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Level 1 Mathematics and Statistics 2020

91031 Apply geometric reasoning in solving problems

9.30 a.m. Friday 20 November 2020
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.

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

TOTAL

ASSESSOR'S USE ONLY

THE GEOMETRY OF SPIDER WEBS

ASSESSOR'S USE ONLY

Spiders create their webs with amazingly detailed geometrical designs, which humans often try to copy. The diagrams in this assessment model parts of different spider webs.

https://pixabay.com/photos/spider-web-dew-pattern-insect-617754/

QUESTION ONE

(a) The section of one spider web shown below has two connecting right-angled triangles.

Angle PQS = 63° QS = 16.4 cm

Angle RQS = Angle QPS = 90° QR = 7.5 cm

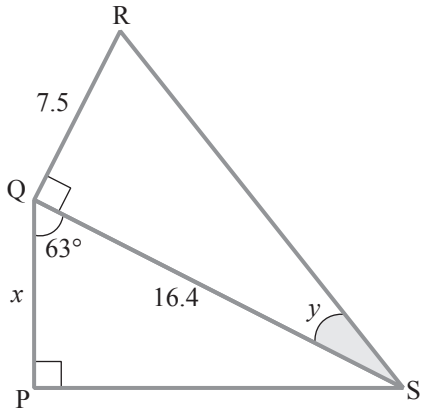

Diagram is NOT to scale

(i) Calculate the length, x, from P to Q.

Show your working clearly.

ASSESSOR'S USE ONLY

(ii) Calculate the size, y, of angle QSR.

Show your working clearly.

(b) Some of the strands from a different spider web are shown below.

Straight lines ABC and EFG are parallel to each other.

Angle CBD = 28° Angle BDF = 136°

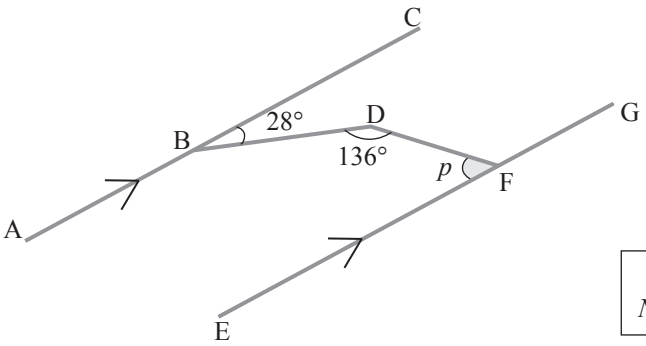

Diagram is NOT to scale

Calculate the size, p, of angle DFE.

Justify your answer with clear geometrical reasoning.

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(c) Spiders often use trees to support their webs.

Angle JKM = 32° KJ = 12.5 cm JH = 21.2 cm NH = 9.4 cm

Angle KMJ = Angle JNH = 90°

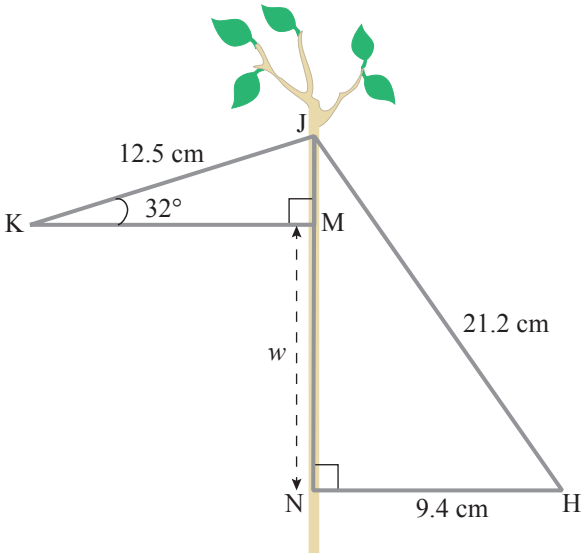


Diagram is NOT to scale

Calculate the length, *w*, from M to N.

