LEVEL 2 MARKING SCHEME

SUMMER 2024

LEVEL 2
ADDITIONAL MATHEMATICS
9550-01

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.

LEVEL 2 ADDITIONAL MATHEMATICS

SUMMER 2024 MARK SCHEME

		Mark	Comment
1			*Penalise including '+c' -1 only throughout*
	(a) $30x^5$ (+) $-5x^{-6}$ (+0) or $30x^5$ (+) $-\frac{5}{x^6}$ (+0)	B3	B1 for $30x^5$ (not $5\times6x^5$), B1 for $-5x^{-6}$ and B1 for +0 (or blank) provided at least one other mark awarded. If B3 penalise further incorrect working -1, e.g. treat further incorrect work with term $-5x^{-6}$ as ISW unless B3
	(b) $\frac{7}{8}x^{-\frac{1}{8}}$ or equivalent	B1	Index needs to be simplified. ISW
	(c) $\frac{-12x^{-5}}{13}$ or $\frac{-12}{13x^5}$	B1	ISW
		5	
2			Indices must be simplified throughout
	(a) $1024x^5$	B2	Mark final answer B1 for nx^5 where $n \neq 0$, including $2^{10}x^5$
	(b) $7x^{\frac{2}{5}} - 6x^{-1}$ or $7x^{\frac{2}{5}} - 6/x$	B2	For award of B2 mark final answer B1 for sight of $x^{\frac{2}{5}}$, (-) $6x^{-1}$ or (-) $6/x$
		4	
3	(Area of a trapezium) $\frac{1}{2}\times$ perpendicular height $\times (1+\sqrt{5} + 6+2\sqrt{5})$ $= 20 + 4\sqrt{5}$	M2	For M2 brackets must be shown unless implied in further working M1 for sight of $1+\sqrt{5} + 6+2\sqrt{5}$ or $7 + 3\sqrt{5}$
	(Perpendicular height =) $\frac{2(20 + 4\sqrt{5})}{1+\sqrt{5} + 6+2\sqrt{5}}$ or $\frac{20 + 4\sqrt{5}}{\frac{1}{2}(1+\sqrt{5} + 6+2\sqrt{5})}$ or $\frac{40 + 8\sqrt{5}}{7 + 3\sqrt{5}}$	A1	Mark final answer, then FT with this answer Do not FT from M1
	(=) $\frac{2(20 + 4\sqrt{5})}{7 + 3\sqrt{5}} \times \frac{7 - 3\sqrt{5}}{7 - 3\sqrt{5}}$ or equivalent	M1	If no working for rationalising seen then M0 A0 Method working **must** be seen FT 'their perpendicular height' provided it is of equivalent level of difficulty, allow FT from e.g. $\frac{20 + 4\sqrt{5}}{7 + 3\sqrt{5}}$
	(=) $40 - 16\sqrt{5}$	A2	FT from previous M1 Mark final answer On FT only award A2 if 'their answer' is in the form $a + b\sqrt{5}$ where a and b are integers A1 for either numerator surds ($160 - 64\sqrt{5}$) or denominator surds (4) correctly simplified, including FT from previous M1 awarded *Note:* $\frac{20 + 4\sqrt{5}}{7 + 3\sqrt{5}} = 20 - 8\sqrt{5}$
		6	

