91031M

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SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Te Pāngarau me te Tauanga, Kaupae 1, 2017

91031M Te whakahāngai whakaaro āhuahanga whaitake hei whakaoti rapanga

9.30 i te ata Rāhina 20 Whiringa-ā-rangi 2017
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakahāngai whakaaro āhuahanga whaitake hei whakaoti rapanga.	Te whakahāngai whakaaro āhuahanga whaitake mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai whakaaro āhuahanga whaitake mā te whakaaro waitara hōhonu hei whakaoti rapanga.

Tirohia mēnā e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Whakaaturia ngā mahinga KATOA.

Mēnā ka hiahia whārangi atu anō mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i ngā tau tūmahi

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

NGĀ RŌPINEPINE

MĀ TE KAIMĀKA ANAKE

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

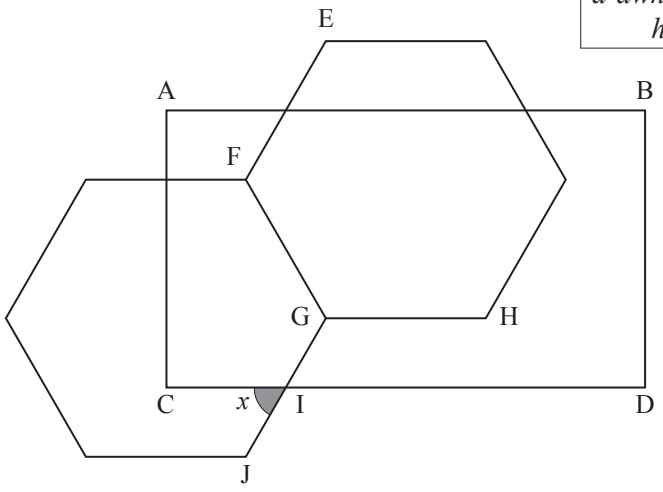
He tauira te rōpinepine o ngā hanga tāruarua e whakamau tahi ana me te kore āpure. Ka taea ēnei tauira te whakarite mai hei pikitia rōpinepine e ai ki te whakaaturanga i runga.

TŪMAHI TUATAHI

(a) Ko te tauira i raro he mea mahi mai i ngā tapaono rite e rua me tētahi tapawhā hāngai i runga ake.

He whakarara a AB ki a GH.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



Tātaihia te rahi, x, o te koki CIJ.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MOSAICS AND TESSELLATIONS

ASSESSOR'S USE ONLY

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

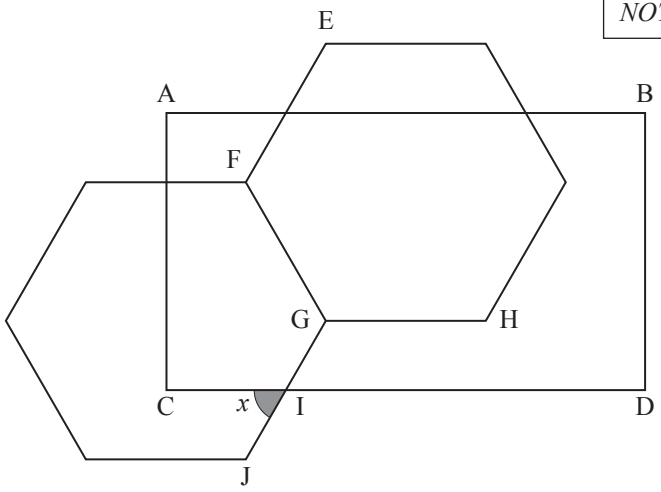
A tessellation is a pattern of repeating shapes fitting together and leaving no gaps. These patterns can be made into mosaic pictures as shown above.

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.