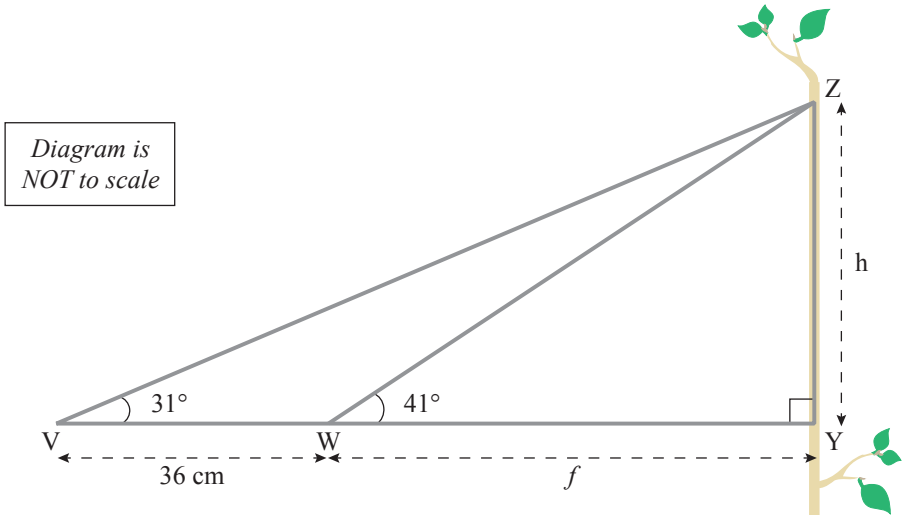
Show your working clearly.

ASSESSOR'S USE ONLY

(d) Spider web strands link together to increase their strength.

Angle ZVY = 31° Angle VYZ = 90°

Angle ZWY = 41° VW = 36 cm



Calculate the length, f, from W to Y.

Show your working clearly.

QUESTION TWO

ASSESSOR'S USE ONLY

Sometimes holes can appear in a spider web.

https://www.patternpictures.com/part-of-a-spider-web-close-up-on-green-backdrop/

(a) Below is part of a spider web with a hole in it.

Points P, Q, and R all lie on the circumference of a circle, with centre C.

Angle PRC = 25°

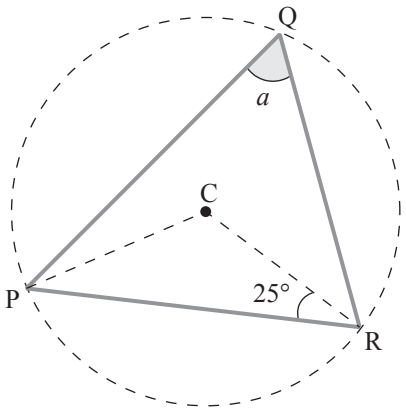


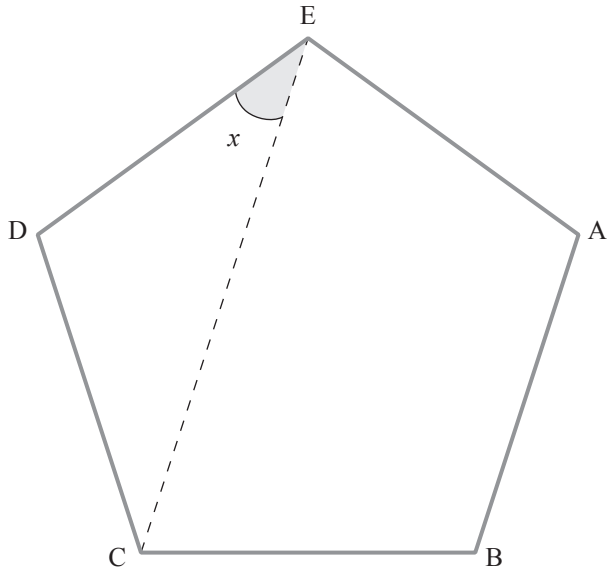
Diagram is NOT to scale

Calculate the size, *a*, of angle PQR.

Justify your answer.

ASSESSOR'S USE ONLY

(b) The spider web below forms a regular pentagon.



Calculate the size, x, of angle CED.

Justify your answer.

