91031

910310

1

SUPERVISOR'S USE ONLY

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Level 1 Mathematics and Statistics, 2017

91031 Apply geometric reasoning in solving problems

9.30 a.m. Monday 20 November 2017
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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–15 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

MOSAICS AND TESSELLATIONS

ASSESSOR'S USE ONLY

http://mosaicsbypost.com/banded-stars/banded-stars-black-195m2

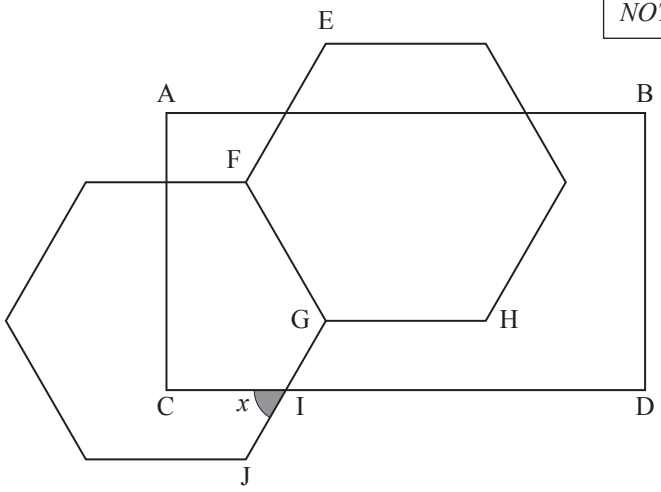
A tessellation is a pattern of repeating shapes fitting together and leaving no gaps. These patterns can be made into mosaic pictures as shown above.

QUESTION ONE

(a) The pattern below is made up of two regular hexagons with a rectangle overlaying them.

AB is parallel to GH.

Diagram is NOT to scale



Calculate the size, x, of angle CIJ.

Justify your answer with clear geometric reasoning.

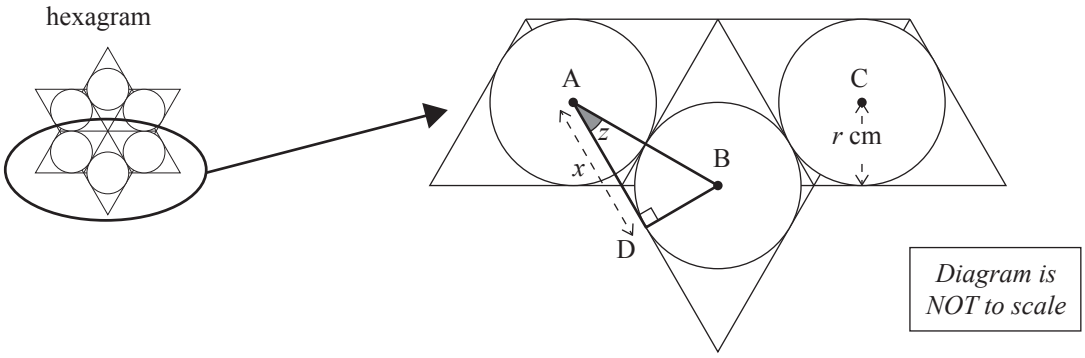
ASSESSOR'S USE ONLY

(b) Circles can be drawn inside **half** a hexagram (which is a regular six-pointed star) as shown in the pattern below.

Points A, B, and C are the centres of the three circles.

The radius of all the circles is r cm.

A triangle ABD is drawn across two of the circles.



(i) Prove that the angle z is equal to 30°.

Show your working clearly.

(ii) Calculate the length, x, of the line AD in terms of r.

Show your working clearly.

ASSESSOR'S USE ONLY

(c) In the diagram below, the line SR is a tangent to the circle.
The line BT passes through O, the centre of the circle.

