



# **GCSE MARKING SCHEME**

**SUMMER 2019** 

MATHEMATICS – COMPONENT 2 (HIGHER TIER) C300UB0-1

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#### INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

### **GCSE MATHEMATICS**

### **COMPONENT 2 – HIGHER TIER**

## SUMMER 2019 MARK SCHEME

	Mark	Comment
1*. 13 × 6 – 17 <sup>3</sup> or 26 × 3 – 17 <sup>3</sup> or 39 × 2 – 17 <sup>3</sup>	B1	
1.34 × 232 0.82 × 4530	B1 B1	Do not accept 134% × 232
-4835 and 310.88 and 3714.6	B1	CAO. Independent mark <u>Misreads</u> : e.g. 5×13 – 17 <sup>3</sup> = -4848 is B0, but FT as misread for possible final B1
2*(a)(i) Mid points: 15, 25, 35, 45	(4) B1	
$15 \times 5 + 25 \times 20 + 35 \times 23 + 45 \times 52$ (= 75 + 500 + 805 + 2340 = 3720)	M1	FT provided 'their midpoints' within the 'bounds' inclusive
÷100 37(.2mm)	m1 A1	Unsupported 37.2, award all 4 marks
$2^{*}(a)(ii) 40 \le x < 50$	B1	Accept any unambiguous indication
2(b) Explanation such as: 'the mean doesn't tell you about the spread of the data', 'all the depths could be very close to 37.2 mm (whilst Marie's table shows her display is spread out)'	E1	Do not accept indication of 'Yes' or an explanation implying 'Yes' Do not accept contradictions Allow if range of Marie's display is used, with lower and upper values considered at 10 mm and 50 mm, or within 1 <sup>st</sup> and last groups Do not accept arguments based on shapes or styles of frames, reasoning and validity of argument must be based only on the depth of lens
3*. sin f = 8.4/12.3 (f =) 43(.07°)	M1 A2 (3)	A1 for (f =) sin <sup>-1</sup> 0.68(29)