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(c) In this spider web, points G, H, T, and S all lie on the circumference of a circle, with centre C.

The straight lines FSJ and FTK are both tangents to the circle at the points S and T.

Angle SCT = 100°

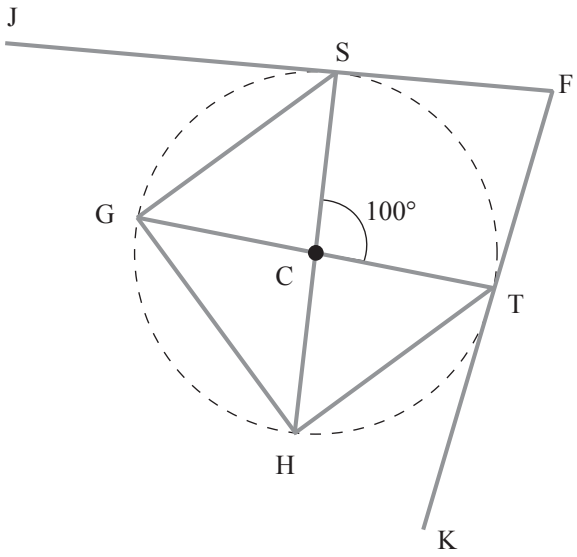

Diagram is NOT to scale

Determine whether the line FSJ is parallel to the line GCT.

Justify your answer with clear geometrical reasoning.

ASSESSOR'S USE ONLY

(d) In this spider web, points M, Q, and N all lie on the circumference of a circle, with centre C.
The straight lines PM and PN are both tangents to the circle at the points M and N.
Angle MQN = 108° PM = 18 cm

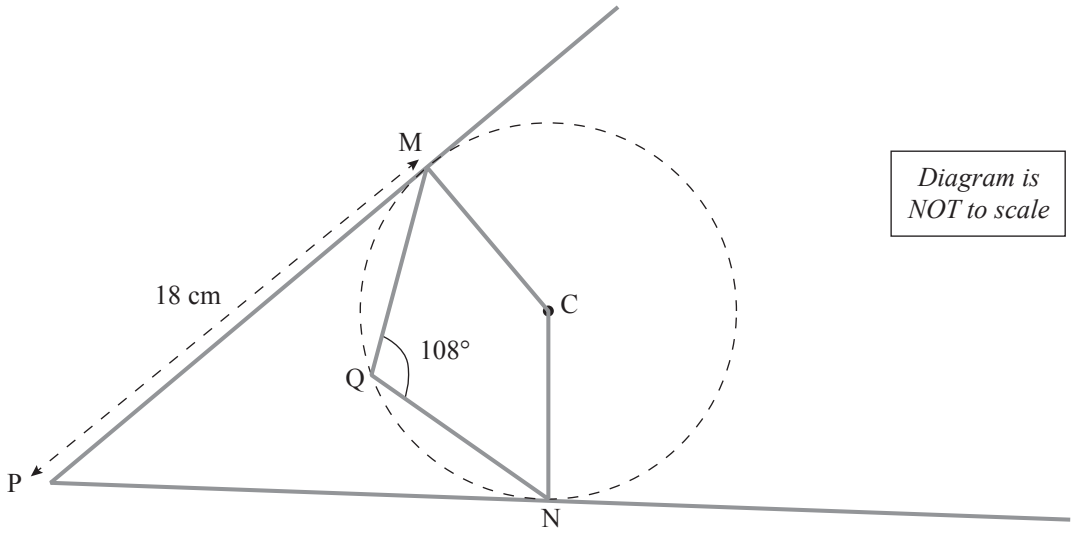

Diagram is NOT to scale

Calculate the radius of the circle.
Justify your answer with clear geometrical reasoning.

