**GCSE  
MATHEMATICS  
8300/2F**

Foundation Tier Paper 2 Calculator

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Mark scheme

November 2018

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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](http://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.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	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>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between a and b inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14 ...</b>	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
<b>Use of brackets</b>	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		
	<b>Additional Guidance</b>			
2	-0.89	B1		
	<b>Additional Guidance</b>			
3	$14x - 3$	B1		
	<b>Additional Guidance</b>			
4	$225^\circ$	B1		
	<b>Additional Guidance</b>			
5	<b>Alternative method 1</b>			
	$37 \times 0.25$ or 9.25	M1	must be working in £	
	312.65	A1	condone £312.65p	
	<b>Alternative method 2</b>			
	$303.4 \div 37 + 0.25$ or 8.45	M1	must be working in £	
	312.65	A1	condone £312.65p	
	<b>Additional Guidance</b>			
	Working in pence must be recovered eg1 $37 \times 25 = 925$ eg2 $37 \times 25 = 925$ 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

Question	Answer	Mark	Comments
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<b>6(a)</b>	884.79	B1																												
	797.48	B1ft	ft their 884.79 – 87.31																											
	2867.23	B1ft	ft their 797.48 + 2069.75 or their 884.79 + 1982.44																											
	<b>Additional Guidance</b>																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Date</th> <th style="width: 30%;">Description</th> <th style="width: 15%;">Credit(£)</th> <th style="width: 15%;">Debit(£)</th> <th style="width: 25%;">Balance(£)</th> </tr> </thead> <tbody> <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> </tbody> </table>				Date	Description	Credit(£)	Debit(£)	Balance(£)	01/09/18	Starting balance			1140.79	06/09/18	Car repairs		256.00	884.79	17/09/18	Gas bill		87.31	797.48	24/09/18	Salary	2069.75		2867.23	<b>B3</b>
	Date	Description	Credit(£)	Debit(£)	Balance(£)																									
	01/09/18	Starting balance			1140.79																									
	06/09/18	Car repairs		256.00	884.79																									
	17/09/18	Gas bill		87.31	797.48																									
	24/09/18	Salary	2069.75		2867.23																									
	Condone £ signs and/ or p																													
Ignore working in shaded cells																														
Do not accept 2.867.23 for the final value																														
Mark the table but be aware of possible transcription errors from other working																														
Only cell completed is the final one with 2867.23			<b>B0B0B1</b>																											

Question	Answer	Mark	Comments
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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
	<b>Additional Guidance</b>		
	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	
	<b>Additional Guidance</b>		
	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
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7(b)	(4, 4)	B1	
	<b>Additional Guidance</b>		
	(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 <i>AB</i> from any point which extends across at least two horizontal squares
	<b>Additional Guidance</b>		
	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
	<b>Additional Guidance</b>		
	Correct orders start with R		
	Ignore repeated orders for both marks		



Question	Answer	Mark	Comments
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<b>8(b)</b>	<b>Alternative method 1</b>		
	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
	<b>Alternative method 2</b>		
	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
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Additional Guidance							
	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	
<b>8(b) cont</b>	Having 0, 1 or 2 breaks will score a maximum of M1						
	Having 4 breaks may score the special case if evaluated correctly						
	Condone using decimal time for a maximum of M1 (unless recovered) eg1 in alt 2, $0.15 + 0.13 + 0.35 + 1.3 = 2 \text{ h } 33 \text{ min}$ (recovered) eg2 in alt 2, $0.15 + 0.13 + 0.35 + 1.3 (= 1.93)$ eg3 in alt 1, $1.5 + 15 = 1.65$ eg4 in alt 1, $2.26 \text{ pm} + 90 = 3.16 \text{ pm}$ (has added 0.9)					at least M1	max M1
	Condone 16.35pm						
	May work in 24-hour clock throughout						
	Times may just be listed as in the table in the AG but if an error is made they must have shown the amount of time intended to be added eg1 2.09, 2.22, 2.26, 3.02, 3.06, 4.36 (error seen at 3.01, time not shown)					M1M0	
	eg2 2.09, 13 mins, 2.22, 2.26, 35 mins, 3.02, 3.06, 4.36 (error seen at 3.01 but intention to add 35 implied)					M1M1	
	4.35 seen, answer 4 h 35 min					M2A0	