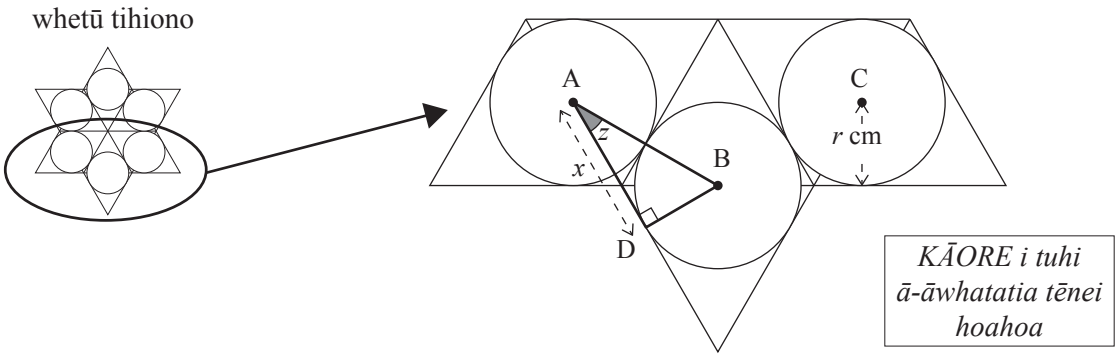
MĀ TE KAIMĀKA ANAKE

(b) Ka taea e ngā porowhita te tātuhi ki roto i te **haurua** o tētahi āhua whetū rite e ono ōna tihi, e ai ki te tauira i raro.

Ko ngā pūwāhi A, B, me C ngā pokapū o ngā porohita e toru.

Ko te pūtoro o ngā porohita katoa he r cm.

Ka tātuhia he tapatoru ABD ki runga ake i ngā porohita e rua.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

(i) Hāponotia e orite ana te koki z ki te 30°.

Āta whakaaturia ō mahinga.

(ii) Tātaitia te roa, x, o te rārangi AD e ai ki r.

Āta whakaaturia ō mahinga.

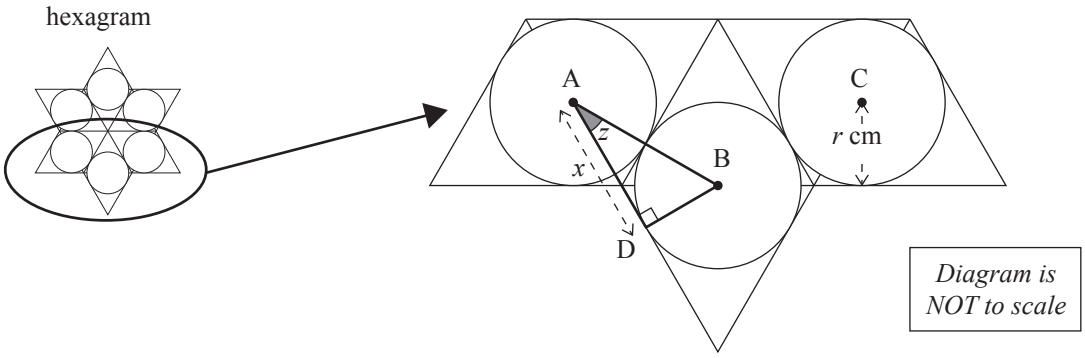
ASSESSOR'S USE ONLY

(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°.

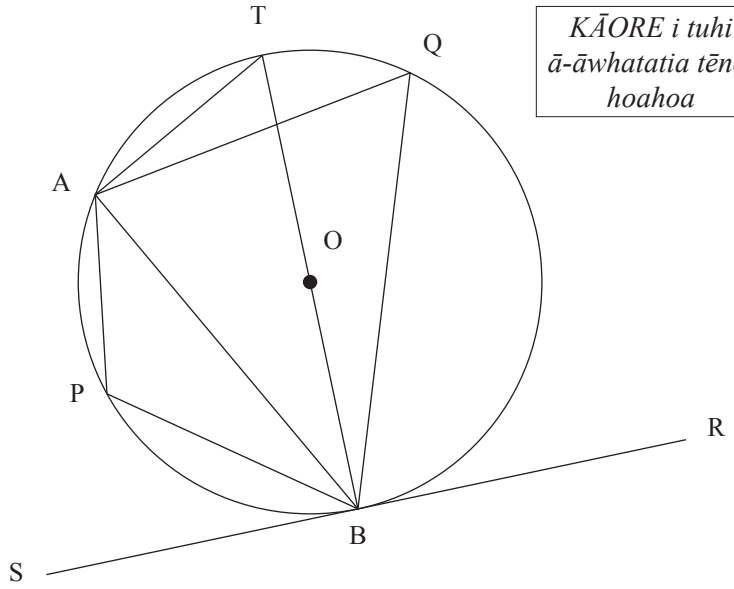
Show your working clearly.

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

Show your working clearly.

(c) Ki te hoahoa i raro, he pātapa te rārangi SR ki te porohita.

