



GCSE MARKING SCHEME

AUTUMN 2024

**GCSE
MATHEMATICS – COMPONENT 2
(HIGHER TIER)
C300UB0-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

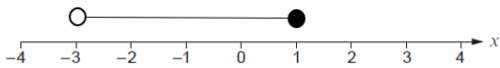
Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

EDUQAS GCSE MATHEMATICS

AUTUMN 2024 MARK SCHEME

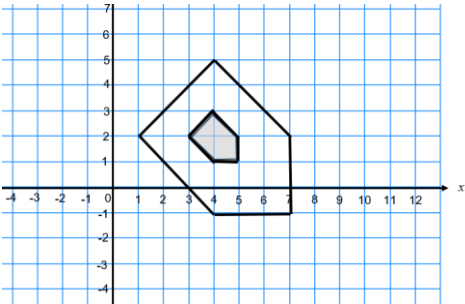
Component 2: Higher Tier	Mark	Comment
1*.		No marks are awarded for an answer of 15.3 obtained from use of a scale drawing.
$(h^2 =) 7.2^2 + 13.5^2$	M1	May be implied in later working. Provided not spoiled by answers of 20.7, 20.7^2 or 428.49.
$h^2 = 234.09$ or $(h =) \sqrt{234.09}$	A1	
$(h =) 15.3$	A1	FT from M1 for the correctly evaluated square root of 'their 234.09' provided 'their answer' > 13.5 (cm) Must be from correct working
(Area of square =) $((7.2 + 13.5 + 15.3) \div 4)^2$	M2	FT 'their 15.3' provided M1 previously awarded. M1 for $(7.2 + 13.5 + 15.3) \div 4 (= 9)$
81 (cm ²)	A1	FT If no marks award SC1 for the correct evaluation of $(13.5 + 7.2 + \text{'their 15.3'}) \div 4)^2$
	(6)	
2*.		
$\pi \times 7^2 \times 21 \div 102$	M2	M1 for $\pi \times 7^2 \times 21 (= 3231 \text{ to } 3233.118 \text{ or } 1029\pi)$ Allow the M1 for sight of $\pi \times 7^2 \times 21$ if embedded in incorrect work e.g. $2 \times \pi \times 7^2 \times 21$
= 31 (complete cylinders)	A1	Unsupported 31.69 or 32 is awarded M2 A0
	(3)	

3*. $8.96 \times 1540 \div 1000$ $= 14 \text{ (kg)}$	M2 A2	Answer space takes precedence M1 for $8.96 \times 1540 (= 13798.4)$ Allow M1 for digits 896×1540 if incorrect mass unit conversion seen first A1 for $13.7(98\dots)$ or 13.8 (kg) FT from M1 to award: A2 for an answer of 14000 Allow A2 for a correct FT answer with 14 as the only non-zero digits from a seen incorrect unit conversion A1 for an answer of $13798(.4)$ or 13800 Allow A1 for either of the following: • $13798(.4)$ seen and then spoiled e.g. 13000 • a correct FT answer with $1379(84)$ or 138 as the only non-zero digits e.g. 138, 0.01379 from a seen incorrect unit conversion If no marks award SC1 for a calculation of: a number with only non-zero digits of $896 \times$ a number with only non-zero digits of 154 e.g. 0.0896×1.54
	(4)	