3	*h = a + b√5 used and compare coefficients* $\frac{1}{2} \times h \times (1 + \sqrt{5} + 6 + 2\sqrt{5}) = 20 + 4\sqrt{5}$ *or* $\frac{1}{2} \times (a + b\sqrt{5})(7 + 3\sqrt{5}) = 20 + 4\sqrt{5}$ *or equivalent* $7a + (7b + 3a)\sqrt{5} + 15b = 40 + 8\sqrt{5}$ *or equivalent* $7a + 15b = 40$ *and* $3a + 7b = 8$ *or equivalent equations* $a = 40$ *or* $b = -16$ *(Height =)* $40 - 16\sqrt{5}$	*M2* *m1* *A1* *A1* *A1* *6*	*M1 for* $1 + \sqrt{5} + 6 + 2\sqrt{5}$ *or* $7 + 3\sqrt{5}$ *FT equivalent from* $h(7 + 3\sqrt{5}) = 20 + 4\sqrt{5}$ *CAO*
4	$\frac{48}{360} \times \pi \times 4.1^2$ or $\frac{1681\pi}{750}$ (=) 7(.04... cm^2)	M1 A1 2	
5	(a) Substitution of $x = -2$, $2(-2)^3 - 3(-2)^2 - 4(-2) + 1$ $(= -16 - 12 + 8 + 1)$ -19 (b)(i) Substitute $x = 3$, $(3)^3 + 4(3)^2 - 9(3) - 36$ $(=27 + 36 - 27 - 36)$ Showing $f(3) = 0$ (ii) $(x - 3)(x^2 + bx + c)$ or intention to divide by $(x - 3)$ with x^2 shown ($(x - 3)$) $(x^2 + 7x + 12)$ or $(x + 3)(x + 4)$ or (bx = +) 7x **and** (c =) 12 $(x - 3)(x + 3)(x + 4)$	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $2x^2 - 7x$ .... Or division method giving $x^2 + 7x$ … Accept sight of **substitution** with '=0' shown <u>Must be a method to factorise using (x – 3) as a factor</u> If any values are inserted at least 1 needs to be correct. Appropriate sight of (+) 7x or (+) 12 implies M1 (and possible A1 to follow) Note: Division may be seen in (b)(i) A1 for (bx = +) 7x or (c =) 12 CAO, with all 3 factors shown, ignore sight of "=0", ISW (e.g. ignore then writing as $(x^2 - 9)(x + 4)$) **Must** be from sight of $x^2 + 7x + 12$ No working to show factorising is M0 A0 A0 If no marks, award SC1 for an answer of $(x - 3)(x + 3)(x + 4)$ from working not from 'hence factorising' with $(x - 3)$ as a known factor, e.g. $x^2(x + 4) - 9(x + 4) = (x^2 - 9)(x + 4)$ $= (x - 3)(x + 3)(x + 4)$

6	$y+\delta y = 11(x+\delta x)^2 + 2(x+\delta x)$ Intention to subtract $(y=)11x^2 + 2x$ to find δy $22x\delta x + 11(\delta x)^2 + 2\delta x$ Dividing by δx **and** (lim) $\delta x \to 0$ $dy/dx = \lim_{\delta x \to 0} \delta y/\delta x = 22x + 2$	B1 M1 A1 M1 A1 5	Or alternative notation Accept δx^2 as meaning $(\delta x)^2$ FT equivalent level of difficulty CAO. Must follow from correct working *Use of dy/dx throughout or incorrect notation then possible maximum is only 4 marks, final A0*
7	$55x^{11}/11 - 6x - 10x^{-5}/-5$ $5x^{11} - 6x + 2x^{-5}$ or $5x^{11} - 6x + 2/x^5$ + c (constant)	B3 B1 B1 5	B1 for each term ISW from correct unsimplified form. CAO simplified form Awarded only if at least B1 is awarded for integration

