91031M

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1

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Te Pāngarau me te Tauanga, Kaupae 1, 2014

91031M Te whakahāngai whakaaro āhuahanga whaitake hei whakaoti rapanga

9.30 i te ata Rātū 18 Whiringa-ā-rangi 2014
Whiwhinga: Whā

Paetae	Paetae Kaiaka	Paetae 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 mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō puka whakauru ki te tau kei runga ake nei.

Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.

Whakaaturia ngā mahinga KATOA.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–23 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

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

TAPEKE

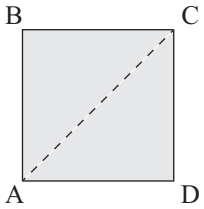
MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI

MĀ TE KAIMĀKA ANAKE

Kua oti tētahi pakitara te uhi ki ngā tāpa tapawhā rite.

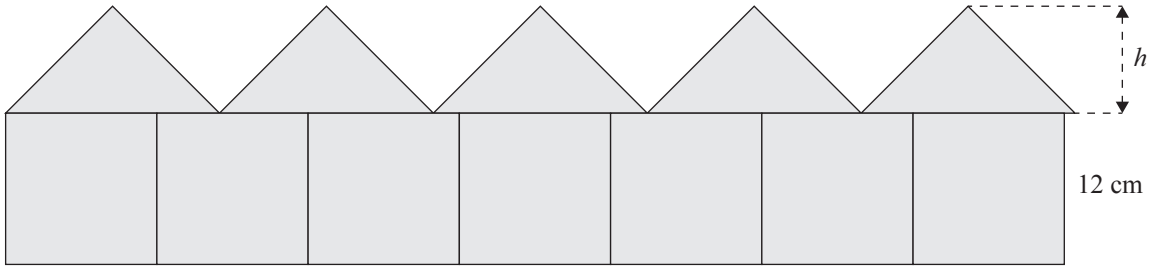
12 cm mā te 12 cm ngā inenga o ia tāpa. Kua tapahi haurokitia ētahi tāpa pēnei i ērā e whakaaturia ana i te taha matau:



(a) (i) He aha te roa o te taha kua tapahia, AC?

(ii) Whakaahuatia te tapatoru ABC ki ngā kupu āhuahanga.

Kei runga ake i te pakitara, kua hangaia he taitapa ki ngā tāpa kua tapahia kia haurua, pēnei i ērā e whakaaturia ana i raro nei:



KĀORE i tuhi ā-āwhatatia te hoahoa

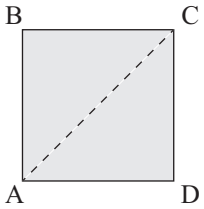
(b) (i) E hia te teitei o te taitapa (te tawhiti *h* kei te hoahoa o runga)?

QUESTION ONE

ASSESSOR'S USE ONLY

A wall has been tiled with square tiles.

Each tile measures 12 cm by 12 cm. Some of the tiles have been cut diagonally as shown on the right:



(a) (i) What is the length of the cut side, AC?

(ii) Describe the triangle ABC using geometric terms.

At the top of the wall, a border has been made from the tiles which have been cut in half, as shown below:

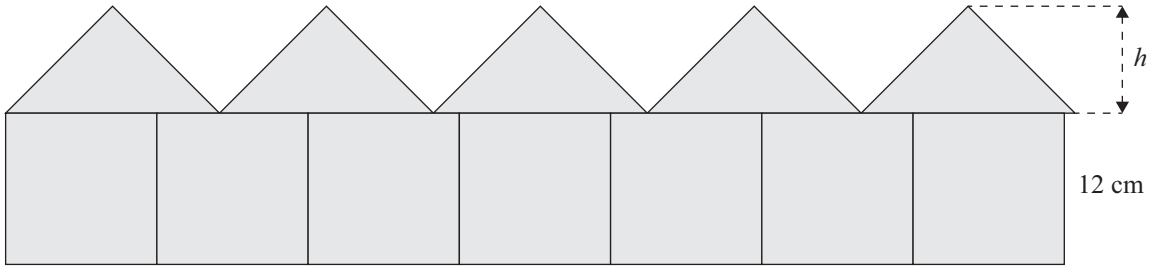
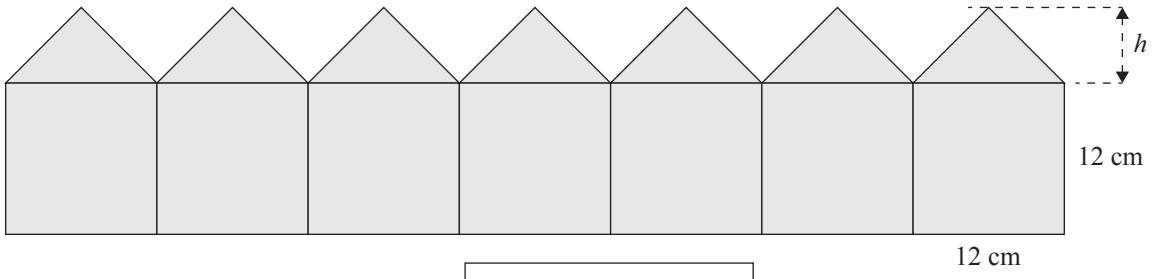


Diagram is NOT to scale

(b) (i) How high is the border (distance *h* in the diagram above)?

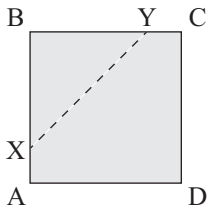
MĀ TE KAIMĀKA ANAKE

(ii) I te titiro a Bob ki tēnei taitapa. Ki tōna whakaaro, ka pai ake pea te āhua mēnā kua poro pū ngā tapatoru taitapa ki te tapa o ngā tāpa tapawhā rite e whakaaturia ana i raro nei (engari kāore i tuhi ā-āwhatatia):



KĀORE i tuhi ā-āwhatatia te hoahoa

Ka hangaia ngā tapatoru mā te tapahi tāpa kia pēnei (kia 12 cm a XY):



E hia te teitei o tēnei taitapa hou (te tawhiti *h* kei te hoahoa o runga)?

Āta whakamāramahia ō mahinga.

ASSESSOR'S USE ONLY

(ii) Bob was looking at this border. He thought that it might look better if the border triangles ended neatly at the edge of the square tiles, as shown below (but not to scale):

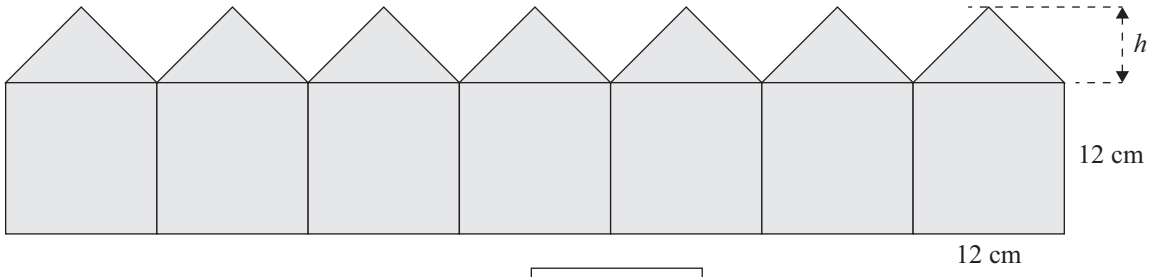
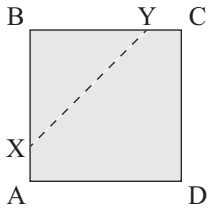


Diagram is NOT to scale

The triangles would be made by cutting tiles like this (so that XY is 12 cm):