4*(a) $28x^5y^6$	B2	B1 for one of the following: • kx^5y^6 $k \neq 28$ or 0 • $28x^ny^6$ $n \neq 5$ or 0 or • $28x^5y^m$ $m \neq 6$ or 0 • $28 \times x^5 \times y^6$ • $28 x^5 \times y^6$ • $28 \times x^5y^6$ Mark final answer. B1 if $28x^5y^6$ seen then spoiled.
4*(b)(i) $11 + 5 < 4n - n$ or $n - 4n < -5 - 11$ $16 < 3n$ or $-3n < -16$ $\frac{16}{3} < n$ oe or $n > \frac{16}{3}$ oe	B1 B1 B1	Implies the first B1 ISW. Allow $5.33... < n$ or $n > 5.33...$ If $n > 5.3$ without $n > \frac{16}{3}$ award B1 B1 B0 FT from $16 < an$ or $b < 3n$ OR $-3n < c$ or $-dn < -16$ where a, b, c and d > 0 Use of equal signs is not awarded the marks unless finally replaced.
4*(b)(ii) 6	B1	FT 'their $n > \frac{a}{b}$ where $a > b$
4*(c) $x = \frac{a}{b}$	B1	Do not allow $x = a \div b$
4.(d) 	B1	
	(8)	
5*. The correct answer circled or clearly indicated 2.4×10^{-6}	B1	
	(1)	

6*(a) $8000 \times (1 - 0.3)^4$ oe = 1920.8 or 1921 $8000 - 1920.8 = 6079.2$ therefore 6079 (£10 vouchers) or $8000 - 1921 = 6079$ (£10 vouchers)	M2 A1 B1	M1 for $8000 \times (1 - 0.3)^n$ oe when $1 \leq n < 4$ $8000 \times (1 - 0.3) (= 5600)$ CAO															
<u>Alternative method</u> A full method for the number of vouchers sent for the 4 weeks. <table border="1"> <thead> <tr> <th></th><th>Vouchers sent</th><th>Houses left</th></tr> </thead> <tbody> <tr> <td>Week1</td><td>$8000 \times 0.3 = 2400$</td><td>$8000 - 2400 = 5600$</td></tr> <tr> <td>Week2</td><td>$5600 \times 0.3 = 1680$</td><td>$5600 - 1680 = 3920$</td></tr> <tr> <td>Week3</td><td>$3920 \times 0.3 = 1176$</td><td>$3920 - 1176 = 2744$</td></tr> <tr> <td>Week4</td><td>$2744 \times 0.3 = 823(.2)$</td><td></td></tr> </tbody> </table> $2400 + 1680 + 1176 + 823.2$ or $2400 + 1680 + 1176 + 823$ = 6079.2 therefore 6079 (£10 vouchers)		Vouchers sent	Houses left	Week1	$8000 \times 0.3 = 2400$	$8000 - 2400 = 5600$	Week2	$5600 \times 0.3 = 1680$	$5600 - 1680 = 3920$	Week3	$3920 \times 0.3 = 1176$	$3920 - 1176 = 2744$	Week4	$2744 \times 0.3 = 823(.2)$		M2 m1 A1	M1 for $8000 - 8000 \times 0.3 (= 5600)$ oe FT provided M2 awarded CAO
	Vouchers sent	Houses left															
Week1	$8000 \times 0.3 = 2400$	$8000 - 2400 = 5600$															
Week2	$5600 \times 0.3 = 1680$	$5600 - 1680 = 3920$															
Week3	$3920 \times 0.3 = 1176$	$3920 - 1176 = 2744$															
Week4	$2744 \times 0.3 = 823(.2)$																
6*(b)(i) A valid assumption that John made e.g. ‘Every house that was sent a voucher used the voucher.’ ‘Every house that was sent the voucher received the voucher.’ ‘Every house that received the voucher used the voucher by the end of the four weeks.’ ‘Every house that received the voucher uses that supermarket.’ ‘They had time to use the voucher.’	E1	Allow e.g. ‘None got lost in the post.’ ‘They use that supermarket.’ ‘That <u>every</u> house will use their voucher’ Do not allow e.g. ‘6039 vouchers would be used’ ‘The vouchers would encourage people to go to the supermarket’															
6*(b)(ii) A valid effect of their assumption e.g. ‘Less than 6079 vouchers would have been used.’	E1	If no valid assumption is made, then this mark cannot be awarded. Cannot award E0 E1. Allow e.g. ‘Less vouchers used.’															
(6)																	

