Pilot Assessment Schedule – 2023

Mathematics and Statistics: Demonstrate mathematical reasoning (91947)

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$T = \pi \times \sqrt{\frac{2.5 \times 0.9659}{9.81}}$ $= \pi \times \sqrt{0.2462}$ $= \pm\pi \times 0.4961$ $= \pm 1.5587$ $\pm$ Not required. Allow C.A.O.	• Correct answer.		
(b)(i)	Area of one label $= 2\pi \times 4.5 \times 15$ $= 424.115\text{ cm}^2$ Total Area of all labels $=12 \times 424.115$ $= 5089.38\text{ cm}^2$ Allow any sensible rounding. Allow $1620\pi\text{ cm}^2$.	• Area of one label. OR Total Area of all labels but with a minor error.	• Correct answer.	
(ii)	Volume of one tin $= 15\pi p^2$ Volume of 12 tins $= 180\pi p^2$ Volume of the box $= 720p^2$ Volume of space $= 720p^2 - 180\pi p^2$ $= 180p^2(4 - \pi)$ Proportion Space $= \frac{180p^2(4-\pi)}{720p^2}$ $= \frac{(4-\pi)}{4}$	• Volume of one tin $= 15\pi p^2$ OR Volume of one box $= 720p^2$	• Volume of space $= 180p^2(4 - \pi)$ OR Proportion space with a minor error.	• Correct working.
(c)(i)	$AB^2 = 70^2 + 140^2$ $AB^2 = 24\,500$ $AB = \sqrt{24\,500}$ $AB = 156.52\text{ km}$ Not required to show that angle APB = 90°	• Correct answer, with appropriate working.		
(ii)	$\tan\angle ABP = \frac{70}{140}$ $\angle ABP = \tan^{-1}\left(\frac{70}{140}\right)$ $\angle ABP = 26.57°$ Required bearing $= 180° + 120° + 26.57°$ $= 326.57°$ Allow other valid methods.	• Finding, with appropriate working that $\angle ABP = 26.57°$ OR CAO	• Correct bearing.	

(iii)	Using speed $= \dfrac{\text{distance}}{\text{time}}$ For ship W: $k = \dfrac{70}{\text{Time}_W}$ $\text{Time}_W = \dfrac{70}{k}$ For ship V: $S_V = \dfrac{140}{\text{Time}_V}$ $\text{Time}_V = \dfrac{70}{S_V}$ But $\text{Time}_W + \text{Time}_V = 4$ $\dfrac{70}{k} + \dfrac{140}{S_V} = 4$ $\dfrac{140}{S_V} = 4 - \dfrac{70}{k}$ $\dfrac{140}{S_V} = \dfrac{4k-70}{k}$ $S_V = \dfrac{140k}{4k-70}$ Allow equivalent solutions.	• Expression for time of ship W. OR Expression for time of ship V. OR $y = \dfrac{140}{4}$ AND $k = \dfrac{70}{4}$	• Forming the equation $\dfrac{70}{k} + \dfrac{140}{S_V} = 4$ OR Correct expression for S_V, but with a minor error. OR $v = 2k$	• Correct expression for S_V.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE question attempted towards solution.	1u	2u	3u	1r	2r	t1	t2