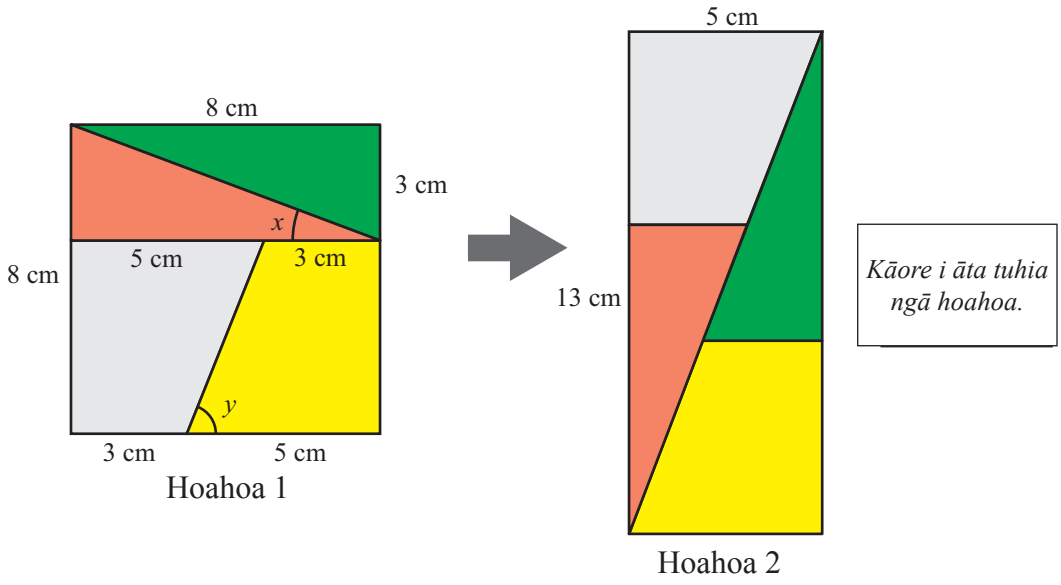
How high would this new border be (distance *h* in the top diagram)?

Explain your working clearly.

(c) I te pānui kōrero a Bob mō ngā panga āhuahanga ko te āhua nei he pono, ēngari ehara i te pono.

Ka tīmata tēnei panga ki te tāpa tapawhā rite, e 8 cm mā te 8 cm. E 64 cm^2 te horahanga o tēnei tāpa (tirohia te Hoahoa 1, kei raro).

Kātahi ka tapahia te tāpa kia whā ngā wāhanga, ā, ka hurinahatia aua wāhanga e ai ki te Hoahoa 2.



Hoahoa 1

Hoahoa 2

Kāore i āta tuhia ngā hoahoa.

Ko te āhua nei e 65 cm^2 te horahanga o te hanga hou. E mārama ana a Bob e kore e tāea te horahanga te huri.

(i) Tātaihia te rahi o te koki x i te Hoahoa 1.

(ii) Tātaihia te rahi o te koki y i te Hoahoa 1.

(iii) Whakamāramahia he aha i hurihia ai te horahanga.

ASSESSOR'S USE ONLY

(c) Bob has been reading about geometric puzzles that seem to be true, but are not actually true.

This puzzle starts with a square tile, 8 cm by 8 cm. The area of this tile is 64 cm^2 (see Diagram 1, below).

The tile is then cut into 4 pieces and these pieces are rearranged as shown in Diagram 2.

