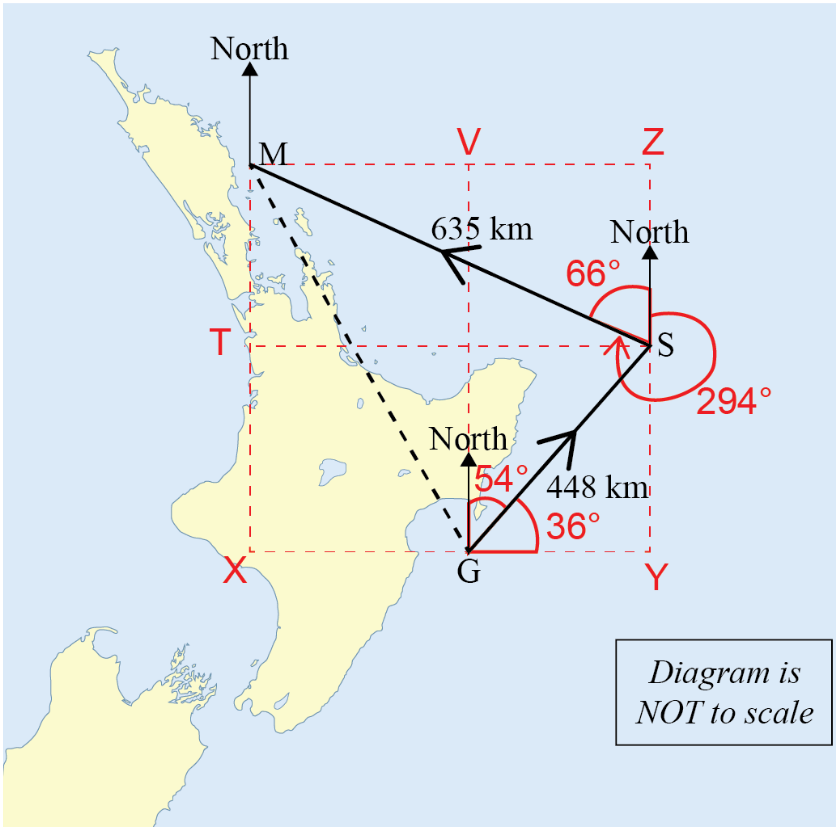
Assessment Schedule – 2019

Mathematics and Statistics: Apply geometric reasoning in solving problems (91031)

Evidence

Q ONE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	∠AED = 58° (∠s in triangle add to 180°) x = ∠AGB = 58° (corr ∠s, // lines =) OR alternative method.	Correct angle OR one step shown.	Correct angle found with at least one valid reason.	
(b)	EK = 2.8 × tan 46 = 2.8995 Area of Triangle AHE = ½ × 4 × 2.8995 = 5.799 m² *(Units not required.)* *(Accept any rounded solution.)*	Calculation of EK (height of triangle AHE) OR consistent calculation of area of triangle using incorrect height.	Area of Triangle AHE found.	
(c)	Showing that triangle P and triangle Q are similar to each other, by considering the AAA rule. Ratio of lengths of the triangles = 3.6 / 1.44 = 2.5. Height of triangle P $= H = \sqrt{(6^2 - 1.8^2)} = 5.724 \text{ m}$ Height of triangle Q $= h = \frac{5.724}{2.5} = 2.289 \text{ m}$ Area of triangle P = ½ × 3.6 × 5.724 = 10.303 m². Area of triangle Q = ½ × 1.44 × 2.289 = 1.648 m² Total sail area = 10.303 + 1.648 = 11.95 m² So sails are not big enough for top speed. OR Ratio of Area P : Area Q Gives Area P = 2.5^2 × Area Q.	Showing triangles are similar OR calculation of height, H, of triangle P OR calculation of ratio of lengths between the two triangles.	Calculation of area of either sail P or sail Q.	Calculation of total sail area AND conclusion that sails not of ideal size.

(d)	SY = 448 × sin 36° = 263.33 km GY = 448 × cos 36° = 362.44 km MZ = 635 × sin 66° = 580.10 km SZ = 635 × cos 66° = 258.28 km MX = 258.28 + 263.33 = 521.61 km GX = 580.10 – 362.44 km = 217.66km $\angle MGX = \tan^{-1}\left(\frac{521.61}{217.66}\right) = 67.3°$ So required bearing = 270° + 67.3° = 337.3°	One correct length from: SY, GY, MZ, SZ.	One correct length from: MX or GX.	Required bearing found.