$4^*(a) 2500 \times 0.84^n$ with any value of n from n=1 to n=10 or equivalentM1 $(2500 \times 0.84 = \pounds 2100)$ $(2500 \times 0.84^2 = \pounds 1764)$ $(2500 \times 0.84^3 = \pounds 1481.76)$ $(2500 \times 0.84^3 = \pounds 1244.6784)$ $(2500 \times 0.84^5 = \pounds 1045.529)$ $(2500 \times 0.84^6 = \pounds 878.245)$ $(2500 \times 0.84^8 = \pounds 619.689)$ $(2500 \times 0.84^9 = \pounds 520.539)$ $(2500 \times 0.84^{10} = \pounds 437.253)$ 6 (years)A1CAO If no working, award SC2 for an answer of 6 (years)	
$ \begin{array}{c c} 2500 \times 0.84^{n} \text{ with a second value of n} \\ \text{from n=1 to n=10 or n = 6 or equivalent} \\ \text{leading to an answer closer to £1000 than} \\ \text{the previous trial} \end{array} \begin{array}{c} \text{m1} & (2500 \times 0.84^{3} = \pounds1481.76) \\ (2500 \times 0.84^{4} = \pounds1244.6784) \\ (2500 \times 0.84^{5} = \pounds1045.529) \\ (2500 \times 0.84^{6} = \pounds878.245) \\ (2500 \times 0.84^{7} = \pounds737.725) \\ (2500 \times 0.84^{8} = \pounds619.689) \\ (2500 \times 0.84^{9} = \pounds520.539) \\ (2500 \times 0.84^{10} = \pounds437.253) \end{array} $	
$ \begin{array}{c c} 2500 \times 0.84^{n} \text{ with a second value of n} \\ \text{from n=1 to n=10 or n = 6 or equivalent} \\ \text{leading to an answer closer to £1000 than} \\ \text{the previous trial} \end{array} \begin{array}{c c} m1 & (2500 \times 0.84^{4} = \pounds 1244.6784) \\ (2500 \times 0.84^{5} = \pounds 1045.529) \\ (2500 \times 0.84^{6} = \pounds 878.245) \\ (2500 \times 0.84^{7} = \pounds 737.725) \\ (2500 \times 0.84^{8} = \pounds 619.689) \\ (2500 \times 0.84^{9} = \pounds 520.539) \\ (2500 \times 0.84^{10} = \pounds 437.253) \end{array} $	
from n=1 to n=10 or n = 6 or equivalent leading to an answer closer to £1000 than the previous trial $(2500 \times 0.84^5 = £1045.529)$ $(2500 \times 0.84^6 = £878.245)$ $(2500 \times 0.84^7 = £737.725)$ $(2500 \times 0.84^8 = £619.689)$ $(2500 \times 0.84^9 = £520.539)$ $(2500 \times 0.84^{10} = £437.253)$ 6 (years)A1	
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$(2500 \times 0.84^9 = \text{\pounds}520.539)$ $(2500 \times 0.84^{10} = \text{\pounds}437.253)$ $6 \text{ (years)}$ $A1  CAO$	
(2500 × 0.84 <sup>10</sup> = £437.253) 6 (years) A1 CAO	
6 (years) A1 CAO	
in the working, award SC2 for an answer of 6 (years	1
	)
4(b) 500 × (1 + 325/100) <sup>3</sup> M2 M1 for 500 × (1 + 325/100) (= £2125) or equivalent	
$\begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 $	
	h <b></b> ≁0
a×1625 + b×500, or 5375, or 6375, where a≠0 and	U≠U
(£) 38 382.81(25) A1 Accept (£)38382 or 38383	
If no marks, award SC1 for sight of $(325/100)^3$ or	
equivalent or sight of 17164.0625 (= 3.25 <sup>3</sup> ×500)	
(6)	
5*(a) $3x^2 + 18xy + 5xy + 30y^2$ B2 B1 for any 2 terms correct	
$3x^2 + 23xy + 30y^2$ B1 FT for equivalent level of difficulty, providing at least	st 3
terms to consider and like terms to collect	
$5^*(b) (x - 9)(x - 4)$ B2       B1 for $(x \dots 9)(x \dots 4)$	
$[5^{*}(a)(u_{1}+0)(u_{2}-0) = 0]$	
$\begin{bmatrix} 5^{*}(c) (w + 9)(w - 2) = 0 \\ w = -9 \text{ with } w = 2 \end{bmatrix}$ $\begin{bmatrix} B2 \\ B1 \text{ for } (w \dots 9)(w \dots 2) \\ B1 \end{bmatrix}$ $\begin{bmatrix} STRICT FT \text{ from 'their pair of brackets'} \end{bmatrix}$	
$(w=) \{-7 \pm \sqrt{(7^2 - 4 \times 1 \times -18)}\}/2$ M1	
$(=) (-7 \pm \sqrt{121})/2$ A1	
$w = -9 \text{ with } w = 2 \qquad A1$	
Account twice Q impartment months of such as if hoth and	
Accept trial & improvement method only if both solu	ltions
are found correctly for B3	
5(d) (y – 11)(y + 11) B1	
5(e) c = 16 B1	
$0 = (-2)^2 + b \times -2 + c$ M1 Allow $-2^2 + b \times -2 + c$	
	Inloss
	mess -
$2^2$ seen or implied later as 4	
$b = 10 \qquad A1 $	
(13)	
$6^{*}$ . (First distance) $45 \times 40 \div 60$ M1 (30 miles)	
$(Second distance) 60 \times 25 \div 60 \qquad M1 \qquad (25 miles)$	
(Total distance)55 (miles)A1CAO. May be implied in further working	
	- 1 141 · · · ·
(Overall average speed) 55 ÷ (65/60) m1 FT 'their 55' depends on M1 previously awarded ar	id 'their
or equivalent in stages total distance' is the sum of two derived distances	
50.7(69mph) or 50.8(mph) or 51(mph) A1	
If no marks, award SC2 for an answer of 50.7(69	) from
(45×40 + 25×60)/(40 + 25) or equivalent	
(5)	

