

91031



Draw a cross through the box (X) if you have NOT written in this booklet

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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Mathematics and Statistics 2023

91031 Apply geometric reasoning in solving problems

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply geometric reasoning in solving problems.	Apply geometric reasoning, using relational thinking, in solving problems.	Apply geometric reasoning, using extended abstract thinking, in solving problems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

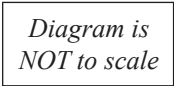
If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Angle PSR = angle PRQ = 90° , SR = 12 metres, PS = 8 metres, PQ = 45 metres.



Show your working clearly.

- The zip-line cable is attached joining A to B, then B to G, and then G to H.

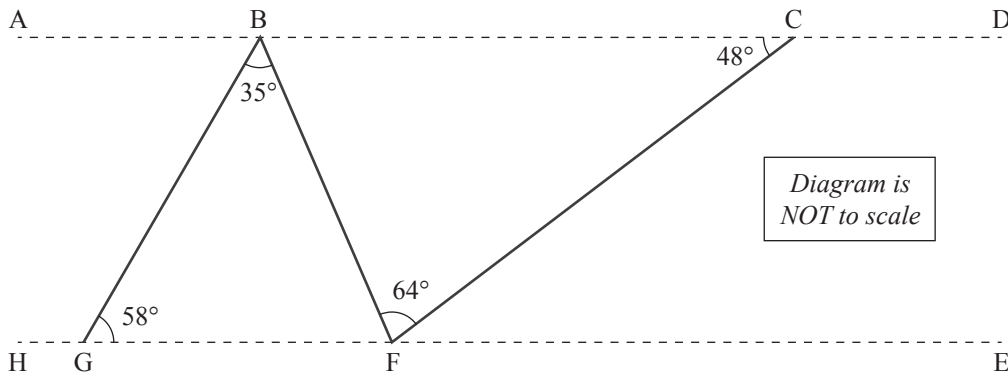
An advertisement claims “more than 200 metres of zip-line fun”.



- (c) The diagram below represents another zip-line design.

The designers claim that the straight lines ABCD and HGFE are parallel to each other.

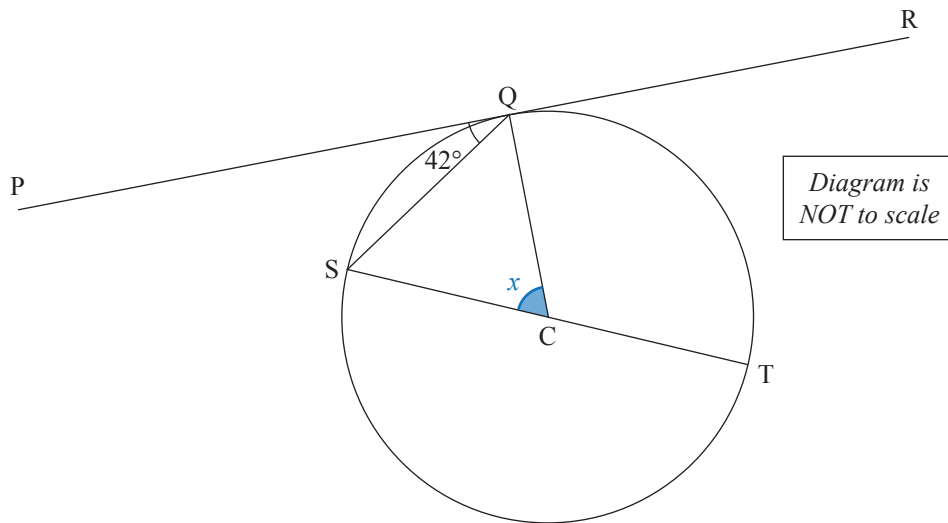
Angle GBF = 35° , angle BGF = 58° , angle BFC = 64° , angle BCF = 48° .



Show whether the designers' claim is true.

Justify your answer with clear geometric reasoning.

- (d) The points Q, S, and T all lie on the circumference of a circle, with centre C. The straight line PQR is a tangent to the circle at Q. SCT is a diameter of the circle. Angle PQS = 42° .