7. (a) 1 AND 5	B2	B1 for one correct value
7.(b) Correct curve drawn through all 6 correct plots.	B2	FT their values from the table for B2 or B1 On FT award B2 only if a smooth curve obtained B1 for at least 5 points plotted correctly with or without curve.
7.(c) $y = 3$	B1	
	(5)	
8*(a) 6T + 7K = (£)185.75 AND 5T + 4K = (£)130.50 Method to eliminate an unknown e.g. equal coefficients and subtraction or rearranges one equation and substitutes into the other Finds one unknown Method to find second unknown Finds second unknown	B1 M1 A1 m1 A1	Both equations given, T & K may be other letters, words are accepted. FT provided at least one equation is correct, the equations have consistent place value and are of an equivalent level of difficulty. No marks for use of T&I or for an unsupported answer. Candidates may use $11T + 11K = (£)316.25$ Allow one error in one term, but not in the equated coefficients CAO; $T = 15.5(0)$ or $K = 13.25$ FT 'their T' or 'their K' used in one of their equations FT
8*(b) 65 % $\equiv$ (£)24570 $24570 \div 65 \times 100$ $= (£)37800$	B1 M1 A1	Allow for clear indication that $65 \% \equiv (£)24570$, not for sight of 65% or 0.65. Or equivalent e.g. $24570 \div 0.65$ This implies B1 M1
	(8)	

9. $(x =) \frac{7 \times 1800}{150}$ $(x =) 84$	M2 Award M2 for $1800 \times 0.466(66\ldots)$ OR $1800 \div 21.4(28\ldots)$ from premature approximation M1 for $\frac{x}{1800} = \frac{7}{150}$ OR $\frac{1800}{x} = \frac{150}{7}$ OR $\frac{x}{7} = \frac{1800}{150}$ A1 A0 for $\frac{84}{1800}$ OR $\frac{84}{150}$	
(3)		
10. A correct enlargement in the correct position. 	B2 B1 for one of the following: • 5 correct vertices not joined together. • 5 vertices joined together with 4 correct. • a correct enlargement of scale factor $\frac{1}{3}$ in an incorrect position in the correct orientation. • a correct enlargement of scale factor 3 with centre (4, 2).	
(2)		
11. (Finding the angle at Port A) $(x =) \tan^{-1}(\frac{17}{11})$ $(x =) 57.09\ldots(^{\circ})$ or $57.1(^{\circ})$ or $57(^{\circ})$ (Bearing) $((180 - 57.09)$ or $(90 + 32.9))$ $122.905\ldots(^{\circ})$ or $122.9(^{\circ})$ or $123(^{\circ})$	M2 M1 for $\tan(x) = \frac{17}{11}$ A1 B1 FT 'their 57.09...' provided M1 awarded	
<u>Alternative method</u> (Finding the angle at Port B) $(x =) \tan^{-1}(\frac{11}{17})$ $(x =) 32.90\ldots(^{\circ})$ or $32.9(^{\circ})$ or $33(^{\circ})$ (Bearing) $((180 - 57.09)$ or $(90 + 32.9))$ $122.905\ldots(^{\circ})$ or $122.9(^{\circ})$ or $123(^{\circ})$	M2 M1 for $\tan(x) = \frac{11}{17}$ A1 B1 FT 'their 32.90...' provided M1 awarded	
(4)		