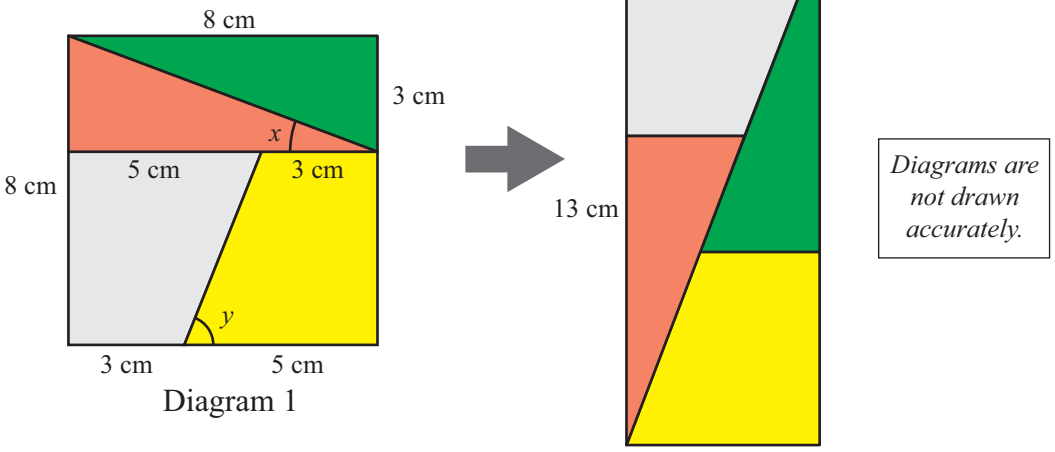


Diagram 1

Diagram 2

This new shape seems to have an area of 65 cm^2. Bob realises that the area cannot change.

(i) Calculate the size of angle x in Diagram 1.

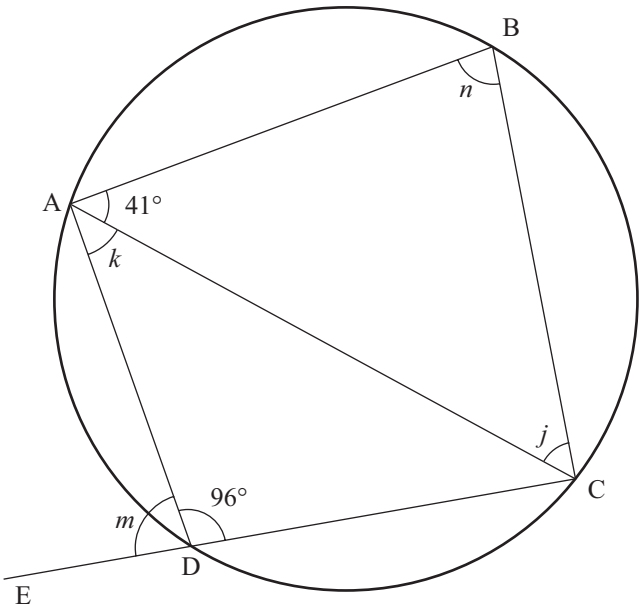
(ii) Calculate the size of angle y in Diagram 1.

(iii) Explain why the area seems to have changed.

PĀTAI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) He tapawhā o tētahi porowhita rāwaho a ABCD, ā, he rārangi torotika a CE.



KĀORE i tuhi ā-āwhatatia te hoahoa

(i) Tātaihia te rahi o te koki *m* i te hoahoa i runga nei.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu whakautu.

(ii) Tātaihia te rahi o te koki *j* i te hoahoa i runga nei.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu whakautu.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) ABCD is a cyclic quadrilateral and CE is a straight line.