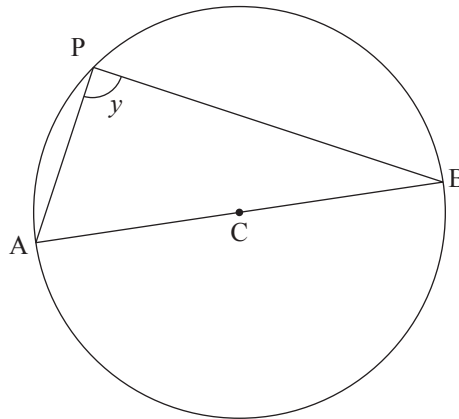


Find the size, x , of angle QCS.

Justify your answer.

- (e) The points A, B, and P all lie on the circumference of a circle, centre C.

A student says that the size of angle APB, y , will always be 90° , whatever the size of the circle or the position of P on the circumference.



Prove that the student is correct.

Justify your answer with clear geometric reasoning.

QUESTION TWO

- (a) The points P, Q, R, and S all lie on the circumference of a circle, centre C.
Angle PTQ = 110° , angle QSR = 40° .

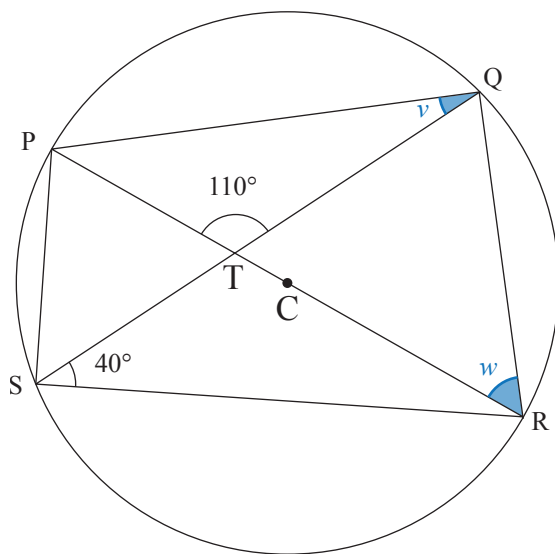


Diagram is
NOT to scale

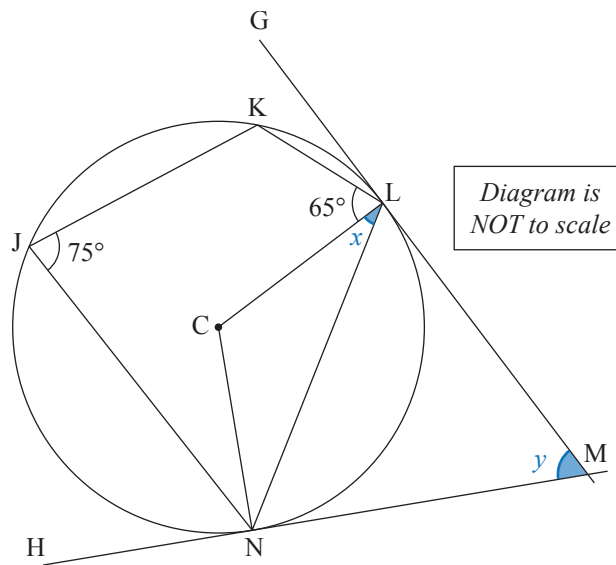
- (i) Find the size, v , of angle PQS.

Justify your answer.

- (ii) Find the size, w , of angle PRQ.

Justify your answer with clear geometric reasoning.

- (b) The points J, K, L, and N all lie on the circumference of a circle, centre C. Straight lines GLM and HNM are both tangents to the circle at L and N respectively. Angle $KLC = 65^\circ$, angle $KJN = 75^\circ$. Angle $KLC = 65^\circ$, angle $KJN = 75^\circ$.

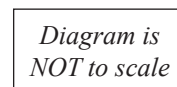


- (i) Show that the size, x , of angle CLN is 40° .

Show your working clearly.

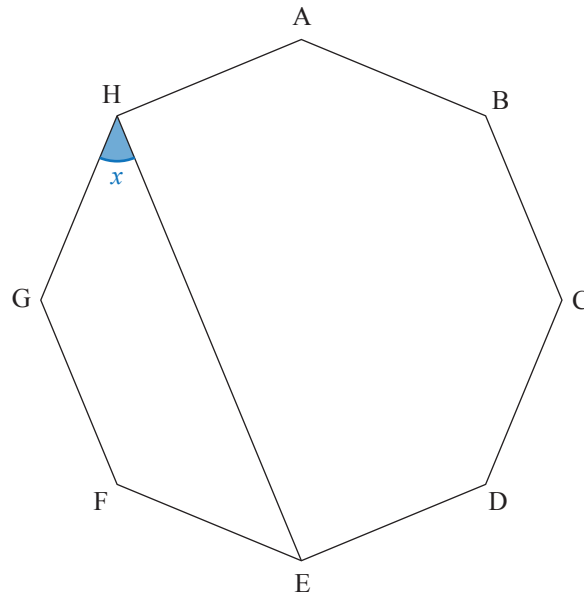
- (ii) Find the size, y , of angle LMN .