T(a) (Volume sphere) $4/3 \times \pi \times 2.7^3$ M1(= 82.4 cm <sup>3</sup> )(Volume of cuboid) 14.2 × height = $4/3 \times \pi \times 2.7^3$ M1FT for 'their volume of sphere'Height = $4/3 \times \pi \times 2.7^3$ + 14.2M1FT for 'their volume of sphere'Answer in the range5.8 to 5.81 (cm')A1CAO7(b) 86 = $\pi \times$ Diameter, or 86 = $2 \times \pi \times$ RadiusM1CAODiameter = 86 + $\pi$ or Radius = 86 + $2\pi$ M1CIameter = 27.37 to 27.4 cm) (Radius = 13.68 to 13.7 cm)Perimeter semi-cicle86 + $2 + 2$ biameter, or 86 + $2 + 2$ biameter, or 86 + $2 + 2 \times$ RadiusM187.7a + 2g = 6(.)15 AND 5a + 8g = 9(.)19B188.Both equations are required for the award of B1M1(9)8*.7a + 2g = 6(.)15 AND 5a + 8g = 9(.)19M1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 arrableFirst variableA1 $e(p)$ $e(p)$ ( $g)$ 8(-) $e(p)$ ( $g)$ 9(a) 86 AND 140B19(b) $e(p)$ ( $g)$ 9(a) 86 AND 140B19(b) $e(p)$ ( $g)$ 9(c) 320 Relvin to Celsus ( $g)$ 9(c) 320 Relvin to Celsus ( $g)$ 9(a) 86 AND 1409(b)9(c) 320 Relvin to Celsus ( $g)$ 9(a) 86 AND 1409(b)9(c) 320 Relvin to Celsus ( $g)$ 9(a) 86 AND 1409(b)9(c) 320 Relvin to Celsus ( $g)$ 9(a) 86 AND 1409(b)9(c) 320 Relvin to Celsus ( $g)$ <			
14.2 × height = $4/3 \times \pi \times 2.7^3 + 14.2$ M1FT for 'their volume of sphere'Height = $4/3 \times \pi \times 2.7^3 + 14.2$ m1FT for 'their volume of sphere'Answer in the range5.8 to 5.81 (cm) <sup>3</sup> )A1CAO7(b) 86 = $\pi \times Diameter,$ or 86 = $2 \times \pi \times Radius$ M1CAODiameter = 86 + $\pi$ or Radius = 86 + $2\pi$ Perimeter semi-circle 86 + $2 + 2$ kadiusM1(Diameter = 27.37 to 27.4 cm) (Radius = 13.68 to 13.7 cm)Perimeter semi-circle 86 + $2 + 2$ kadiusM1Their derived $2 \times radius', independent of previous marks70.4 (cm) or 704 mmA2CAO. For A2 if units are given they must be correctA1 for a correct anxer given to the wrong level ofaccuracy (70.37 to 70.39 or 70(cm)).8*.70.4 (cm) or 704 mmA2Muthod to find second variable, e.g. equalcoefficients andmethod to find second variableM1First variableA1FT provided at least one equation is correct and the otheris of equivalent dificulty.Allow 1 error in one term, not one with equal coefficients9(b)E1CAO, not FT9(a) 86 AND 140B19(b)E29(a) 20 kelvin to Celsius: working with100 difference in both kelvin and Celsus46.85 (degrees Celsius)A146.85 (degrees Celsius)A146.85 (degrees Celsius)A141.12 (CAO, independent of all other marksLook for evidence in the tableAnswer for Fahrenheit between 104 and122 exclusiveB1CAO, independent of all other marksLook for evidence in the tableAnswer for Fahrenheit between 104 and122 exclusive$	7(a) (Volume sphere) 4/3 × π × 2.7 <sup>3</sup> (Volume of cuboid)	M1	(≈ 82.4 cm <sup>3</sup> )
Answer in the range5.8 to 5.81 (cm3)A1CAO7(b) 86 = $\pi \times \text{Diameter,} \\ 07 86 = 2 \times \pi \times \text{Radius}$ M1Diameter = 86 + $\pi$ or Radius = 86 + 2 $\pi$ M1Diameter = 86 + $\pi$ or Radius = 86 + 2 $\pi$ M186 + 2 + Diameter, or86 + 2 + 2 × Radius70.4 (cm) or 704 mmA287. 7a + 2g = 6(.)15A1AND 5a + 8g = 9(.)19B186 + 2 + 1aimeter, or8087. 7a + 2g = 6(.)15B1AND 5a + 8g = 9(.)19B1Method to eliminate variable, e.g. equal coefficients and method to find second variableM1First variableA169.CAO, not FT9(a) 86 AND 140B19(b)(£)4.999(b)(£)4.999(c) 320 kelvin to CelsiusM19(c) 320 kelvin to Celsius46.85 (degrees Celsius)A1CAO, not FT9(a) 86 AND 1409(b)9(c) 320 kelvin to Celsius46.85 (degrees Celsius)A147. 72.1510116 (.33 Fahrenheit)116 (.33 Fahrenheit)A1A2A3A4A4A5A5A6A6A7A7A7A7A7B4B4B4B4B4B4B4B5B5B6B6B7B7B8<		M1	FT for 'their volume of sphere'
T(b) 86 = m × Diameter, or 86 = 2 × m × RadiusM1Diameter = 86 + m or Radius = 86 + 2m Perimeter semi-circle 86 + 2 + Diameter, or 	Height = $4/3 \times \pi \times 2.7^3 \div 14.2$	m1	FT for 'their volume of sphere'
or 86 = 2 × $\pi$ × Radiusm1(Diameter = 86 + $\pi$ or Radius = 86 + $2\pi$ Perimeter semi-circle 86 + 2 + Diameter, or 86 + 2 + 2 × Radius 	Answer in the range 5.8 to 5.81 (cm <sup>3</sup> )	A1	CAO
Perimeter semi-circle $86 + 2 + 1$ lameter, or $86 + 2 + 2 \times Radius$ $70.4 (cm) or 704 mm$ M1 A2 A2 (P)FT 'their derived 2 $\times$ radius, independent of previous marks (A2 CAO. For A2 if units are given they must be correct A1 for a correct answer given to the wrong level of accuracy (70.37 to 70.39 or 70(cm)). $8^*$ . $7a + 2g = 6(.)15$ AND $5a + 8g = 9(.)19$ B1Both equations are required for the award of B1Method to eliminate variable, e.g. equal coefficients and method to find second variableM1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1a = 67(p) or a = (£ 0).67 or g = 73(p) or g = (£ 0).73Second variableA1FT their first variable provided M1 previously awarded (£)4.999(b)(£)4.99B1 (CAO, not FT9(a) 86 AND 140B19(b)273.15 (200)-73.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1 e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(a) 36 (degrees Celsius)A1 (Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1 (16.33 Fahrenheit)A1 A1CAO, independent of 18 e.g. 7 tenths of 18 FT 'their derived 46.85 'C' provided M1 previously awardedA12 (10)116(.33 Fahrenheit)A13 (116, 23 Fahrenheit)A14 (A14		M1	
$\begin{array}{c} 86 + 2 + Diameter, or \\ 86 + 2 + 2 \times Radius \\ 70.4 (cm) or 704 mm \\ \hline Rel \\ R$	Diameter = 86 $\div \pi$ or Radius = 86 $\div 2\pi$	m1	
70.4 (cm) or 704 mmA2CAO. For A2 if units are given they must be correct A1 for a correct answer given to the wrong level of accuracy (70.37 to 70.38 or 70(cm)). $8^*$ $7a + 2g = 6(.)15$ AND $5a + 8g = 9(.)19$ B1Both equations are required for the award of B1Method to eliminate variable, e.g. equal coefficients and method to find second variableM1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1 $a = 67(p)$ or $a = (£ 0).67$ or $g = 73(p)$ or $g = (£ 0).73$ Second variableA1FT their first variable provided M1 previously awarded(E)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1B19(b)B2B1 for 1 correct entry or for all 3 negative entries with correct differences9(c) 320 kelvin to CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 320 kelvin to CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.1546.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 469, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1CAO, independent of all other marks Look for evidence in the tableSuitable calculation, e.g. • 104 + (6.85/10)×18m1FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT their derived 46.85 °C' provided M1 previously awarded• 122 - (10 - 6.85) ×18 10 116(.33 Fahrenheit)A1A1Accept 116 (Fahrenheit)) form correct working </td <td>86 ÷ 2 + Diameter, or</td> <td>M1</td> <td></td>	86 ÷ 2 + Diameter, or	M1	
At for a correct answer given to the wrong level of accuracy (70.37 to 70.39 or 70(cm)). $8^*$ . $7a + 2g = 6(.)15$ AND $5a + 8g = 9(.)19$ B1Both equations are required for the award of B1Method to eliminate variable, e.g. equal coefficients and method to find second variableM1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1a = 67(p) or a = (£ 0).67 or g = 73(p) or g = (£ 0).73Second variableA1FT their first variable provided M1 previously awarded(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1CAO, not FT9(b)B2B1 for 1 correct entry or for all 3 negative entries with correct differences9(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.1546.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1CAO, independent of all other marks Look for evidence in the tableSuitable calculation, e.g. 104 + (6.85/10)×18m1FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT their derived 46.85 °C' provided M1 previously awarded122 - (10 - 6.85) × 18 10 116(.33 Fahrenheit)A1Accept 116 (Fahrenheit)) from correct working		A2	'their derived 2 × radius', independent of previous marks