8	$\frac{4x+1}{6} = \frac{x^2}{2} - 2x + 3$ or $6(\frac{1}{2}x^2 - 2x + 3) = 4x + 1$ or equivalent	M1	For M1 allow intention, with no more than 1 slip or for use of $y = 4x/6 + 1$ or $y = 4x + 1/6$
	$3x^2 - 16x + 17 = 0$ or $\frac{x^2}{2} - \frac{8x}{3} + \frac{17}{6} = 0$ or equivalent	A1	CAO. Must be equated to zero. '=0' may be implied in further work to solve, if no further work and not '=0' then A0
	$x = \frac{-(-16) \pm\sqrt{((-16)^2 - 4\times3\times17)}}{2\times3}$ or equivalent	m1	Working **must** be seen for m1 to be awarded No further FT from m0 if no working seen Allow 1 slip in substitution (not a slip with the formula) FT provided M1 awarded for equivalent level of difficulty, 3 term quadratic equation Allow $(-16 \pm\sqrt{((-16)^2 - 4\times3\times17)})/(2\times3)$ or $(-16 \pm\sqrt{(16^2 - 4\times3\times17)})/(2\times3)$ as 1 slip On FT, 'their quadratic equation' factorised correctly is awarded m1 A1 (then possible A1 A1)
	$x = \frac{16 \pm\sqrt{52}}{6}$ or equivalent	A1	Do not FT from m1 awarded when there has been 1 slip in substitution
	x = 3.8685... or 3.87 **with** x = 1.46(48...)	A1	ISW. Allow x = 1.465 for x = 1.4648… FT from m1 awarded when there has been 1 slip in substitution
	x = 3.87 **and** y = 2.75 **with** x = 1.46 **and** y = 1.14	A1	FT provided M1, m1 previously awarded, provided not from a slip in substitution, using their unrounded values of x in $(4x + 1)/6$ or $y = x^2/2 - 2x + 3$, but not in an incorrect rearrangement of the given equations, to find y-values correct to 2 d.p. FT values must be written to 2 d.p. Accept answers given as coordinates *Note: Final A0 for premature approximation of x = 1.4648 leading to $y \neq 1.14$*
	<u>Alternative using x = (6y - 1)/4</u>		*<u>Apply same guidance as detailed in the main method</u>*
	$y = \frac{(6y-1)^2}{2\times4^2} - 2\frac{(6y-1)}{4} + 3$ *or equivalent*	*M1*	
	$36y^2 - 140y + 113 = 0$ *or equivalent*	*A1*	*Must equate to zero*
	$y = \{-(-140) \pm\sqrt{((-140)^2 - 4\times36\times113)}\}/2\times36$ *or equivalent*	*m1*	*Working **must** be seen for m1 to be awarded* *Allow 1 slip in substitution (not a slip with the formula)* *FT provided M1 awarded for equivalent level of difficulty*
	$y = (140 \pm\sqrt{3328})/72$ *or equivalent*	*A1*	*Do not FT from m1 awarded when there has been a slip in substitution*
	*y = 2.7456... or 2.75 **with** y = 1.14(3...)*	*A1*	*FT from m1 awarded when there has been 1 slip in substitution*
	*x = 3.87 **and** y = 2.75* ***with** x = 1.46 **and** y = 1.14*	*A1*	*FT to final A1, provided M1, m1 previously awarded using their values of y in (6y - 1)/4 or $y = x^2/2 - 2x + 3$,*

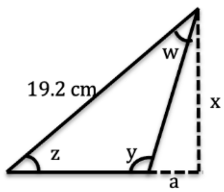
		6	*but not in an incorrect rearrangement of the given equations, to find x-values correct to 2 d.p.*
9	$2 \times \frac{7}{2w+3} + \frac{11}{5w-2}$ $\frac{92w+5}{(2w+3)(5w-2)}$	B2 B3 5	B1 for either fraction, or for (2 ×) 7 ÷ (2w +3) or 11 ÷ (5w – 2), with or without brackets CAO from correct working. Mark final answer FT from B1 for possible B2 or B1 Allow expansion of the denominator, however penalise -1 if the denominator is incorrectly expanded **B2** for any one of the following, or equivalent: *Unsimplified correct working* • $\frac{14(5w-2)+11(2w+3)}{(2w+3)(5w-2)}$ • $\frac{70w-28+22w+33}{10w^2+11w-6}$ *Simplified answers* From B2: FT for a simplified answer following 1 slip in working From B1 FT: • $\frac{57w+19}{(2w+3)(5w-2)}$ from $\frac{7}{2w+3} + \frac{11}{5w-2}$ • $\frac{114w+38}{(4w+6)(5w-2)}$ from $\frac{2 \times 7}{2 \times (2w+3)} + \frac{11}{5w-2}$ • $\frac{114w+38}{(2w+3)(5w-2)}$ from $2 \times \frac{7}{2w+3} + 2 \times \frac{11}{5w-2}$ • $\frac{79w+52}{(2w+3)(5w-2)}$ from $\frac{7}{2w+3} + 2 \times \frac{11}{5w-2}$ **B1** for any one of the following: From B2: • 14(5w – 2) + 11(2w + 3) as a numerator • 70w – 28 + 22w + 33 as a numerator • (2w + 3)(5w – 2) as a denominator • $10w^2 + 11w - 6$ as a denominator From B1 FT: • Numerator for 'their sum of 2 fractions' fully simplified correctly in 'their final answer' • Common denominator for the sum of 'their two fractions' correct in 'their final answer' If no marks, award SC1 for an answer of $\frac{79w+52}{77}$ (from starting with inverted fractions)