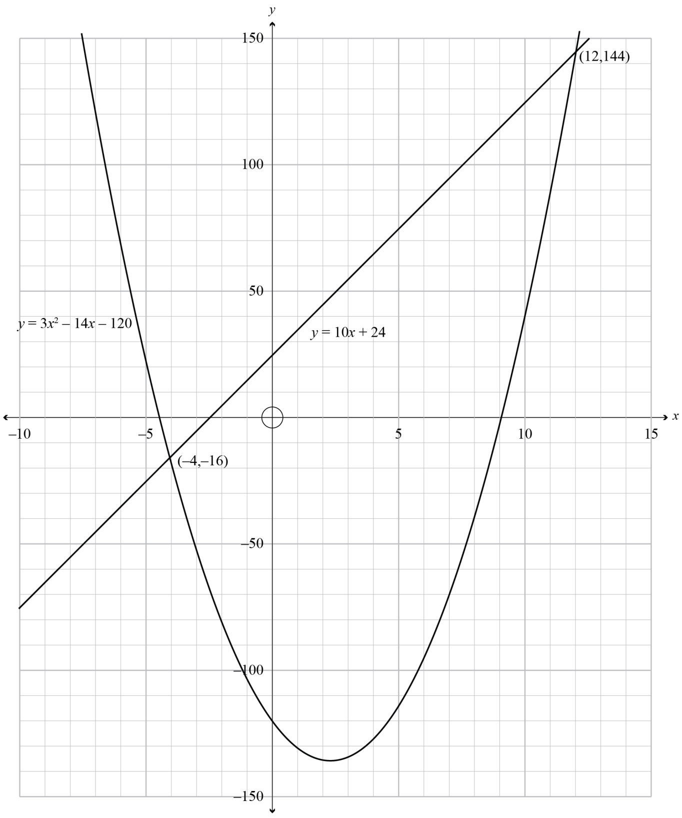
Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	$\angle\text{HAB} = \dfrac{(8-2)\times 180°}{8}$ $= 135°$ $\angle\text{ZAB} = v = \dfrac{135°}{2} = 67.5°$ Do not allow assumption of $v = 67.5°$.	• Clear and justified working to show that $v = 67.5°$.		
(ii)	In triangle ZAX: $\sin 67.5 = \dfrac{\text{XZ}}{120}$ $\text{XZ} = 120 \times \sin 67.5$ $\text{XZ} = 110.87$ cm Also $\cos 67.5 = \dfrac{\text{AX}}{120}$ $\text{AX} = 120 \times \cos 67.5$ $\text{AX} = 45.92$ cm Area of triangle ZAX: $= \dfrac{1}{2} \times 45.92 \times 110.87$ $= 2545.69 \text{ cm}^2$ Area of whole octagon: $= 16 \times 2515.69$ $= 40\,730.99 \text{ cm}^2$ Allow other valid methods.	• Finding, with appropriate working that XZ = 110.87 cm. OR Finding, with appropriate working that AX = 45.92 cm. OR Consistent area of triangle. OR Area of octagon, but with a minor error.	• Correct answer for the area of the whole octagon.	
(iii)	For the n-sided table: $\angle\text{HAB} = \dfrac{(n-2)\times 180°}{n}$ $\angle\text{ZAB} = v = \dfrac{(n-2)\times 180°}{2n}$ In triangle ZAX: $\sin\left(\dfrac{(n-2)\times 180}{2n}\right) = \dfrac{\text{XZ}}{\text{p}}$ $\text{XZ} = p\sin\left(\dfrac{(n-2)\times 180}{2n}\right)$ Also $\text{AX} = p\cos\left(\dfrac{(n-2)\times 180}{2n}\right)$ Area of triangle ZAX: $= \dfrac{1}{2} \times p^2 \times \sin\left(\dfrac{(n-2)\times 180}{2n}\right) \times \cos\left(\dfrac{(n-2)\times 180}{2n}\right)$ Area of triangle ZAB: $= p^2 \times \sin\left(\dfrac{(n-2)\times 180}{2n}\right) \times \cos\left(\dfrac{(n-2)\times 180}{2n}\right)$ Area of whole polygon: $= np^2 \times \sin\left(\dfrac{(n-2)\times 180}{2n}\right) \times \cos\left(\dfrac{(n-2)\times 180}{2n}\right)$	• Finding expression for angle v. OR Finding expression for height h. OR Finding expression for AX.	• Finding expression for area of triangle ZAX. OR Finding consistent expression for area of whole polygon. OR Finding expression for area of whole polygon, with one error.	• Finding a correct expression for the area of the whole polygon table. Allow one minor error.