$8^*$ $7a + 2g = 6(.)15$ AND $5a + 8g = 9(.)19$ B1Both equations are required for the award of B1Method to eliminate variable, e.g. equal coefficients and method to find second variableM1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1 $a = 67(p)$ or $a = (£ 0).67$ or $g = 73(p)$ or $g = (£ 0).73$ Second variableA1FT their first variable provided M1 previously awarded(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1CAO, not FT9(b)0-273.159(c) 0-273.159(c) 200 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.1546.85 (degrees Celsius)A1Answer for Fahrenheit between 104 and 122 exclusiveB1Suitable calculation, e.g. 104 + (6.85/10)×18M1e. 102 - (10 - 6.85) ×18 10 116(.33 Fahrenheit)A1A1Arcept 116 (Fahrenheit)) from correct working			A1 for a correct answer given to the wrong level of
AND $5a + 8g = 9(19)$ Method to eliminate variable, e.g. equal coefficients and method to find second variableM1FT provided at least one equation is correct and the other is of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1 $a = 67(p) \text{ or } a = (\pounds 0).67$ or $g = 73(p) \text{ or } g = (\pounds 0).73$ Second variableA1FT their first variable provided M1 previously awarded(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1CAO, not FT9(b)(100) -173.15 (200) -73.15B29(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM146.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1CAO, independent of all other marks Look for evidence in the tableSuitable calculation, e.g. • 104 + (6.85/10)×18M1FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT frier ir derived 46.85 "C" provided M1 previously awarded• $122 - (10 - 6.85) \times 18$ $10$ A1Accept 116 (Fahrenheit)) from correct working		(9)	
coefficients and method to find second variableis of equivalent difficulty. Allow 1 error in one term, not one with equal coefficientsFirst variableA1 $a = 67(p)$ or $a = (\pounds 0).67$ or $g = 73(p)$ or $g = (\pounds 0).73$ Second variableA1FT their first variable provided M1 previously awarded(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1E9(b)B1 (100)-173.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 22 celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1Suitable calculation, e.g. • 104 + (6.85/10)×18M1e.g. 7 tenths of 18 FT 'their derived 46.85 'C' provided M1 previously awarded• 122 - (10 - 6.85) ×18 10 116(.33 Fahrenheit)A1Accept 116 (Fahrenheit)) from correct working	0 ()	B1	Both equations are required for the award of B1
First variableA1 $a = 67(p) \text{ or } a = (\pounds 0.67 \text{ or } g = 73(p) \text{ or } g = (\pounds 0.73)$ Second variableA1FT their first variable provided M1 previously awarded(\pounds)4.99B1CAO, not FT9(a) 86 AND 140B19(b)B1 $(100)$ -273.15 $(100)$ -73.15 $(200)$ -73.15 $(200)$ -73.15 $(200)$ -73.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and Celsius46.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1Suitable calculation, e.g. • 104 + (6.85/10)×18M1FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT 'their derived 46.85 °C' provided M1 previously awarded $122 - (10 - 6.85) \times 18$ 10 116(.33 Fahrenheit)A1Accept 116 (Fahrenheit)) from correct working	coefficients and	M1	is of equivalent difficulty.
Second variableA1FT their first variable provided M1 previously awarded(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B1CAO, not FT9(b)B1 (0)-273.15 (100)B29(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.1546.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1CAO, independent of all other marks Look for evidence in the tableSuitable calculation, e.g. • 104 + (6.85/10)×18 • 122 - (10 - 6.85) ×18 10 • 116(.33 Fahrenheit)M1FT from rounding or truncation of 46.85 °C' provided M1 previously awardedA1Accept 116 (Fahrenheit)) from correct working	method to find second variable		Allow 1 error in one term, not one with equal coefficients
(£)4.99B1 (5)CAO, not FT9(a) 86 AND 140B19(b)B1 $(0)$ -273.15 $(100)$ -173.15 $(200)$ -73.159(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.159(c) 320 kelvin to Celsius: 100 difference in both kelvin and CelsiusM146.85 (degrees Celsius)A1Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1Suitable calculation, e.g. • $104 + (6.85/10) \times 18$ M1FT from rounding or truncation of 46.85 (Celsius) • $g. 7$ tenths of 18 FT 'their derived 46.85 °C' provided M1 previously awardedawardedA1	First variable	A1	
(5) $9(a) 86 \text{ AND } 140$ B1 $9(b)$ B1 $(0)$ $-273.15$ $(100)$ $-173.15$ $(200)$ $-73.15$ $9(c) 320 \text{ kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1e.g. \text{ sight of } 20 + 26.85, 126.85 - 80, 320-273.1546.85 \text{ (degrees Celsius)}A1Look for response in the table Accept 46.8, 46.9, 47Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1Suitable calculation, e.g.M1104 + (6.85/10) \times 18M1122 - (10 - 6.85) \times 1810A1Answer for Tahrenheit)A1Answer for Tahrenheit)A1Accept 116 (Fahrenheit)) from correct working$	Second variable	A1	FT their first variable provided M1 previously awarded
$9(a) 86 \text{ AND } 140$ B1 $9(b)$ B1 $(0)$ -273.15 $(100)$ -173.15 $(200)$ -73.15 $9(c) 320$ kelvin to Celsius: working with 100 difference in both kelvin and CelsiusM1 $e.g.$ sight of $20 + 26.85$ , $126.85 - 80$ , $320-273.15$ $46.85$ (degrees Celsius)M1 $46.85$ (degrees Celsius)A1Look for response in the table Accept $46.8, 46.9, 47$ Look for evidence in the tableAnswer for Fahrenheit between 104 and $122$ exclusiveB1Suitable calculation, e.g.M1 $104 + (6.85/10) \times 18$ M1 $122 - (10 - 6.85) \times 18$ $10$ A1A1Accept $116$ (Fahrenheit)) from correct working	(£)4.99		CAO, not FT
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	9(a) 86 AND 140		
9(c) 320 kelvin to Celsius: working with 100 difference in both kelvin and Celsius       M1       e.g. sight of 20 + 26.85, 126.85 - 80, 320-273.15         46.85 (degrees Celsius)       A1       Look for response in the table Accept 46.8, 46.9, 47 Look for evidence in the table         Answer for Fahrenheit between 104 and 122 exclusive       B1       CAO, independent of all other marks Look for evidence in the table         Suitable calculation, e.g.       m1       FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT 'their derived 46.85 °C' provided M1 previously awarded         • 122 - (10 - 6.85) ×18 10 116(.33 Fahrenheit)       A1	(0) -273.15 (100) -173.15	B2	
Accept 46.8, 46.9, 47 Look for evidence in the tableAnswer for Fahrenheit between 104 and 122 exclusiveB1CAO, independent of all other marks Look for evidence in the tableSuitable calculation, e.g. • $104 + (6.85/10) \times 18$ m1FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT 'their derived 46.85 °C' provided M1 previously awarded• $122 - (10 - 6.85) \times 18$ 10 116(.33 Fahrenheit)A1Accept 116 (Fahrenheit)) from correct working	9(c) 320 kelvin to Celsius: working with	M1	e.g. sight of 20 + 26.85, 126.85 – 80, 320-273.15
122 exclusiveLook for evidence in the tableSuitable calculation, e.g.m1 $104 + (6.85/10) \times 18$ FT from rounding or truncation of 46.85 (Celsius) e.g. 7 tenths of 18 FT 'their derived 46.85 °C' provided M1 previously awarded $122 - (10 - 6.85) \times 18$ 10 116(.33 Fahrenheit)A1Accept 116 (Fahrenheit)) from correct working	46.85 (degrees Celsius)	A1	Accept 46.8, 46.9, 47
• $104 + (6.85/10) \times 18$ • $122 - (10 - 6.85) \times 18$ 10 116(.33 Fahrenheit) A1 Accept 116 (Fahrenheit)) from correct working		B1	
<ul> <li>122 – (<u>10 – 6.85</u>) ×18 10 116(.33 Fahrenheit) A1 Accept 116 (Fahrenheit)) from correct working</li> </ul>	-	m1	e.g. 7 tenths of 18 FT 'their derived 46.85 °C' provided M1 previously
116(.33 Fahrenheit) A1 Accept 116 (Fahrenheit)) from correct working			awarded
	-	A1	Accept 116 (Fahrenheit)) from correct working
		(8)	