N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	One point made incompletely.	1 of u	2 of u	3 of u	2 of r	3 of r	1 of t	2 of t

Q TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)(i)	Use of Pythagoras to find $h = \sqrt{(8^2 - 4.9^2)} = 6.32\text{m}$	Showing, with evidence of working, that h = 6.32 m.		
(ii)	Use of Pythagoras to find $\text{MQ} = \sqrt{11^2 - 6.32^2} = 9$ m So g = PQ = MQ – MP = 9 – 4.9 = 4.1 m. *(Units not required)*	Finding length MQ OR finding length g, using incorrect h, from consistent calculations from (i).	Finding g = 4.1 m.	
(iii)	In triangle MPN, $\angle\text{MPN} = \tan^{-1}\left(\frac{6.32}{4.9}\right)$ $= 52.2$ In triangle MPY, MY = 4.9 × sin 52.2 = 3.87 m. PY = 4.9 × cos 52.2 = 3 m. Total length = 3.87 + 3 + 4.9 = 11.77 m *(Units not required)* OR alternative method.	Calculation of ∠MPN	Finding length MY OR length PY	Finding perimeter.
(b)(i)	∠SAH = 90 (Angle between tangent and radius). ∠AGH = 90 (Angle in semicircle is a right angle) ∠GAH = 90 – p ∠GHA = 180 – 90 – (90 – p) = 180 – 90 – 90 + p = p ∠GBA = ∠GHA = p (Angles in the same segment are equal) So ∠SAG = ∠AHG = ∠GBA = p. As required. OR *Use of Alternate Segment Theorem could be utilised e.g.* ∠SAG = p = ∠AHG (alt seg thm) ∠GBA = ∠GHA = p (Angles in the same segment are equal) So ∠SAG = ∠AHG = ∠GBA = p. As required. Note: "**alt seg thm**" may also be expressed more fully, as: *the* ***angle between a chord and a tangent*** *is equal to an angle at the circumference that sits on the chord in* ***the alternate segment.***	Evidence of use of one circle theorem included in a calculation. e.g. Recognising that ∠GHA = ∠GBA, with reason. OR e.g. Recognising that ∠GAH = 90 – p OR two steps, having substituted a numerical value for p.	Proof completed but with imperfect reasoning. OR proof connecting ∠GAS and either ∠GHA or ∠GBA, with reasoning.	Three angles shown to all be equal to each other in a conclusive statement.

Q TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(b)(ii)	$\angle VRU = \frac{(180-38)}{2} = 71$ ($\angle$sum of isos triangle) $\angle$URT = 38 (Using the result of part (i) of question or Alternate Segment Theorem). So $\angle$VRS = q = 180 – 71 – 38 = 71 (Angles on a straight line add to 180 OR using part (i) of question or Alternate Segment Theorem) OR By adding to the diagram, centre O and radii OU and OR. $\angle$UOR = 2 x 38 = 76° ($\angle$@ centre = 2 x $\angle$ @ circ) $\angle VRU = \frac{180-38}{2} = 71^\circ$ ($\angle$sum of isos triangle) $\angle ORU = \frac{180-76}{2} = 52^\circ$ ($\angle$sum of isos triangle) $\angle$VRO = 71 – 52 = 19 So q = $\angle$VRS = 90 – 19 = 71° (rad & tangent property)	Correct angle OR one step shown.	Finding angle q, with at least one valid reason.	

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No response; no relevant evidence.	One point made incompletely.	1 of u	2 of u	3 of u	2 of r	3 of r	1 of t	2 of t

Q THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	∠EBM = 58° (alternate ∠s, // lines =) ∠EMB = 58° (base angles of isosceles triangle equal) ∠MEB = 180 – 58 – 58 = 64° (angle sum of triangle = 180) OR Alternative method.	Correct angle OR one step shown.	Correct angle found with at least one valid reason.	
(b)	∠CML = 90° (angle between tangent and radius is 90). So triangle CML is a right-angled triangle ∠MLC = 36° (bisecting ∠MLN) LC = 28 / sin 36 = 47.64 mm. *(Units not required)*	Find length LC OR finding angles ∠CML and ∠MLC.	Finding length LC, including justification of the right-angled triangle CML.	
(c)	∠DEB = 90° (angle in a semicircle is a right-angle) ∠EAB = 180° – x (opposite angles of a cyclic-quad add up to 180) ∠DBE = 180° – 90 – x = 90 – x (angle sum of triangle BDE) $\angle ABE = \frac{180-(180-x)}{2}$ $= \frac{180-180+x}{2} = \frac{x}{2}$ (base angles of an isosceles triangle are equal) $\angle DBA = 90 - x + \frac{x}{2}$ $= 90 - \frac{x}{2}$	One step shown involving calculation of an angle involving x i.e. Finding ∠DBE or ∠EAB OR two steps, having substituted a numerical value for x.	Finding two angles, involving calculations including x, with at least one valid reason.	Finding ∠DBA, in terms of x, with clear justification.
(d)	∠PNM = 135° (internal angle of a regular polygon). Let Z be the midpoint of NM. ∠CNM = 67.5° (symmetry) CZ = r × sin 67.5° (or cos 22.5°) = 0.9239 r NZ = r × cos 67.5° (or sin 22.5°) = 0.3827 r NM = 2 × 0.3827 r = 0.7654 r Area = ½ × 0.7654 r × 0.9239 r = 0.3536 r^2 Total Area = 8 × 0.3536 r^2 = 2.8285 r^2	Finding ∠CNM = 67.5°, Or ∠NCZ = 22.5° with justification. Accept any rounding / truncation.	Finding an expression for the total area, having substituted a numerical value for r OR finding length CZ or length NZ, in terms of r, with clear working.	Finding an expression for the total area in terms of r, with clear working.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 19	20 – 24