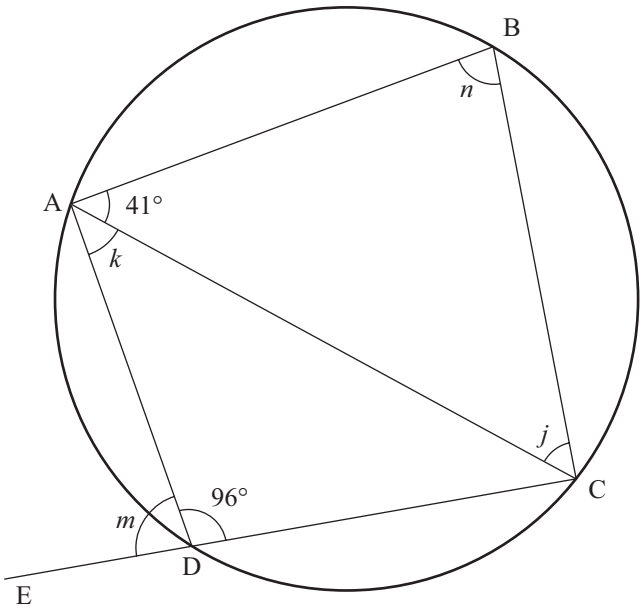


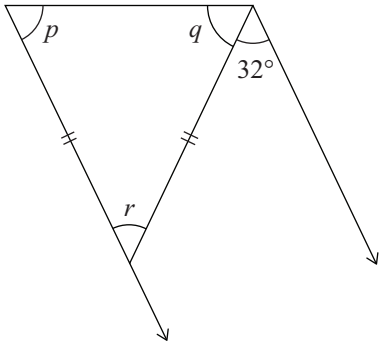
Diagram is NOT to scale

(i) Calculate the size of angle *m* in the diagram above.
Justify your answer with clear geometric reasoning.

(ii) Calculate the size of angle *j* in the diagram above.
Justify your answer with clear geometric reasoning.

(b) (i) I te hoahoa i raro nei, tātaihia te rahi o te koki *p*.

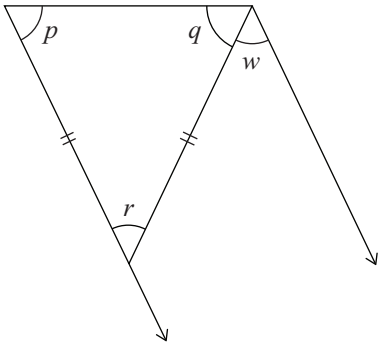
Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu whakautu.



KĀORE i tuhi ā-āwhatatia te hoahoa

(ii) I te hoahoa i raro nei, kimihia tētahi kīanga mō te koki *p* e pā ana ki *w* anake.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu whakautu.



KĀORE i tuhi ā-āwhatatia te hoahoa

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(b) (i) In the diagram below, find the size of angle p.

Justify your answer with clear geometric reasoning.

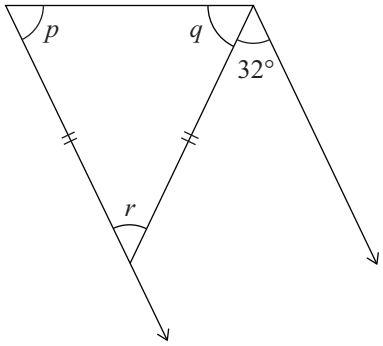


Diagram is NOT to scale

(ii) In the diagram below, find an expression for angle p in terms of w only.

Justify your answer with clear geometric reasoning.

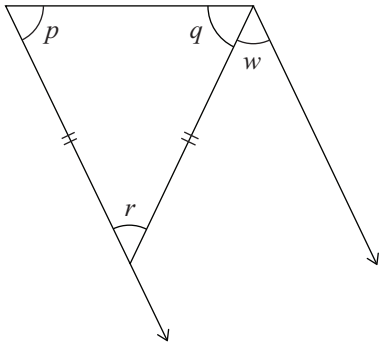
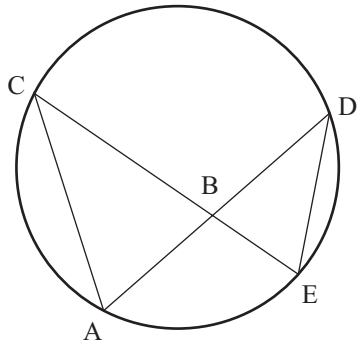


Diagram is NOT to scale

(c) I te hoahoa i raro nei, e takoto ana a A, C, D, me E i te paenga o tētahi porowhita, ā, EHARA a B i te pū[1] o te porowhita.

MĀ TE KAIMĀKA ANAKE



(i) Whakamahia te whakaaro āhuahanga hei whakamārama he aha i rite ai a ABC me EBD.