10(a) y α 1/x OR y = k/x 124.5 = k/18 or k = 2241 y = 2241/x	B1 M1 A1	Allow y $\alpha$ k/x FT non linear only May be seen in part (b), must be sight of y = 2241/x, not for the implied use of this Do not accept y $\alpha$ 2241/x
10(b) x 1⁄2 18 24.9 y 4482 2241 90	B2 (5)	FT their non linear expression B1 for each value Allow 24.9 given as 25 provided k = 2241 seen in (a) or (b)
11. 100g = 0.22 pounds or 1 pound = (1 ÷ 2.2 =) 0.4545kg	B1	May be embedded in working
<sup>1</sup> ⁄ <sub>2</sub> pound or 8 ounces ≈ (100 ÷ 0.22) × 0.5 (g) or (1 ÷ 2.2) ÷ 2 (kg)	M1	Or equivalent Award of M1 implies award of B1 previously
227(.2727 g) or 0.227(27 kg)	A1	
(£) 227(.2727) × 11 ÷ 100 or (£) 0.227(27) × 11 × 1000 ÷ 100	M1	FT use of 'their 227(.2727)' provided at least 1 mark previously awarded
Answer in the range (£)24.97 to (£)25.00	A1	FT for a similar range from rounding or truncation to a whole number If final M0, A0 due to 200g or 300g considered following otherwise correct working, award SC1 for answers of £22 or £33 respectively
		Alternative 1:       (For) £11 gets 0.22 lbs (of steak)       B1         (Which is) 16 × 0.22       M1 $= 3.52 \text{ oz}$ A1         (may be embedded)         (8 oz costs) 8 × 11 ÷ 3.52       M1 (FT16 × 0.22) $= (\pounds)25$ A1
	(5)	Alternative 2:B1 $(For) \ \pounds 110 \ gets \ 2.2 \ lbs \ (of \ steak)$ B1 $110 \ \div \ 2.2$ M1 $= (\pounds) 50 \ (per \ lb)$ A1 $(8 \ ounces \ costs)$ $50 \ \div \ 2$ M1 $= (\pounds) \ 25$ A1
12. x+ x + 40+ 2x - 30 +3x – 120+ 3x	B1	3(x - 40) = 3x - 120 may be seen in later working
(Interior angle sum) 3 × 180(°) or alternative FULL method 540(°)	M1 A1	
10x -110 = 540 or 10x = 540 + 110	M1	FT 'their 10x – 110' = n where n ≥ 360
or 10x = 650 x = 65(°)	A1	CAO
(65(°), 105(°), 100(°), 75(°),) <b>195</b> (°) (so this angle is greater than 180°)	E1	FT provided similar outcome
13. n <sup>2</sup> - 8	(6) B2	Award B1 for (1)n <sup>2</sup> $\pm$ 'any number', provided this number
	(2)	$\neq 0$ If no marks, award SC1 for n <sup>2</sup> – 8n