10	Intention to integrate $18x^3/3 - 3x^2/2$ or $6x^3 - 3x^2/2$ Use of correct limits 2 & 1 in correct order **and** intention to subtract 37½ or 75/2	M1 A2 m1 A1 5	Intention to integrate (manipulated given, hence not using given or differentiated expression). Sight of integration symbol alone is insufficient A1 for one term correct. Ignore 'c' included CAO, do not accept 37½ + c. Answer only gets no marks. No marks for use of the trapezium rule
11	(Height of can 23.8 ÷ 6.8) 3.5 (cm) $\pi \times$ radius^2 = 6.8 or equivalent (Diameter) 2.9(4...) or 3 (cm) $Rod^2 = 3.5^2 + 2.9(4...)^2$ or Rod = $\sqrt{(3.5^2 + 3^2)}$ 4.57(... cm) or 4.6 (cm)	B1 B1 B1 M1 A1	Allow 3.5(0…) from appropriate working (Radius =1.4712... cm) Do not accept from incorrect working Accept use of diameter = 3 (cm) FT provided at least B2 previously awarded Do not accept truncation to 4.5 (cm) Use of 3 cm diameter gives 4.6(09... cm) *Note:* *Use of the radius leads to $Rod^2 = 3.5^2 + (1.47...)^2$, and Rod = 3.796… (cm) or 3.8 (cm)*
	QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps **AND** • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to present work clearly, with words explaining process or steps **OR** • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	QWC 2 7	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
12	$910x^{12}$	B2 2	B1 for sight of $70x^{13}$ FT to 2nd B1 from $dy/dx = kx^n$ B0 for 70^{13} or 840^{13} or 910^{12}

13	Midpoint $(2 + -4)/2, (7 + -5)/2$ or equivalent $(-1, 1)$ $m = 4$ $\frac{y-1}{x-(-1)} = 4$ or $y - 1 = 4(x + 1)$ or $1 = 4 \times -1 + c$ or $c = 5$ $4x - y + 5 = 0$ or $y - 4x - 5 = 0$	M1 A1 B1 M1 A2 6	Accept (-1, …) or (… , 1) CAO. Allow (x =) -1 (and y =) 1 Award M1 A1 for (-1, 1) if unsupported, provided not from incorrect working FT 'their midpoint' and 'their m' (including -1/4 or 8), provided 'their m' $\neq$ -1, 0 or 1 Must be in the form $ax + by + c = 0$ Only FT for A2 from 'their midpoint' and use of $m = 4$ A1 for $y = 4x + 5$ FT for possible A1 from 'their midpoint' and 'their m' (including -1/4 or 8) for an answer in the form $ax + by + c = 0$
14	$(\sqrt{2}\sin 60° + \sqrt{3}\sin 45° =)\ \frac{\sqrt{2}\sqrt{3}}{2} + \frac{\sqrt{3}}{\sqrt{2}}\ (=\sqrt{x})$ or $\frac{\sqrt{2}\sqrt{3}}{2} + \frac{\sqrt{3}\sqrt{2}}{2}\ (=\sqrt{x})$ $\frac{\sqrt{6}}{2} + \frac{\sqrt{6}}{2} = \sqrt{x}$ or $\frac{\sqrt{6}}{2} + \frac{\sqrt{6}}{2} = \sqrt{6}$ or $\sqrt{6} = \sqrt{x}$ $x = 6$	M1 m1 A1 3	**All** stages of working in the mark scheme must be shown Allow if the sum of LHS terms is squared, i.e. '=x' *Note: if no working shown award M0 m0 A0*
15	$(dy/dx=)\ 6x^2 - 12x$ $dy/dx = 0$ or $6x^2 - 12x = 0$ $x = 0$ and $y = -7$ $x = 2$ and $y = -15$ $d^2y/dx^2 = 12x - 12$ At $(0, -7)$: $d^2y/dx^2 < 0$, point is a maximum At $(2, -15)$: $d^2y/dx^2 > 0$, point is a minimum	B1 M1 A1 A1 M1 A1 A1 7	 FT their dy/dx form $ax^2 + bx$ throughout If A0, A0 here, award A1 for $x = 0$ with $x = 2$ *Answer only, no working shown M0 A0 A0* *Method for determining min or max MUST be shown, final answer only is M0 here, then A0,A0* Or first derivative test, interpretation of first derivative test. Or alternative. FT for their x value (ignore y-values) FT for their other x value provided this does not have the same interpretation as the first x value (ignore y-values) *SC1 for correct FT from $d^2y/dx^2 = ax + b$, $a>0$, including allowed FT from $d^2y/dx^2 = 12x$, with x=0 as maximum and x=2 as a minimum (despite $d^2y/dx^2 = 0$)* *Do not accept trial & improvement methods unless both stationary points are found correctly and confirmed as stated in the mark scheme*