12.		Angles may be seen on the diagram. No marks for sight of 64(°) or 65(°) unless appropriately labelled or correctly placed on the diagram.
$\widehat{ADC} = 64(^{\circ})$ (opposite angles in a cyclic quadrilateral sum to 180°)	B1	
$\widehat{CAD} = 65(^{\circ})$ (angles in a triangle sum to 180)	B1	$\widehat{CAD} = 65(^{\circ})$ must be from correct working.
$\widehat{CDE} = 65(^{\circ})$ with <u>alternate segment theorem</u>	B1	
<u>Alternative method 1</u>		
$\widehat{ADC} = 64(^{\circ})$ (opposite angles in a cyclic quadrilateral sum to 180°)	B1	
$\widehat{ADF} = 51(^{\circ})$ with <u>alternate segment theorem</u>	B1	
$\widehat{CDE} = 65(^{\circ})$ (angles in a straight line sum to 180°)	B1	
<u>Alternative method 2</u>		
$\widehat{ABD} = 51(^{\circ})$ (angles in the same segment)		
$\widehat{DBC} = 116 - 51 = 65(^{\circ})$	B1	The two steps are required for this mark
$\widehat{CAD} = 65(^{\circ})$. (angles in the same segment)	B1	
$\widehat{CDE} = 65(^{\circ})$ with <u>alternate segment theorem</u>	B1	
<u>Alternative method 3</u>		
$\widehat{COD} = 116 \times 2 - 51 \times 2 = 130(^{\circ})$ (Angle at the centre is twice that at the circumference)	B1	
$\widehat{CAD} = 65(^{\circ})$ (Angle at the centre is twice that at the circumference)	B1	$\widehat{CAD} = 65(^{\circ})$ must be from correct working.
$\widehat{CDE} = 65(^{\circ})$ with <u>alternate segment theorem</u>	B1	
	(3)	

15. (Creates an equation in x using speed, distance, and time) $1.25 = \frac{5x + 0.5}{1.8x + 7} \quad \text{or} \quad 1.25(1.8x + 7) = 5x + 0.5$ or $1.8x + 7 = \frac{5x + 0.5}{1.25}$ (Remove fractions and expands brackets) $2.25x + 8.75 = 5x + 0.5 \quad \text{or} \quad 1.8x + 7 = 4x + 0.4$ (Isolates and collects x terms) $8.25 = 2.75x \quad \text{or} \quad 2.2x = 6.6$ $x = 3$ (Distance =) 15.5 (km)	B1 B1 B1 B1 B1	Or equivalent. Do not allow 1 hr 15 unless later replaced by 1.25 Or equivalent. Allow for use of 1.15 (hours) or 75 (mins) Use of 1.15 $2.07x + 8.05 = 5x + 0.5$ oe or $1.8x + 7 = 4.347...x + 0.4347..$ Use of 75 mins $135x + 525 = 5x + 0.5$ oe or $1.8x + 7 = 0.0666..x + 0.00666..$ FT from their equation provided no errors Allow for use of 1.15 (hours) or 75 (mins) Use of 1.15 $2.93x = 7.55$ Use of 75 mins $130x = -524.5$ FT from one arithmetic error provided time = 1.25 $2.75x = a$ or $2.2x = b$ OR $ax = 8.25$ or $bx = 6.6$ Use of 1.15 (hours) $x = 2.5(767.)$ or 2.6 B0 for use of 75 mins as x is negative CAO If no marks award SC1 for sight of one of the following: 1 hour 15 mins = $\frac{5x + 0.5}{1.8x + 7}$ oe (Distance =) $2.25x + 8.75$ (Speed =) $\frac{5x + 0.5}{1.25}$
	(5)	
16. $\frac{1}{2}(-8r + 6q) \text{ oe}$ $= 3q - 4r$	M1 A1	If no marks award SC1 for an answer of $-3q + 4r$
	(2)	