Ka rere te rārangi BT mā O, te pokapū o te porohita.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Hāponotia he ōrite te koki ABS ki te koki AQB.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MĀ TE KAIMĀKA ANAKE

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.

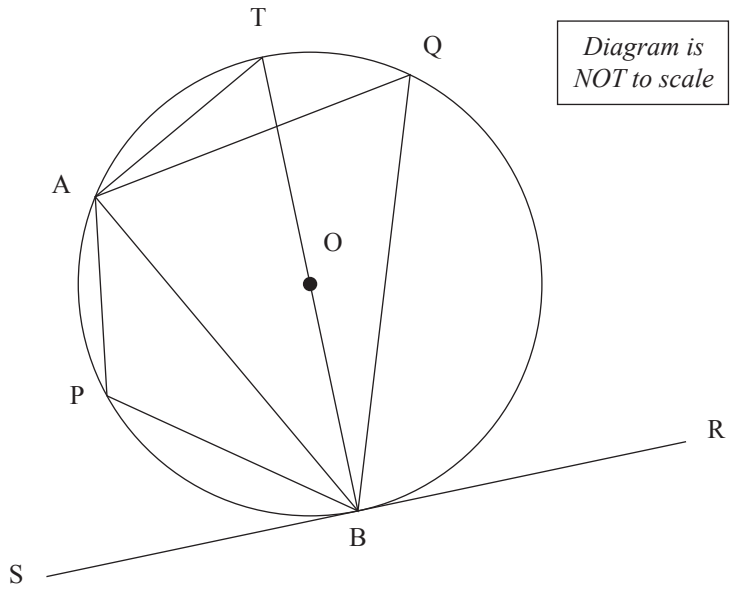


Diagram is NOT to scale

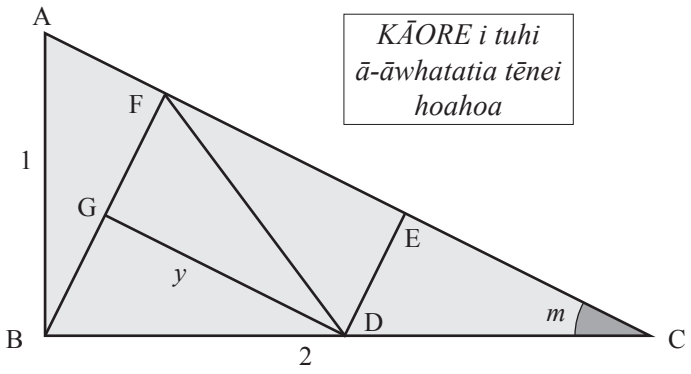
Prove that angle ABS equals angle AQB.
Justify your answer with clear geometric reasoning.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) He tauira te hanga i raro o ngā Tangariki Tapatoru Hurihuri (Pinwheel Tiling), e whakamahia ai ngā tapatoru hāngai ōrite pū hei waihanga i tētahi rōpinepine i roto i tētahi tapatoru hāngai nui ake.

1 wae te roa o AB, ā, he 2 wae te roa o BC.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

(i) Tātaihia te rahi, m, o te koki ACB.

Āta whakaaturia ō mahinga.

(ii) Tātaihia te roa, y, o te rārangi GD.

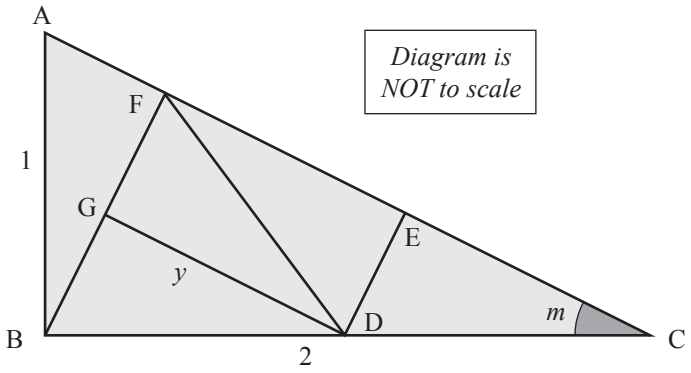
Āta whakaaturia ō mahinga.

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.