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(e) In this spider web, points A, B, E, and F all lie on the circumference of a circle, with centre C.
Lines FE and FA are of equal length.
Angle AEF = x
Angle ADF = y

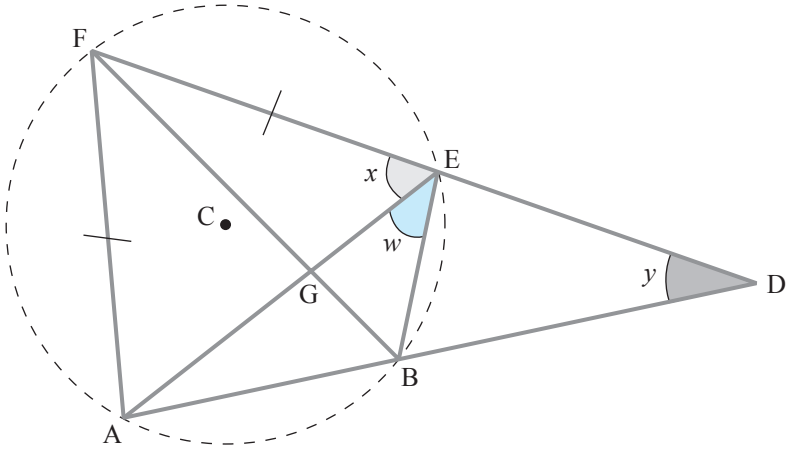

Diagram is NOT to scale

Find the size, w, of angle AEB, in terms of x and y.
Justify your answer with clear geometrical reasoning.

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Please turn over ➤

QUESTION THREE

ASSESSOR'S USE ONLY

This question looks at more spider webs.

https://pixabay.com/photos/cobweb-dewdrop-web-insect-case-921039/

(a) In this spider web, ABC is a straight line.

Lines AD and BE are parallel to each other and DB = AB.

Angle DBE = 64°

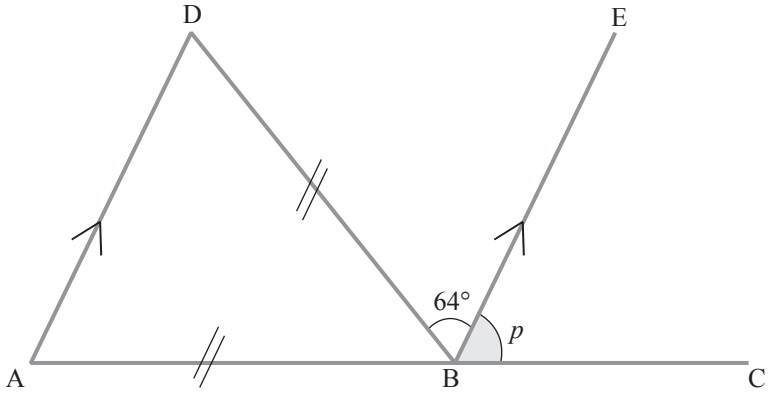

Diagram is NOT to scale

Calculate the size, p, of angle EBC.

Justify your answer.

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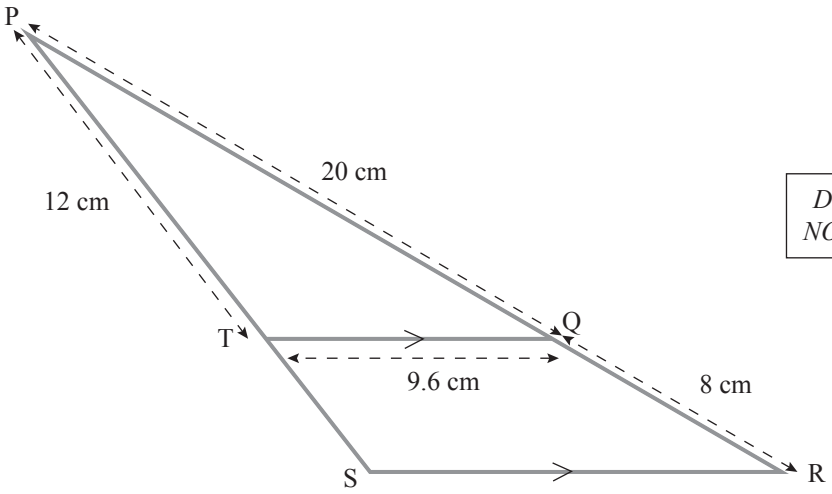
(b) In this triangular spider web, lines TQ and SR are parallel to each other.