17.(a) $1.2 \times 20 + 4.2 \times 10 + 5 \times 5 + 3.4 \times 5 + 0.8 \times 30$ $(24 + 42 + 25 + 17 + 24)$ = 132 (cars) (Estimated median =) 30 (mph)	M1 A1 B1	Allow one slip (e.g. <u>the sum</u> of 5 values with 4 correct) CAO. FT 'their 132' provided M1 awarded A median of 30 from <u>incorrect work</u> or unsupported is awarded no marks. Median = 30 and $24 + 42 = 25 + 17 + 24$ oe is awarded all 3 marks If no marks award SC1 for sight of the 5 correct values: 24, 42, 25, 17 AND 24
17.(b)(i) $\frac{1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5}{150} \times 100 \quad (= 84\%)$ or $\frac{150 - (0.5 \times 20 + 2.8 \times 5)}{150} \times 100$	B2	B1 for $1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5 (= 126)$ ($10 + 30 + 72 + 14$) or $150 - (0.5 \times 20 + 2.8 \times 5)$ $150 - (10 + 14)$
<u>Alternative method 1</u> $0.84 \times 150 = 126 \quad \text{AND}$ $1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5 = 126$ OR $150 - (0.5 \times 20 + 2.8 \times 5) = 126$	B2	B1 for one of the following: $1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5 \quad (= 126)$ $150 - (0.5 \times 20 + 2.8 \times 5) \quad (= 126)$ $0.84 \times 150 = 126 \text{ AND}$ sight of 5, 30, 72 and 14
<u>Alternative method 2</u> $(1 - 0.84) \times 150 \text{ OR } 0.16 \times 150 = 24 \text{ AND}$ $150 - (1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5) = 24$ OR $0.5 \times 20 + 2.8 \times 5 = 24$	B2	B1 for one of the following: $150 - 1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 5 (= 24)$ $0.5 \times 20 + 2.8 \times 5 \quad (= 24)$
<u>Alternative method 3</u> $\frac{1 \times 10 + 6 \times 5 + 7.2 \times 10}{150} \times 100 = 74.66... \text{ or } 75 (\%)$ AND $\frac{1 \times 10 + 6 \times 5 + 7.2 \times 10 + 2.8 \times 10}{150} \times 100 = 93(.33..)(\%)$ AND e.g. '84% lies between these values'	B2	B1 for both percentages attempted with at least one correct

17.(b)(ii) A correct explanation e.g. 'Irene cannot be sure that 14 cars in the 4th bar were travelling less than 30mph'. 'More than half of the cars in the 4th bar could have been travelling more than 30 mph'. 'More than half of the cars in the 4th bar could have been travelling less than 30 mph'.	E1	Do not allow e.g. 'The graph does not show the exact number of cars' without further explanation.
17.(c) Speed bumps selected with a <u>valid reason</u> <u>quoting values</u> from the histograms e.g. 'With 30 mph signs 50% of cars travelled at a speed less than 30 mph, but, with speed bumps 84%* of cars travelled at a speed less than 30 mph'. 'With 30 mph hour signs 50% of cars travelled at a speed more than 30 mph, but, with speed bumps 16% of cars travelled at a speed more than 30 mph'. * Allow 75% to 93% ** Allow 16% to 25%	E1	Allow e.g Speed bumps selected and: 'Less people travel at over 40 mph' 'Less people travel at over 35 mph' 'No one travelled at over 55 mph' 'More people travel at less than 30 mph with the speed bumps' provided supporting evidence seen in (a) AND (b)(i). 'Median speed with speed bumps is lower than with 20 mph signs' provided answer to (a) > 25 Do not allow e.g. 'More people travel at less than 30 mph with the speed bumps' without supporting evidence seen in (a) AND (b)(i). 'There are less people going faster' without reference to values from the graph
(7)		