14(a) Method to find the rate, e.g.	M1	
7.5 cm per hour, or 1.25 cm per 10		
minutes		
0.125 (cm/min)	A1	
14(b)(i) 20 (cm) or 200 (mm)	B1	CAO. If units are given they must be correct
14(b)(ii) Statement, e.g.	E1	
'container might overflow',		
'may not continue at the same rate',		
'cross section of the container might		
change'		
change	(4)	
15*(a) (Mass =) 2.4 × 13.4	( <del>4</del> ) M1	
32.16 (g)	A1	CAO, accept 32.2(g) from correct working
52.10 (g)	AI	CAO, accept 52.2(g) from correct working
15(h) (D =) 125 + 0.26	M2	or equivalent full method which may be seen in stages
$15(b) (P =) 135 \div 0.36$	IVIZ	
or (135 ÷ 3600) × 100 <sup>2</sup>		M1 for 135 ÷ 3600 or 135 ÷ 'digits 36 with incorrect place
		value'
375 (N/m²)	A1	CAO
	(5)	
16(a) Area of sector $\frac{42}{100} \times \pi \times 3.6^2$	M1	
360	• •	
Answer in range 4.748 (m <sup>2</sup> ) to 4.75 (m <sup>2</sup> )	A1	May be implied later
	•••	
(Area ACD) ½× 3.6 × 4.1 ×sin 67(°)	M1	
6.79(m <sup>2</sup> )	A1	May be implied later
	-	
Total area	B1	FT provided at least M2 A1 previously awarded (with
11.53(8m <sup>2</sup> ) to 11.54(m <sup>2</sup> ) <b>AND</b> Yes		appropriate conclusion)
16(b) (Arc length) $2 \times \frac{42}{22} \times \pi \times 3.6$	M1	
360		
2.64 (m)	A1	Accept 2.63(m)
(Triangle ACD) AD <sup>2</sup> = 18.2(356)	M2	M1 for $AD^2 = 4.1^2 + 3.6^2 - 2 \times 4.1 \times 3.6 \times \cos 67(^\circ)$
AD = 4.27(m)	A1	Accept 4.3(m)
	_	
(Perimeter) (4.1 + 3.6 + 2.64 + 4.27)	B1	FT correct evaluation of
14.6(1 m) <b>AND</b> No		'their arc' + 'their AD' + 4.1 + 3.6
		provided at least M2 and A1 previously awarded
	(11)	
	/	· /