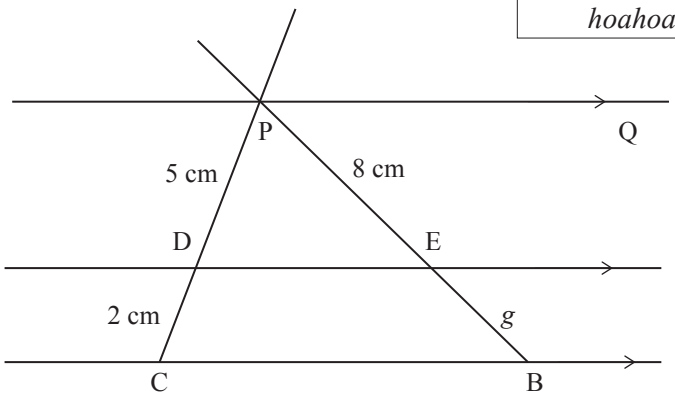
(b) Ki te hoahoa i raro, he whakarara a PQ ki ngā rārangi DE me te CB.

E 8 henemita te roa o PE.

E 5 henemita te roa o PD.

E 2 henemita te roa o DC.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



(i) Tātaihia te roa, *g*, o te wāhanga rārangi BE.

Āta whakaaturia ō mahinga.

MĀ TE KAIMĀKA ANAKE

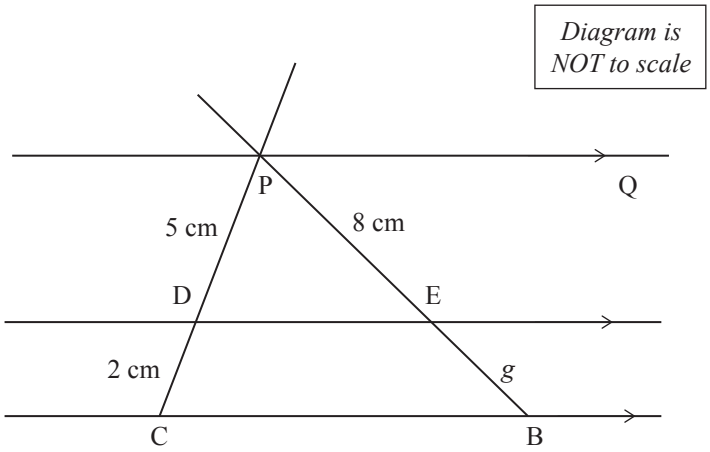
ASSESSOR'S USE ONLY

(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.

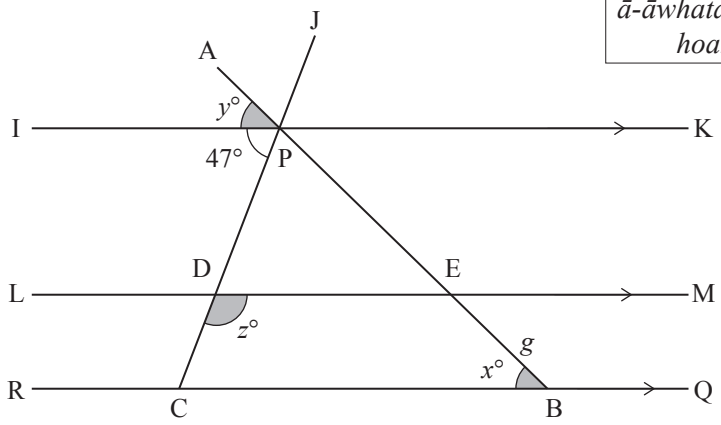


(i) Calculate the length, g, of the line segment BE.

Show your working clearly.

(ii) Ko te koki API he $y°$, ko te koki CDE he $z°$, ā, ko te koki IPC he 47°.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



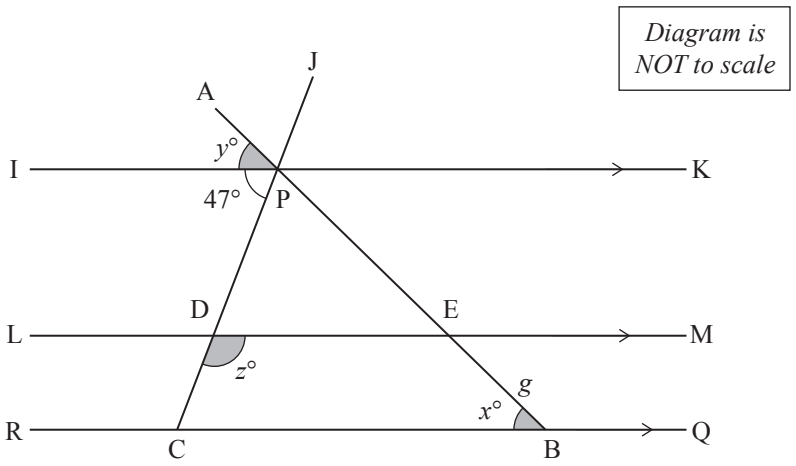
Whakapuakitia te koki x e ai ki y me z.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