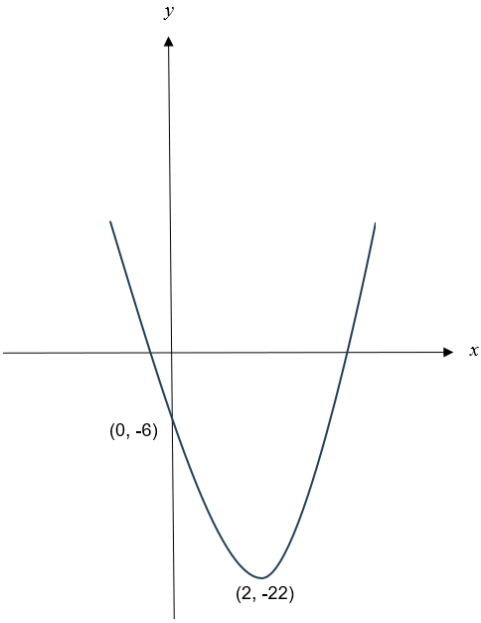
18.(a) (Expression for total volume) $\frac{1}{2} \times \frac{4}{3} \times \pi \times (x+1)^3 + \frac{1}{3} \times \pi \times (x+1)^2 \times 5$ (Equate to 24π and expands brackets correctly) $2x^3 + 11x^2 + 16x + 7 = 72$ or $\frac{2\pi}{3}x^3 + \frac{11}{3}\pi x^2 + \frac{16}{3}\pi x + \frac{7}{3}\pi = \frac{72}{3}\pi (=24\pi)$ or $(2x^3+4x^2+2x+2x^2+4x+2)+(5x^2+10x+5)=72$ Convincingly leading to $2x^3 + 11x^2 + 16x = 65$	B1 B3 B1	Need not be equated to 24π for this mark FT provided of the form: $k\pi(x+1)^3 + 5m\pi(x+1)^2 (=24\pi)$ B2 for volume equated to 24π and both $(x+1)^3$ and $(x+1)^2$ expanded correctly e.g. $\frac{2}{3}\pi(x^3 + 2x^2 + x + x^2 + 2x + 1) +$ $\frac{5}{3}\pi(x^2 + 2x + 1) = 24\pi$ or $2(x^3 + 2x^2 + x + x^2 + 2x + 1) +$ $5(x^2 + 2x + 1) = 72$ OR for $(x^2 + 2x + 1)(2x + 7) = 72$ B1 for one of the following: $2(x+1)^3 + 5(x+1)^2 = 72$ $(x+1)^2(2(x+1) + 5) = 72$ $(x+1)^2(2x + 7) = 72$ CAO If no marks award SC1 for sight of: $\frac{1}{2} \times \frac{4}{3} \times \pi \times (x+1)^3$ AND $\frac{1}{3} \times \pi \times (x+1)^2 \times 5$ If no marks or B1 B0 B0 awarded, award SC1 for the correct expansion of $(x+1)^3$ $x^3 + x^2 + x^2 + x^2 + x + x + x + 1$ or better
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18.(b)		Correct evaluation regarded as enough to identify if < 0 or > 0 . If evaluations not seen accept 'too high' or 'too low'. Some candidates may test $2x^3 + 11x^2 + 16x - 65 = 0$ <table><thead><tr><th>x</th><th>$2x^3 + 11x^2 + 16x$</th><th></th><th></th></tr></thead><tbody><tr><td>1.6</td><td>61.952</td><td></td><td></td></tr><tr><td>1.61</td><td>62.619...</td><td></td><td></td></tr><tr><td>1.62</td><td>63.291...</td><td></td><td></td></tr><tr><td>1.63</td><td>63.967...</td><td></td><td></td></tr><tr><td>1.64</td><td>64.647...</td><td>1.635</td><td>64.306...</td></tr><tr><td>1.65</td><td>65.331...</td><td>1.645</td><td>64.989...</td></tr><tr><td>1.66</td><td>66.020...</td><td>1.646</td><td>65.0575..</td></tr><tr><td>1.67</td><td>66.712...</td><td>1.655</td><td>65.675...</td></tr><tr><td>1.68</td><td>67.409...</td><td></td><td></td></tr><tr><td>1.69</td><td>68.110...</td><td></td><td></td></tr><tr><td>1.7</td><td>68.816...</td><td></td><td></td></tr></tbody></table> <u>Note:</u> Evidence for M1 must be <u>seen</u> before A1 can be awarded. No marks awarded for an unsupported answer of 1.65.	x	$2x^3 + 11x^2 + 16x$			1.6	61.952			1.61	62.619...			1.62	63.291...			1.63	63.967...			1.64	64.647...	1.635	64.306...	1.65	65.331...	1.645	64.989...	1.66	66.020...	1.646	65.0575..	1.67	66.712...	1.655	65.675...	1.68	67.409...			1.69	68.110...			1.7	68.816...		
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19.(a) A fully correct Venn diagram Year 6 pupils Rock climbing Coasteering Gorge walking 32 28 25 15 21 14 8 0	B3	Allow no entry outside the circles to imply zero If 15 is changed to 23 then no marks are awarded. 21 in correct position 14 in correct position - Rock climbing total = 76 23 + 'their 21' + 'their 32' = 76 - Coasteering total = 65 23 + 'their 14' + 'their 28' = 65 - Overall total = 143 Award B2 for four of the above conditions met. Award B1 for two or three of the above conditions met.																																																
19.(b) $\frac{14}{143}$ oe ISW	B1	CAO																																																
19.(c) $\frac{29}{68}$ oe ISW	B2	FT 'their 21' + 8 and 'their 21' + 'their 14' + 'their 25' + 8 for either B2 or B1 provided it gives a fraction < 1 . B1 for one of the following: $\frac{29}{a}$ provided $a > 29$ and $a \neq 143$ $\frac{\text{'their 21' + 8}}{b}$ provided $b > \text{'their 21' + 8}$ $\frac{c}{68}$ provided $c < 68$																																																
	(6)																																																	