Question	Answer	Mark	Comments
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<b>9(a)</b>	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	
	<b>Additional Guidance</b>			
	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			

<b>9(b)</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
	$\frac{48}{72}$		A1
	$\frac{2}{3}$	A1ft	ft M1A0 with their fraction $< 1$ seen, if it can be simplified and it is fully simplified
	<b>Additional Guidance</b>		
	$\frac{2}{3}$ changed to decimal or percentage		M1A1A0
Do not allow misreads from the table			

Question	Answer	Mark	Comments
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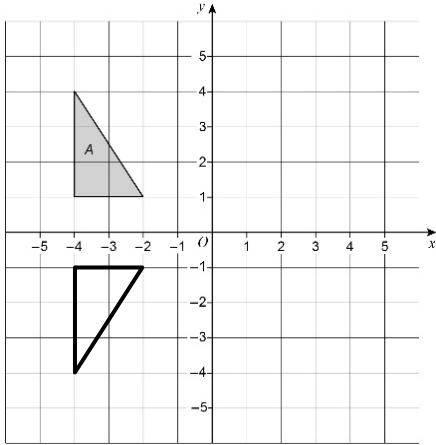
10	× 3	B1	
	<b>Additional Guidance</b>		

11(a)	Correct values and units		B3	B2 two or three correct values (ignore units) B1 one correct value (ignore units) or $9 \div 6$ or 1.5 seen or $6 \div 9$ or $\frac{2}{3}$ seen	
	Flour	180 grams			
	Eggs	3 (eggs)			
	Milk	315 millilitres			
	<b>Additional Guidance</b>				
	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 $2 \div 6 (= 0.3) \times 9 = 2.7$ 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					

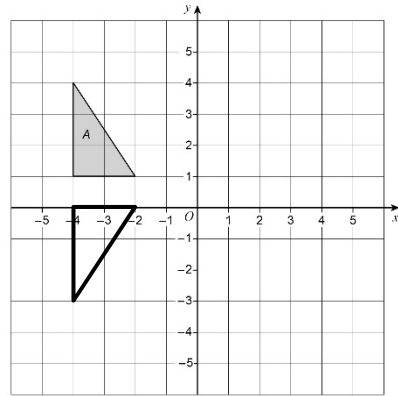
11(b)	$210 \div 28.4$ or 7.39...	M1	
	7.4	A1	
	<b>Additional Guidance</b>		
	Only 7.4 seen		M1A1
	Only 7.3 seen		M0A0
	7.40		A0

Question	Answer	Mark	Comments
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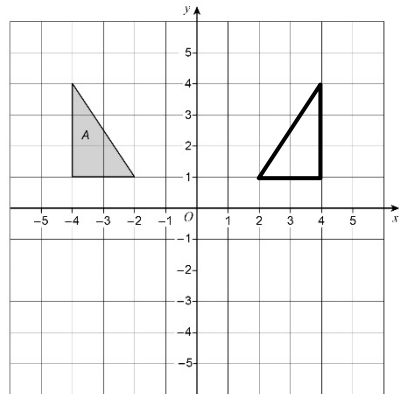


B1 reflection in any horizontal line  
eg



B2

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
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<b>13(a)</b>	<b>Alternative method 1</b>		
	$3000 \div 2$ or 1500	M1	oe
	their $1500 \times 8.6(0)$ or 12 900	M1dep	oe
	their $1500 \div 3$ or 500	M1dep	oe condone $1500 \times 0.3(\dots)$ oe dep on 1st mark
	their $500 \times 8.6(0) \times 0.25$ or 1075	M1dep	oe
	their 12 900 + their 1075	M1dep	dep on 2nd and 4th mark
	13 975	A1	accept 14 000 with working
	<b>Alternative method 2</b>		
	$3000 \div 2$ or 1500	M1	oe
	their $1500 \div 3$ or 500	M1dep	oe condone $1500 \times 0.3(\dots)$ oe
	(their $1500 -$ their $500$ ) $\times 8.6(0)$ or 8600	M1dep	oe
	their $500 \times 8.6(0) \times 1.25$ 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
	<b>Alternative method 3</b>		
	$3000 \div 2$ or 1500	M1	oe
	their $1500 \times 8.6(0)$ or 12 900	M1dep	oe
	their $12\,900 \div 3$ or 12 900 and 4300	M1dep	oe condone $12\,900 \times 0.3(\dots)$ oe
	their $4300 \times 0.25$ 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
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<b>13(a) cont</b>	<b>Additional Guidance</b>		
	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 <b>without</b> 12 900 implies 1st, 3rd and 4th marks in Alt 1		M3
	5375 <b>without</b> 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		M5A0
	£13975.00p		M5A1