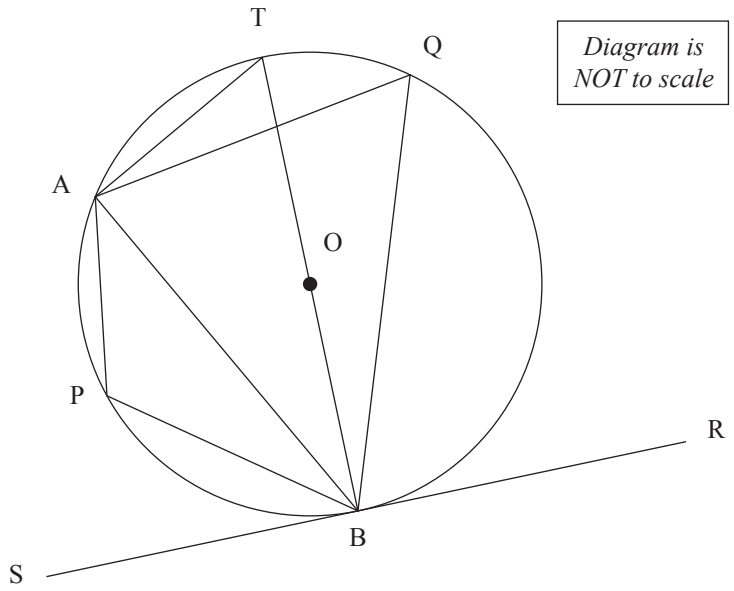


Diagram is NOT to scale

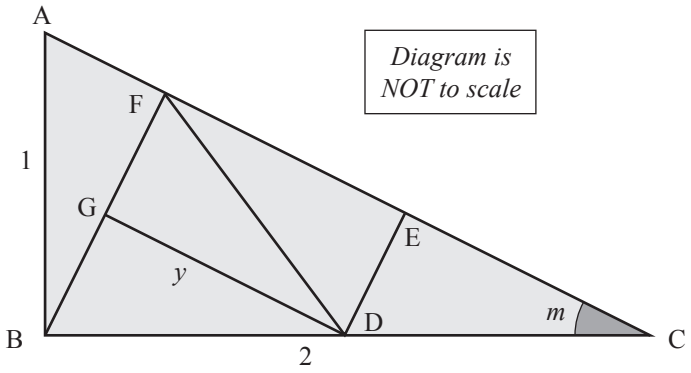
Prove that angle ABS equals angle AQB.
Justify your answer with clear geometric reasoning.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) The shape below is an example of Pinwheel Tiling, where identical right-angled triangles are used to create a tessellation within a larger right-angled triangle.

AB is 1 unit long and BC is 2 units long.



(i) Calculate the size, m, of angle ACB.

Show your working clearly.

(ii) Calculate the length, y, of the line GD.

Show your working clearly.

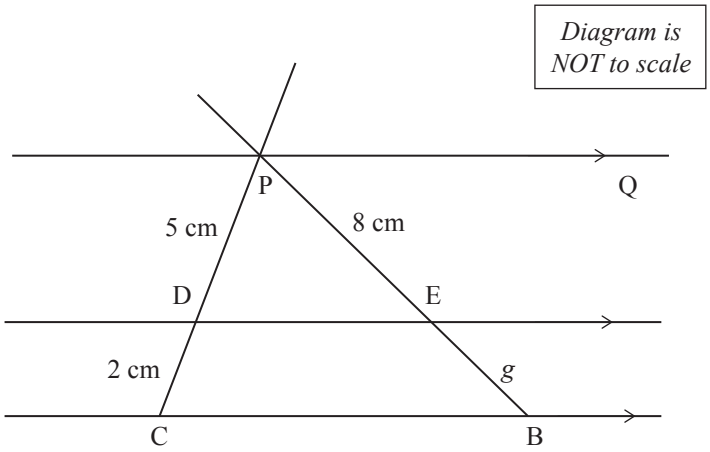
ASSESSOR'S USE ONLY

(b) In the diagram below, PQ is parallel to the lines DE and CB.

PE is 8 cm long.

PD is 5 cm long.

DC is 2 cm long.

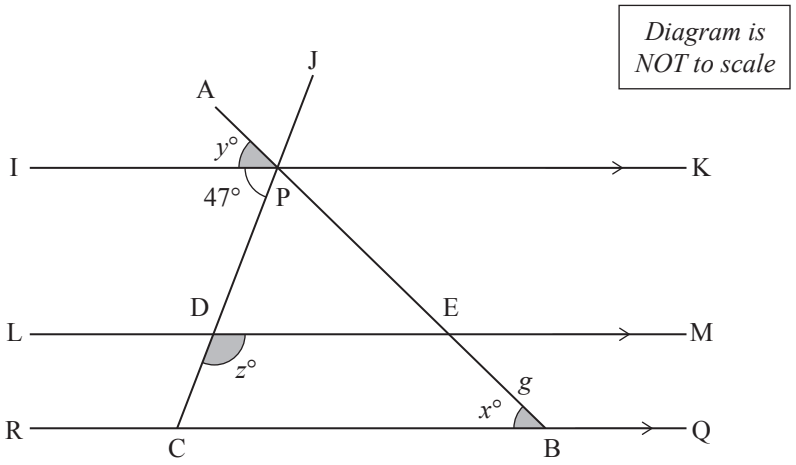


(i) Calculate the length, g, of the line segment BE.

Show your working clearly.