16	$(x+14)^2$ (± …) or $(x+28/2)^2$ (± …) or $(x+a)^2 + b$ with a = 14 or equivalent (Minimum value when x =) -14 (Minimum value is) -96	M1 A1 A1 3	Ignore 'their (± …)' or '=0' Do not accept method dy/dx =2x+28 CAO. Must be from $(x+14)^2$ CAO. Must be from completing the square, $(x+14)^2 - 96$ or $(x+14)^2 - 196 + 100$ Use of quadratic formula is awarded M0 A0 A0
17	(a) $\frac{(x+3)(x-3)}{(x+3)(x+5)}$ $\left(= \frac{x-3}{x+5}\right)$ (provided $x \neq -3$) (b) $x - 3 = (x-3)(x+5)$ $x^2 + x - 12 = 0$ or $(x-3)(x+5-1) = 0$ $(x+4)(x-3) = 0$ Both answers x = -4 and x = 3	B2 M1 m1 M1 A1 6	B1 for sight of either the correctly factorised numerator or denominator *Do not accept cross multiplying to show LHS = RHS* Must be rearranged, '= 0' FT from M1 for 'their quadratic' If quadratic formula used must be correct to simplified form $(n \pm \sqrt{m})/p$ Must be from appropriate working <u>If no marks</u>: from $\frac{x-3}{x+5} = x - 3$ award • SC1 for $1 = \frac{1}{x+5}$ or $x + 5 = 1$ or SC2 for x = -4 OR • SC2 for x = 3 <u>*If part (a) not used to '**hence** solve', allow*</u> *SC1 for $x^3 + 4x^2 - 9x - 36 = 0$* *(from $(x+3)(x-3) = (x-3)(x+3)(x+5)$)* *AND for following correct working SC1 for any one of* • *$(x^2 - 9)(x+4)$* • *$(x+3)(x^2 + x - 12)$* • *$(x-3)(x^2 + 7x + 12)$* • *$(x+3)(x-3)(x+4) = 0$* • *x = -3, x = 3, x = -4* *OR* *SC1 for x = -4 from $x^2 + 8x + 15 = x + 3$* *or $x^2 + 7x + 12 = 0$*

18	When $x = 1$, finding $y = -3$ $dy/dx = 4x - 10$ (when $x = 1$) gradient is -6 Use of $\frac{y - y_1}{x - x_1} = m$ or $y = mx + c$ $y + 3 = -6(x - 1)$ or $-3 = -6\times1 + c$, $c = 3$ $y = -6x + 3$	B1 M1 A1 M1 A1 A1 6	 Ignore notation, e.g. $y = 4x - 10$, provided clear not from any wrong method. Must be from sight of $dy/dx = 4x - 10$ Method to form equation with appropriate substitution for at least two of x, y and m. FT 'their derived y value' and 'their derived gradient'. Needs to be $x = 1$, do not FT 'their x' FT for $x = 1$, 'their y' and 'their derived m' CAO. Must be in this form
19	(a) General $y = \tan 2x$ form • passing through (0°,0), (90°,0) and (180°,0) as unique intersections with the x-axis **<u>with</u>** • asymptotes uniquely at 45° and 135° (b) 42.(1447...°) **and** 132.(1447...°)	B2 B2 4	For B2, sketch must not cross or touch asymptotes, maximum of B1 if cross or touch of asymptotes seen, or 'curve away' from the asymptotes If asymptotes are not shown it must be clear there is no overlap of the curves (mark intention) B1 for general $y = \tan 2x$ form • passing through (0°,0), (90°,0) and (180°,0) as unique intersections with the x-axis **<u>or</u>** • asymptotes uniquely at 45° and 135° These values need to be selected, not amongst others unless unambiguously indicated as the response. B1 for sight of any one of the following: • 42.(1447...°) • 132.(1447...°) • a pair of positive angles, a and b, such that $0 < a < b < 180$ and $b - a = 90$.