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



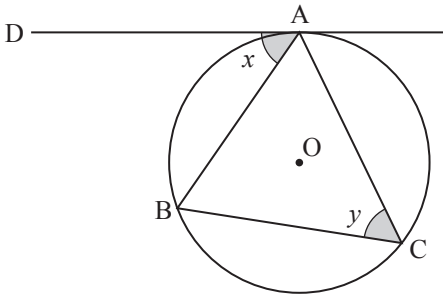
Express angle x in terms of y and z.

Justify your answer with clear geometric reasoning.

(c) E tātuhia ana he tapatoru ABC ki roto i tētahi porohita.

Ko O te pū o te porowhita.

He pātapa a DE ki te porowhita. Ko te pūwāhi A te wāhi ka pā a DE ki te porohita.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Hāponotia he ōrite te koki *x* ki te koki *y*.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MĀ TE KAIMĀKA ANAKE

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.

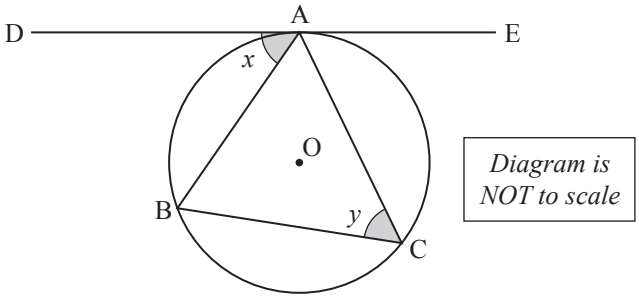


Diagram is NOT to scale

Prove that angle x equals angle y.

Justify your answer with clear geometric reasoning.

TŪMAHI TUATORU

KĀORE i tuhi ā-āwhatatia tēnei hoahoa

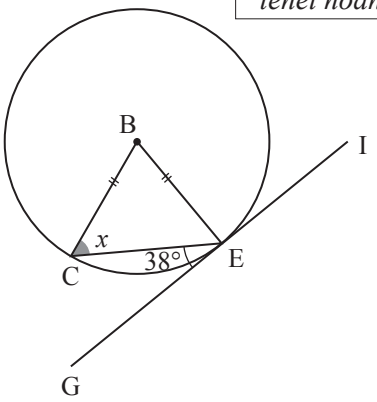
MĀ TE KAIMĀKA ANAKE

(a) I te hoahoa i te taha:

He pūtoro o te pokapū porohita B a BC me BE.

He pātapa a GI ki te porowhita.

Ko te koki CEG he 38°



(i) Tātaihia te rahi, *x*, o te koki BCE.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

E rua ngā porohita inaki, me ngā pokapū A me B me te pūtoro ōrite, ka tātuhia ki roto i tētahi tapawhā e hangarite ana mā te HG.

He ōrite te tawhiti i waenga i A me B ki te pūtoro o ngā porohita.

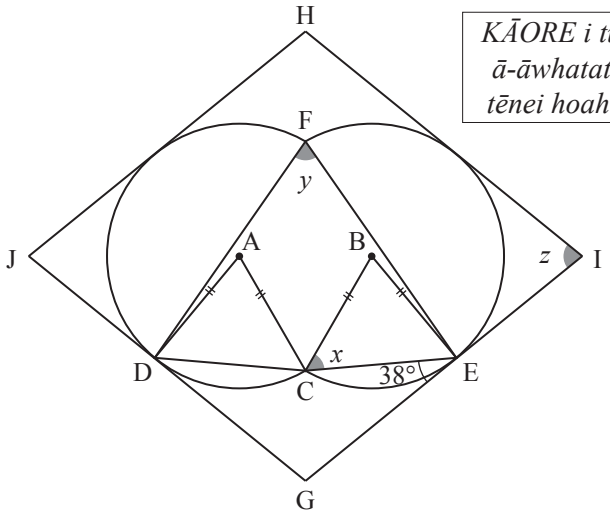
He tapawhā whakarara rite a HIGJ.