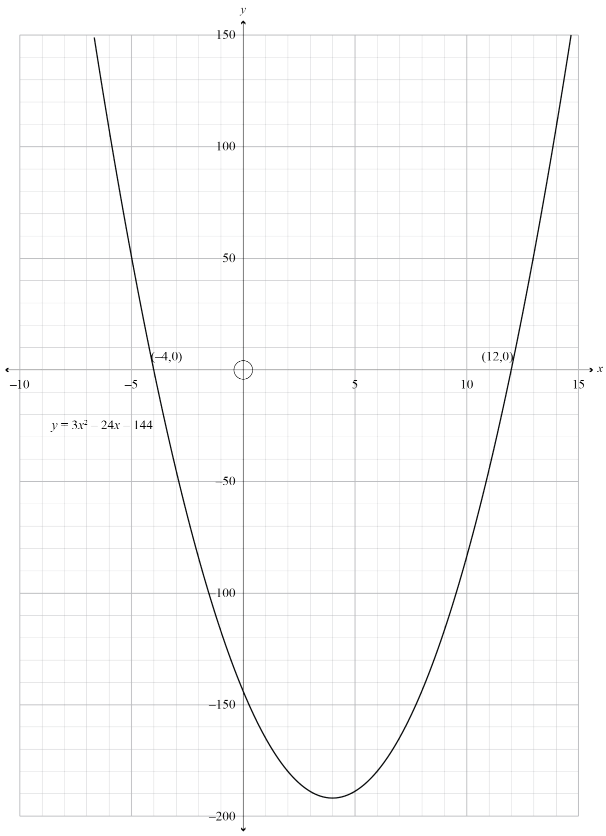
	Alternative Method In triangle ZAX: $\mathrm{AX} = p\cos\left(\dfrac{(n-2)\times180}{2n}\right)$ Then Pythagoras' theorem in triangle ZAX gives: $\mathrm{XZ}^2 = p^2 - p^2\cos^2\left(\dfrac{(n-2)\times180}{2n}\right)$ $\mathrm{XZ} = \sqrt{p^2 - p^2\cos^2\left(\dfrac{(n-2)\times180}{2n}\right)}$ $\mathrm{XZ} = p\sqrt{1-\cos^2\left(\dfrac{(n-2)\times180}{2n}\right)}$ Area of triangle ZAB $= p^2\times\sqrt{1-\cos^2\left(\dfrac{(n-2)\times180}{2n}\right)}\times\cos\left(\dfrac{(n-2)\times180}{2n}\right)$ Area of whole polygon $= p^2\times\sqrt{1-\cos^2\left(\dfrac{(n-2)\times180}{2n}\right)}\times\cos\left(\dfrac{(n-2)\times180}{2n}\right)$ Or equivalent solution.			
(b)(i)	Perimeter = 100 cm $2x + 2y = 100$ $x + y = 50$ $y = 50 - x$ OR $y^2 = x^2 + 10^2$ $y = \sqrt{x^2+100}$ OR equivalent.	• Finding any correct equation involving x and y.	• Finding y in terms of x.	
(ii)	Pythagoras Theorem: $x^2 + 10^2 = (50 - x)^2$ #1 $x^2 + 100 = 2500 - 100x + x^2$ $100x = 2400$ $x = 24$ cm Area of triangle $\frac{1}{2}\times48\times10 = 240\text{ cm}^2$	• Expanding RHS to (#1). OR Consistent simplification to equation in its simplest form. OR CAO	• Finding $x = 24$ cm. OR Area of triangle but with a minor error.	• Area of triangle found.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE question attempted towards solution.	TWO questions attempted towards solution.	1u	2u	1r	2r	t1	t2

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	y = $5x + 15$ Accept $5x + 15$	Correct answer.		
(ii)	$y = 2x^2 - 2x$ Allow any equivalent version.	Coefficient of x^2 or x correct. AND Recognition of a quadratic equation.		
(iii)	$2x^2 - 2x = 5x + 15$ $2x^2 - 7x - 15 = 0$ (#1) $(2x + 3)(x - 5) = 0$ $2x + 3 = 0$ AND $x - 5 = 0$ $x = \frac{-3}{2}$ AND $x = 5$ Allow any equivalent form. Allow consistency from (i) and (ii) as long as quadratic equation is formed.	Formaing the quadratic equation in three terms (# 1) OR Consistent factorisation of quadratic at Level 6.	Both values of x.	
(b)	Accurate graph drawn of $y = 10x + 24$ Accurate graph drawn of $y = 3x^2 - 14x - 120$ Intersection points identified $x = 12$ and $x = -4$ Allow the algebraic rearrangement to $3x^2 - 24x - 144 = 0$ or $x^2 - 8x - 48 = 0$ and then a graphical method using either of these graphs Do not allow C.A.O. Must have evidence of a graphical method for the award of grade r or grade t.	Accurate graph of any of $y = 3x^2 - 14x - 120$ $y = 3x^2 - 24x - 144$ $y = x^2 - 8x - 48$ OR Both intersection points identified algebraically. OR Evidence of a systematic process involving tables and method of trial and improvement for the two solutions.	Both intersection points identified, but not accurately.	Both intersection points identified accurately. AND with evidence of use of an accurate graph.
(c)	Area = 20 $\frac{1}{2} \times x \times (2x + x + 7) = 20$ (#1) $x(3x + 7) = 40$ $3x^2 + 7x - 40 = 0$ $(3x - 8)(x + 5) = 0$ (#2) Either $3x - 8 = 0$ or $x + 5 = 0$ $x = \frac{8}{3}$ or $x = -5$ ignore	Setting up relevant equation (#1) OR Consistent factorisation	Reaching stage (#2) OR Consistent solutions	$x = \frac{8}{3}$ with evidence that $x = -5$ has been ignored.

Solution to Question Three (b)





NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE point made incompletely.	1u	2u	3u	1r	2r	1t	2t

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24