20. $2(y - 7)^8$	B1	Mark final answer
	(1)	
21. $(r =) \sqrt{\frac{12 \times 360}{55\pi}}$ or $\sqrt{\frac{12}{\frac{55}{360} \times \pi}}$ oe $r = 5(\text{cm})$ oe (Perimeter =) $\sqrt{5^2 + 5^2 - 2 \times 5 \times 5 \cos(180 - 55)}$ $+ \frac{180-55}{360} \times \pi \times 2 \times 5$ OR $2 \times 5 \sin\left(\frac{180-55}{2}\right) + \frac{180-55}{360} \times \pi \times 2 \times 5$ OR $\frac{5 \sin 125}{\sin((180 - 125) \div 2)} + \frac{180 - 55}{360} \times \pi \times 2 \times 5$ 19.7(7...) (cm) or 19.8(cm)	M2 A1 M3 A3	Mark final answer M1 for $12 = \frac{55}{360} \times \pi \times r^2$ or better $r = \sqrt{\frac{864}{11\pi}}$ FT 'their derived r' M2 for one of the following: (AD=) $\sqrt{5^2 + 5^2 - 2 \times 5 \times 5 \cos(180 - 55)}$ (AD=) $2 \times 5 \sin\left(\frac{180 - 55}{2}\right)$ (Arc AD =) $\frac{180-55}{360} \times \pi \times 2 \times 5$ oe AND $AD^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \cos(180 - 55)$ oe OR $(AD =) \frac{5 \sin 125}{\sin((180 - 125) \div 2)}$ OR $\frac{5 \sin 125}{\sin 27.5}$ oe M1 for one of the following: $AD^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \cos(180 - 55)$ oe (Arc AD =) $\frac{180 - 55}{360} \times \pi \times 2 \times 5$ $\frac{AD}{\sin 125} = \frac{5}{\sin((180-125) \div 2)}$ oe Allow answers in the range 19.7 to 20 inclusive from correct working. A1 for each of the following: (AD =) 8.8(7...)(cm) or 8.9(cm). Allow 9 from correct working. (Arc AD =) 10.9(08...)(cm). Allow 11 from correct working. - The correct evaluation of 'their AD' + 'their arc AD' providing at least M1 M2 previously awarded and one is correct.
	(9)	

22.(a) 136.9(7...) or 137(°) AND 223(°) with no other values	B2	B1 for either angle. Allow embedded answers. Penalise -1 for each additional incorrect value. Ignore additional correct values outside the range for B2 or B1. If no marks award SC1 for answers of 136(°) AND 224(°) with no other values
22.(b) A correct translation through $\begin{pmatrix} 0 \\ -1 \end{pmatrix}$ with at least -2 indicated on the y axis and 180 and 360 indicated on the x axis.	B2	B1 for a correct translation through $\begin{pmatrix} 0 \\ -1 \end{pmatrix}$ without labels on the axes.
	(4)	
23. 2×3×2×3×2×1 AND 6×5×4×3×2×1 (6×5×4×3×2×1 – 2×3×2×3×2×1) = 648 (more combinations)	M3 A1	M2 for 2×3×2×3×2×1 (= 72) or M1 for 6×5×4×3×2×1 or 6! (= 720)
	(4)	