He pātapa a HI, IG, GJ me te HJ ki ngā porowhita.

Ko te koki CEG he 38°.

He hāngai a AD ki JG, ā, he hāngai a BE ki GI.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



(ii) Tātaihia te rahi, *y*, o te koki DFE.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MĀ TE KAIMĀKA ANAKE

(ii) Tātaihia te rahi, *z*, o te koki HIG.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

Ka haere tonu te Tūmahi Tuatoru i te whārangi 20.

QUESTION THREE

ASSESSOR'S USE ONLY

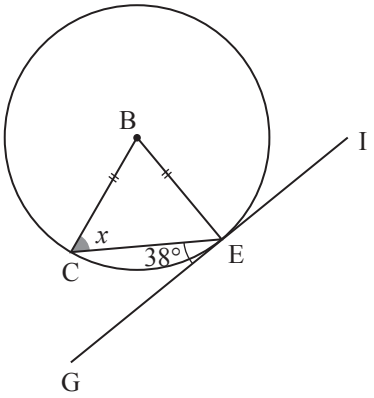
(a) In the diagram alongside:

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.

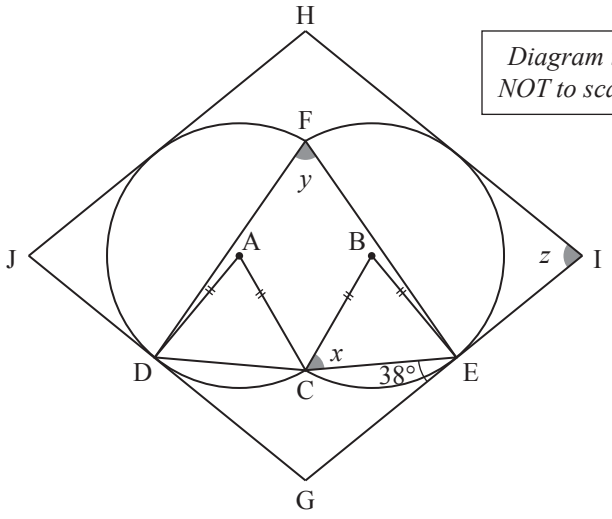
HIGJ is a rhombus.

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.

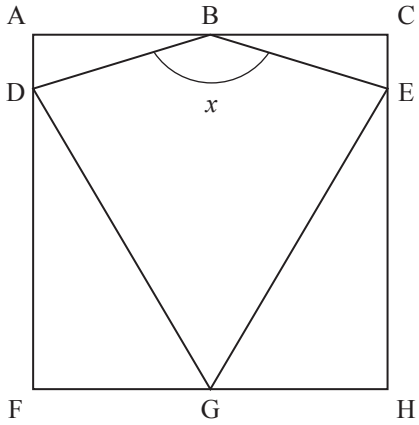
(iii) Calculate the size, z, of angle HIG.

Justify your answer with clear geometric reasoning.

Question Three continues on page 21.

(b) Ka raua te manu aute GDBE ki roto i te tapawhā rite ACHF.

DG = GB = EG



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Tātaihia te rahi, x, o te koki DBE.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu tuhinga.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

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

DG = GB = EG

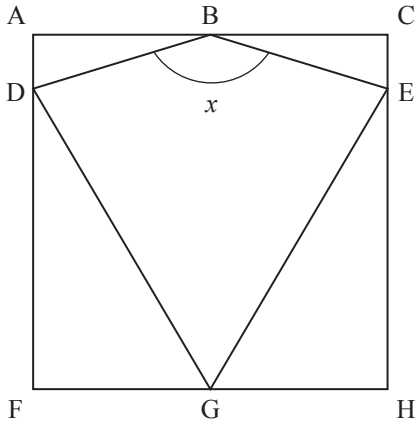


Diagram is NOT to scale

Calculate the size, x, of angle DBE.

Justify your answer with clear geometric reasoning.

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 1 Mathematics and Statistics, 2017

91031 Apply geometric reasoning in solving problems

9.30 a.m. Monday 20 November 2017
Credits: Four

91031M

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 2–23 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.