Question	Answer	Mark	Comments
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<b>13(b)</b>	Ticks 'It should be higher' with correct reason	B1	eg the 25% will be on a higher amount the government will pay more
	<b>Additional Guidance</b>		
	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
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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 $x = 5$
	<b>Additional Guidance</b>		
	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 ... <b>and</b> 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
	<b>NB</b> (-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 <b>to</b> 5 not -5 to 5		B0

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

Question	Answer	Mark	Comments
16	A and B	B1	
	<b>Additional Guidance</b>		
17	Pi or $\pi$	B1	accept a value in range [3.14, 3.142]
	<b>Additional Guidance</b>		
	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	
	<b>Additional Guidance</b>		
	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 $240 \div 31 = 7.7\dots$ and answer 8		B0

Question	Answer	Mark	Comments
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18(b)	<b>Alternative method 1</b>		
	$[28, 31] \times 10$ or $[280, 310]$	M1	appropriate days in 10-month year
	their $[280, 310] \times 25$ or $[7000, 7750]$ or their $[280, 310] \times 240$ or $[67\,200, 74\,400]$	M1dep	litres per year per cow  milkings per year for 240 cows
	their $[7000, 7750] \times 240$ or their $[67\,200, 74\,400] \times 25$	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
	<b>Alternative method 2</b>		
	$25 \times 240$ or 6000	M1	litres per day for 240 cows may be seen embedded in a <b>product</b> eg $25 \times 10 \times 240$
	their $6000 \times [28, 31]$ or $[168\,000, 186\,000]$ or $25 \times 240$ or 6000 <b>and</b> $[28, 31] \times 10$ or $[280, 310]$	M1dep	litres per month for 240 cows  litres per day for 240 cows <b>and</b> appropriate days in 10-month year
	their $[168\,000, 186\,000] \times 10$ or $25 \times 240 \times [28, 31] \times 10$ or their $6000 \times$ 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
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<b>18(b) cont</b>	<b>Alternative method 3</b>		
	[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
	<b>Alternative method 4</b>		
	[28, 31] × 240 or [6720, 7440]	M1	milking 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	milking 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
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<b>Additional Guidance</b>			
<b>18b cont</b>	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 <b>consistent</b> use of approximations to 1 sf throughout (this leads to an answer in the given range) ie $30 \times 10 \times 30 \times 200 = 1\,800\,000$		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: $28 \times 10 \times 25 \times 240 = 1\,680\,000$ 300 days: $30 \times 10 \times 25 \times 240 = 1\,800\,000$ 310 days: $31 \times 10 \times 25 \times 240 = 1\,860\,000$ 303 days: $303 \times 25 \times 240 = 1\,818\,000$ 304 days: $304 \times 25 \times 240 = 1\,824\,000$ 305 days: $305 \times 25 \times 240 = 1\,830\,000$		M3A1
	eg 12 months of 28 days: $28 \times 12 \times 25 \times 240 = 2\,016\,000$ 12 months of 30 days: $30 \times 12 \times 25 \times 240 = 2\,160\,000$ 12 months of 31 days: $31 \times 12 \times 25 \times 240 = 2\,232\,000$ 365 days: $365 \times 25 \times 240 = 2\,190\,000$ 366 days: $366 \times 25 \times 240 = 2\,196\,000$		SC2