ASSESSOR'S USE ONLY

(ii) Angle API is $y°$, angle CDE is $z°$ and angle IPC is 47°.



Express angle x in terms of y and z.

Justify your answer with clear geometric reasoning.

ASSESSOR'S USE ONLY

(c) A triangle ABC is drawn inside a circle.

O is the centre of the circle.

DE is a tangent to the circle. Point A is where DE touches the circle.

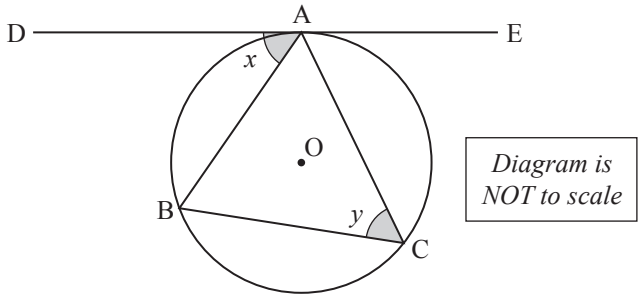


Diagram is NOT to scale

Prove that angle x equals angle y.

Justify your answer with clear geometric reasoning.

This page has been deliberately left blank.

The examination continues on the following page.

QUESTION THREE

ASSESSOR'S USE ONLY

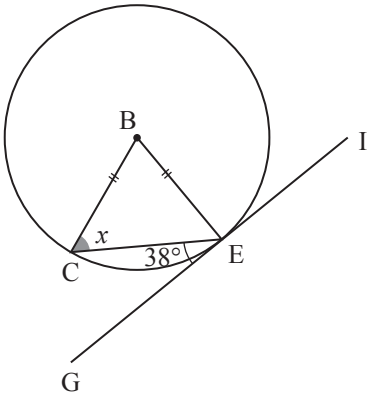
(a) In the diagram alongside:

BC and BE are radii of the circle centre B.

GI is a tangent to the circle.

Angle CEG is 38°

Diagram is NOT to scale



(i) Calculate the size, x, of angle BCE.

Justify your answer with clear geometric reasoning.

Two overlapping circles, with centres A and B and the same radii, are drawn in a quadrilateral which is symmetrical through HG.

The distance between A and B is equal to the radius of the circles.

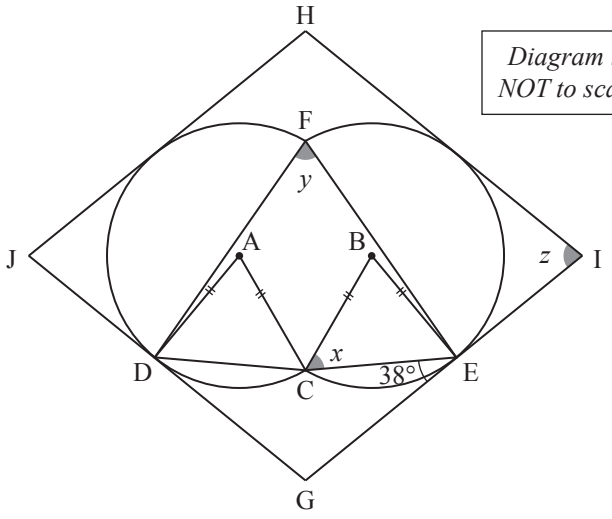
HIGJ is a rhombus.

HI, IG, GJ, and HJ are tangents to the circles.

Angle CEG is 38°.

AD is perpendicular to JG and BE is perpendicular to GI.

Diagram is NOT to scale



ASSESSOR'S USE ONLY

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

Justify your answer with clear geometric reasoning.

(iii) Calculate the size, z, of angle HIG.

Justify your answer with clear geometric reasoning.

Question Three continues on the following page.

ASSESSOR'S USE ONLY

(b) The kite GDBE is placed in the square ACHF.

DG = GB = EG

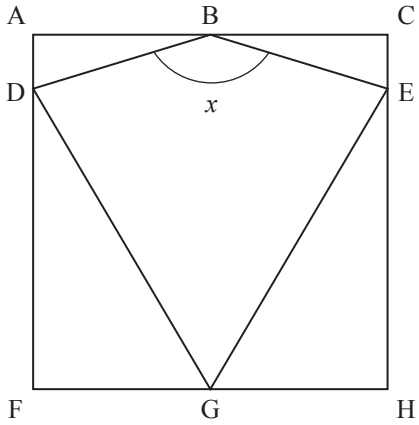


Diagram is NOT to scale

Calculate the size, x, of angle DBE.

Justify your answer with clear geometric reasoning.

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

91031