PQ = 20 cm QR = 8 cm

PT = 12 cm TQ = 9.6 cm



Calculate the perimeter of the trapezium **QRST**.

Show your working clearly.

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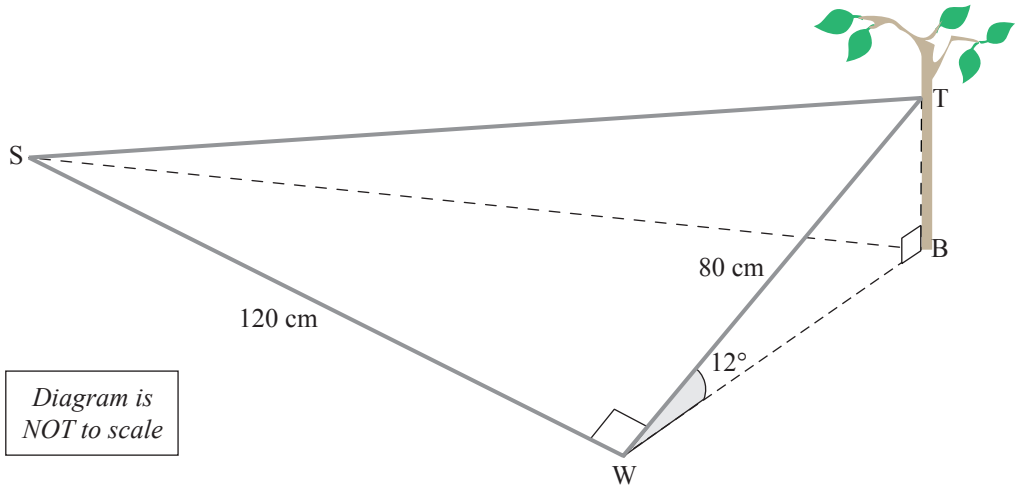
(c) One spider makes a large spider web by fixing its web between a vertical tree at point T and two points on the ground at W and S.

Point B is at the base of the tree, below T. Points B, W, and S are all on the same horizontal level (ground level).

Angle SWT = Angle WBT = 90° SW = 120 cm

Angle TWB = 12° WT = 80 cm



(i) Show that the height of the spider web, BT, is 16.63 cm.

Show your working clearly.

(ii) Find the angle of elevation of T above S, angle TSB.

Show your working clearly.

ASSESSOR'S USE ONLY

(d) A spider is crawling along level ground. The spider starts at point S and crawls directly north for a distance of 54 cm, until it reaches point H. The spider then changes direction and heads to point F, which is 140 cm away, on a bearing of 078°.

SH = 54 cm HF = 140 cm

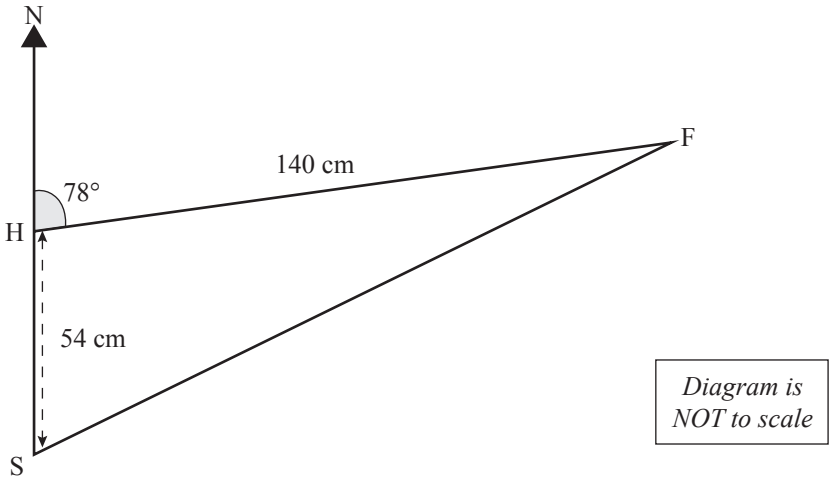


Diagram is NOT to scale

Find the direct distance and bearing of S from F.

Show your working clearly.

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

QUESTION NUMBER

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