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

Question	Answer	Mark	Comments
<b>20</b>	<b>Alternative method 1</b>		
	$35x + 6x = ax$ 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 $a = 41, b = \frac{5}{3}$
	<b>Alternative method 2</b>		
	$35x + 40 + 6x + 3b$ or $41x + 40 + 3b$	M1	
	$35x + 6x = ax$ or $35 + 6 = a$ <b>and</b> $40 + 3b = 13$	M1dep	oe eg $41x = ax$ and $3b = -27$
	$a = 41$	A1	implies first M1 only
	$b = -9$	A1	SC3 $a = 41, b = -27$ or $a = 41, b = \frac{5}{3}$
	<b>Additional Guidance</b>		
	$a = 41$ 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	
	<b>Additional Guidance</b>		
22(a)	$2.5 \times 12$ or 30 and $7.5 \times 7$ or 52.5 and $12.5 (\times 1)$ or 95	M1	allow one incorrect midpoint or $[2, 3] \times 12$ and $[7, 8] \times 7$ and $[12, 13] (\times 1)$  ignore $t \geq 15$ row
	$\frac{\text{their } 30 + \text{their } 52.5 + \text{their } 12.5}{12 + 7 + 1}$ or $95 \div 20$	M1dep	$t \geq 15$ product must be 0 if seen condone bracket error seen eg $30 + 52.5 + 12.5 \div 20$
	4.75	A1	accept 4.8 or 5 if full working shown using <b>correct</b> midpoints
	<b>Additional Guidance</b>		
	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 $2.5 \times 12$ and $7 \times 7$ and $12 (\times 1)$ or $3 \times 12$ and $7 \times 7$ and $13 (\times 1)$ 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 $20 \div 4 = 5$		M0
22(b)	Lower than part (a)	B1	
	<b>Additional Guidance</b>		

Question	Answer	Mark	Comments	
23	$12 \times 6$ or 72	M1	oe area of rectangle	
	$\pi \times 6^2$ or $36\pi$ or [113, 113.112]	M1	oe may be implied eg $\pi \times 6^2 \div 4$ or $9\pi$ or [28.2, 28.3]	
	$\pi \times 6^2 \div 2$ or $18\pi$ or [56.4, 56.6]	M1dep	oe dep on 2nd M1	
	[15.4, 15.5] or $72 - 18\pi$	A1		
	<b>Additional Guidance</b>			
	$72 - 18\pi = 54\pi$		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
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<b>24</b>	<b>Alternative method 1</b> 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)
	<b>Alternative method 2</b> 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
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<b>24 cont</b>	<b>Alternative method 3</b> 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	
	<b>Alternative method 4</b> 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	
	<b>Alternative method 5</b> 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 <b>and</b> 79.8 ÷ 7.5 or 180 ÷ 7.5 <b>and</b> 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
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24 cont	Additional Guidance		
	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
	$(6 \times \text{their } 7.5 - 10) \times 3$ or $(4 \times \text{their } 7.5 + 5) \times 3$ or $10 \times (\text{their } 7.5 - 4) \times 3$ or $35 \times 3$ or $6 \times \text{their } 7.5 - 10 + 4 \times \text{their } 7.5 + 5$ $+ 10 \times (\text{their } 7.5 - 4)$ or $20 \times \text{their } 7.5 - 45$ 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
	<b>Additional Guidance</b>		
	$4x + 5 = 6x - 10 = 10(x - 4)$		M1
	Condone $10x - 4$ for $10(x - 4)$ for up to M3		

Question	Answer	Mark	Comments
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<b>26</b>	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...
	<b>Additional Guidance</b>		
	Must see calculation for the A mark		
	Do not allow use of a more precise value of $\pi$ for the A mark		

<b>27</b>	$2.85 \times 10^6$	B2	B1 correct value not in standard form eg 2 850 000 or $28.5 \times 10^5$ or $2.9 \times 10^6$
	<b>Additional Guidance</b>		
	Condone different spacing or commas eg 2850000 or 28,50,000		B1
	$2.85.10^6$		B1
	$2.85 \times 10^6$ in working with $2.9 \times 10^6$ on answer line		B2
	$2.85 \times 10^6$ in working with $3 \times 10^6$ on answer line		B2
	$2.9 \times 10^6$ in working with $3 \times 10^6$ on answer line		B1
	$3 \times 10^6$ only		B0
	$2.85 \times 10^6$ 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 $2.8 \times 10^6$ on answer line		B1
	$2.8 \times 10^6$ only		B0