17(a) Reflection in the x-axis	M1	
(0, 2)	A1	Accept 2 indicated correctly on the y-axis
17(b) Horizontal translation	B1	Any horizontal translation without including any other transformation
Correct translation with (1, 0) and (3,0) indicated on the x-axis	B2	Accept indication of 1 and 3 on the x-axis with the correct translation
		B1 for a correct translation with only one of the values 1 and 3 indicated, or for a horizontal translation with (-1, 0) and (1, 0) indicated on the x-axis as intersections, or for a horizontal translation to show $y = g(x)$ with (0, 0) and (2, 0) indicated on the x-axis as intersections
17(c) Correct negative enlargement	B2 (7)	B1 an enlargement with scale factor -½, with correct orientation with incorrect placement.
18. Showing $x^2 + 2x - 132.48 = 0$ or $2x^2 + 4x - 264.96 = 0$	B2	B1 for $x^2 + (x + 2)^2 = 16.4^2$
$x = \frac{-4 \pm \sqrt{(4^2 - 4 \times 2 \times -264.96)}}{2 \times 2}$ or $x = \frac{-2 \pm \sqrt{(2^2 - 4 \times 1 \times -132.48)}}{2 \times 1}$ or $(x + 1)^2 - 133.48 = 0$	M1	FT for equivalent level of difficulty Allow 1 slip in substitution, not use of incorrect formula
$x = \frac{-4 \pm \sqrt{2135.68}}{4} \text{ or } x = \frac{-2 \pm \sqrt{533.92}}{2}$ or x + 1 = $\sqrt{133.48}$	A1	Either negative x-value not given or ignored in further working
x = 10.55(cm) or 10.6(cm)	A1	Candidate must not show working with negative x-value
(Volume =) ⅓ × π × 10.55² × 12.55	M1	FT provided at least 2 marks previously awarded
Answer in the range 1462 (cm³) to 1483 (cm³)	A1	Must be from correct working FT for an answer in a similar range, not allowing truncation of 'their x' to a whole number or 1 d.p.
	(7)	