Justify your answer with clear geometric reasoning.



QUESTION THREE

- (a) The diagram below shows a regular octagon.



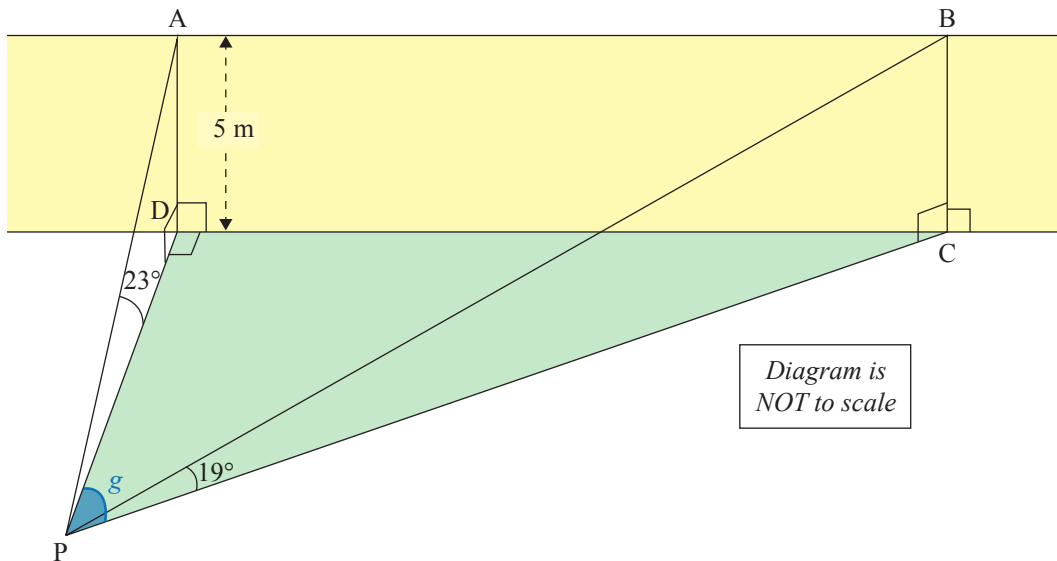
Find the size, x , of angle GHE.

Justify your answer.

- (c) The diagram below represents a vertical yellow wall, ABCD, built on horizontal flat ground, CDP.

$$\text{Angle PDA} = \text{Angle PCB} = \text{Angle PDC} = \text{Angle ADC} = \text{Angle BCD} = 90^\circ.$$

Angle APD = 23° , Angle BPC = 19° . AD = 5 metres. The line AB is parallel to the line DC.



- (i) Petra is stood directly in front of the wall, at the point P.

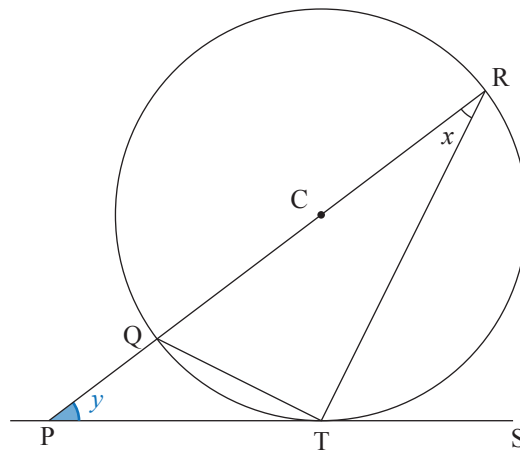
Calculate the shortest distance, PD, from Petra to the wall.

Show your working clearly.

- (ii) Angle g is the angle on the ground between the lines PD and PC.

Find the size, g , of angle DPC.

- (d) The points Q, R, and T all lie on the circumference of a circle, with centre C. The straight line PTS is a tangent to the circle, at T. Angle QRT = x .



Find the size, y , of angle RPT, giving your answer in terms of x .

Justify your answer with clear geometric reasoning.

Extra space if required.
Write the question number(s) if applicable.

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