20	$\cos y = \frac{9.7^2 + 10.8^2 - 19.2^2}{2\times9.7\times10.8}$ or cosy = -0.753675... (y =) 138.9(097...°) or 139(°) $\sin(180 - 138.9) = \frac{x}{9.7}$ or $\sin 41 = \frac{x}{9.7}$ or x = 9.7 × sin (180 – 138.9) or x = 9.7 × sin 41.1 Vertical height (x), answer in the range 6.36(cm) to 6.4 (cm) *Alternatives:* 	M2 A1 m1 A1 5	M1 for $19.2^2 = 9.7^2 + 10.8^2 - 2\times9.7\times10.8\times\cos y$ Or alternative **full** method FT provided M1 previously awarded provided 90 < 'their 139' <180 Must be from correct working *<u>Alternative method</u>* *$a^2 + x^2 = 9.7^2$ AND $x^2 + (a + 10.8)^2 = 19.2^2$* M1 *$(a + 10.8)^2 - a^2 = 19.2^2 - 9.7^2$* m1 *$21.6a = 19.2^2 - 9.7^2 - 10.8^2$* m1 *a = 7.3(106... cm)* A1 *(Vertical height x =) 6.36(cm) to 6.4(cm)* B1 *(from correct working)*
	$\cos z = \frac{19.2^2 + 10.8^2 - 9.7^2}{2\times19.2\times10.8}$ or cosz = 0.94326… *z = 19.393…(°)or 19.4(°)* *$\sin z = \frac{x}{19.2}$ or x = 19.2 × sin19.393..* *Vertical height (x), answer in the range 6.36(cm) to 6.4 (cm)*	*M2* *A1* *m1* *A1* *5*	*M1 for $9.7^2 = 19.2^2 + 10.8^2 - 2\times19.2\times10.8\times\cos z$* *Allow rounded to 19(°)* *FT provided M1 previously awarded* *Must be from correct working*
	$\cos z = \frac{19.2^2 + 10.8^2 - 9.7^2}{2\times19.2\times10.8}$ or cosz = 0.94326… *z = 19.393…(°)or 19.4(°)* *$\sin y = 19.2 \times \frac{\sin 19.393\ldots}{9.7}$ or y = 138.9(097...°)* *or 180 – 138.9(097...°) (= 41.1..)* ***<u>AND</u>*** *$\sin(180 - 138.9..) = \frac{x}{9.7}$ or x = 9.7 × sin 41.1* *or x = 9.7 × sin(180 – 138.9..)* *Vertical height (x), answer in the range 6.36(cm) to 6.4 (cm)*	*M2* *A1* *m1* *A1* *5*	*M1 for $9.7^2 = 19.2^2 + 10.8^2 - 2\times19.2\times10.8\times\cos z$* *Allow rounded to 19(°)* *FT provided M1 previously awarded* *Allow $\sin 138.9.. = \frac{x}{9.7}$ or x = 9.7 × sin138.9…* *Must be from correct working*
	$\cos w = \frac{19.2^2 + 9.7^2 - 10.8^2}{2\times19.2\times9.7}$ or w = 21.697…(°) ***AND*** *$\sin y = 19.2 \times \frac{\sin w}{10.8}$* *(y =)138.9(097...°) or 139(°)* *or 180 – 138.9(097...°) (= 41.09…°)*	*M2* *A1*	*M1 for $10.8^2 = 19.2^2 + 9.7^2 - 2\times19.2\times9.7\times\cos w$* ***AND*** *$\frac{\sin y}{19.2} = \frac{\sin w}{10.8}$*

	sin(180 – 138.9) = $\frac{x}{9.7}$ or x = 9.7 × sin 41.1 or equivalent	*m1*	*FT provided M1 previously awarded provided 90 < 'their 139' <180*
	Vertical height (x), answer in the range 6.36(cm) to 6.4 (cm)	*A1*	Must be from correct working
		5	