19(a) 0.78 x 1 or equivalent, AND an attempt to consider the other 22%	M1	Not for sight of 78% alone
0.22 x ¼ or equivalent	M1	
Showing the need to add (0.78 + 0.055)	M1	Method considers 78% + 22% of ¼
0.835 or 83.5%	A1	Alternative: (Number of questions) $0.78 \times 50 + (50 - 0.78 \times 50) \times 0.25$ M1 (= 39 + 2.75 =) 41.75 A1 (Probability) 41.75/50 (FT from M1) M1 = 0.835 A1
19(b)Probability from part (a)×50	M1	FT from part (a), apart from 78% giving an answer of 39, this is M0 A0
41.75 with interpretation 'No'	A1 (6)	FT from part (a), apart from 78%, with appropriate interpretation $\geq$ 43 as 'yes' or <43 as 'no' Award M1 A1 for an appropriate conclusion without working only if the alternative method is used in (a) Alternative 1: (43/50 as) 86% compared with probability 83.5% M1 Interpretation 'No' A1 Alternative 2: (With 83.5% seen in (a)) 41 or 42 questions correct M1 Interpretation 'No' A1
20(a) Correct sketch	B1	
20(b) 23.578(°) and 156.42(°) alone	B2 (3)	B1 for either angle Accept rounding and truncation of angles

C300UB0-1 EDUQAS GCSE Mathematics - Component 2 HT MS S19/DM