24. $y \propto \frac{1}{w^3} \quad \text{or} \quad y = \frac{k}{w^3}$ OR $w \propto \sqrt{x} \quad \text{or} \quad w = c\sqrt{x}$ $\frac{1}{9} = \frac{k}{6^3}$ $y = \frac{24}{w^3} \quad \text{oe}$ $6 = c\sqrt{4}$ $w = 3\sqrt{x}$ $y = \frac{24}{(3\sqrt{x})^3} \quad \text{or} \quad y = \frac{8}{9(\sqrt{x})^3} \quad \text{oe}$ $y = \frac{8}{9}x^{-\frac{3}{2}}$	B1 M1 A1 M1 A1 M1 A1	FT $y \propto \frac{1}{w}$ or $y \propto w^3$ Note: $k = 24$ implies M1 CAO. May be seen in later work FT $w \propto x^2$ $c = 3$ implies M1 CAO May be seen in later work FT provided M1 M1 previously awarded. Mark final answer. A0 on FT if $y = mx^n$ and m and n are not both fractions
<u>Alternative method</u> $y \propto \frac{1}{w^3} \quad \text{or} \quad y = \frac{k}{w^3}$ OR $w \propto \sqrt{x} \quad \text{or} \quad w = c\sqrt{x}$ (Substitutes in for w) $y = \frac{k}{(c\sqrt{x})^3}$ (Changes constants) $y = \frac{k}{c^3(\sqrt{x})^3} \quad \text{or} \quad y = \frac{P}{(\sqrt{x})^3} \quad \text{oe}$ $\frac{1}{9} = \frac{P}{(\sqrt{4})^3}$ $P = \frac{8}{9} \quad \text{oe}$ $y = \frac{24}{(3\sqrt{x})^3} \quad \text{or} \quad y = \frac{8}{9(\sqrt{x})^3} \quad \text{oe}$ $y = \frac{8}{9}x^{-\frac{3}{2}}$	B1 M1 A1 M1 A1 M1 A1	FT $y \propto \frac{1}{w}$ or $y \propto w^3$ or $w \propto x^2$ CAO CAO FT provided M1 M1 previously awarded. Mark final answer. A0 on FT if $y = mx^n$ and m and n are not both fractions
(7)		

25. $(y =) 4(x^2 - 4x) - 6$ or $4[x^2 - 4x - 1.5]$ or $4x^2 - 16x + 16 - 16 - 6$ $(y =) 4(x - 2)^2 - 4 \times 2^2 - 6$ or $4[(x - 2)^2 - 1.5 - 2^2]$ oe or $(2x - 4)^2 - 16 - 6$ $(y =) 4(x - 2)^2 - 22$ or $(2x - 4)^2 - 22$ Sketch of a quadratic curve with (0,-6) indicated at the intercept with the y axis and (2, -22) indicated at stationary point 	B1 B2 B1 B2	FT from $4(x^2 - 4x) + c$ Award B1 for $4(x - 2)^2$ or $(2x - 4)^2$ Either B2 or B1 implies the first B1. CAO No marks are awarded for the graph unless an expression of the form $a(x \pm b)^2 \pm c$ obtained with $a > 1$, $b \neq 0$ and $c \neq 0$ FT 'their expression' in the form $a(x \pm b)^2 \pm c$ B1 for the correct shape curve with either the y-intercept coordinate correct, or the stationary point coordinates correct. Intercepts on the x-axis are not required but, if given they must be correct for their equation (4.345.. and -0.345 if correct)
	(6)	