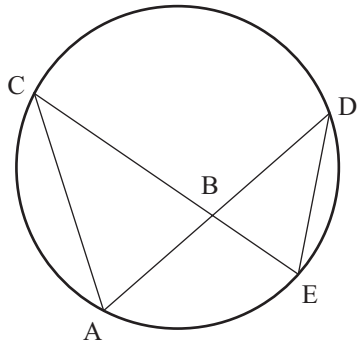
(ii) Hāponotia ko AB × BD = BC × BE.

Whakamahia te whakaaro āhuahanga mārama hei parahau i tāu whakautu.

[1] pokapū

ASSESSOR'S USE ONLY

(c) In the diagram below, A, C, D, and E lie on the circumference of a circle, and B is NOT the centre of the circle.



(i) Use geometric reasoning to explain why triangles ABC and EBD are similar.

(ii) Prove that $AB \times BD = BC \times BE$.

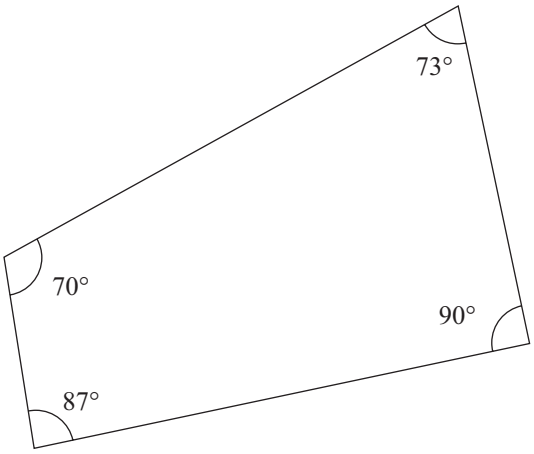
Justify your answer with clear geometric reasoning.

PĀTAI TUATORU

MĀ TE KAIMĀKA ANAKE

E tūhurahura tapawhā ana a Ahmed.

(a) E whakamahi ana ia i tāna ine-koki ki te ine i ngā koki i te tapawhā i raro nei. Kua hē tana ine i ngā koki. Kua tuhi ā-āwhatatia te hoahoa i raro nei.



KUA tuhi ā-āwhatatia te hoahoa

(i) E rua ngā pūtake āhuahanga e whakaatu ana kua TINO hē a Ahmed.

` Whakamāramatia he aha aua pūtake e rua.

Pūtake 1: _____

Pūtake 2: _____

(ii) Whakamāramatia te hē pea a Ahmed i tana whakamahi i tana ine-koki.

QUESTION THREE

ASSESSOR'S USE ONLY

Ahmed has been investigating quadrilaterals.

(a) He uses his protractor to measure the angles in the quadrilateral below. He has made a mistake in measuring the angles. The diagram below is to scale.

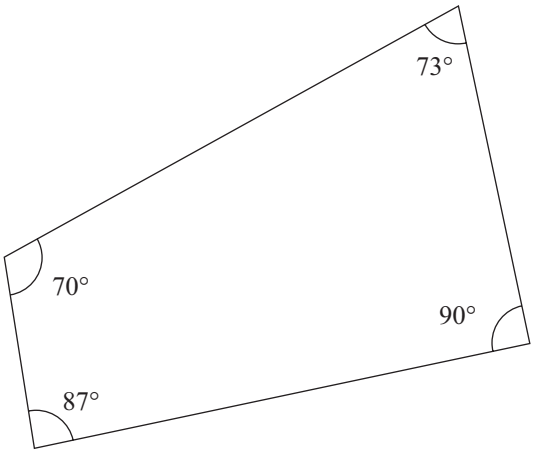


Diagram IS drawn to scale

(i) There are two geometric reasons that show that Ahmed MUST have made a mistake.

` Explain what these two reasons are.

Reason 1: _____

_____

_____

_____

Reason 2: _____

_____

_____

_____

(ii) Explain what mistake Ahmed might have made in using his protractor.

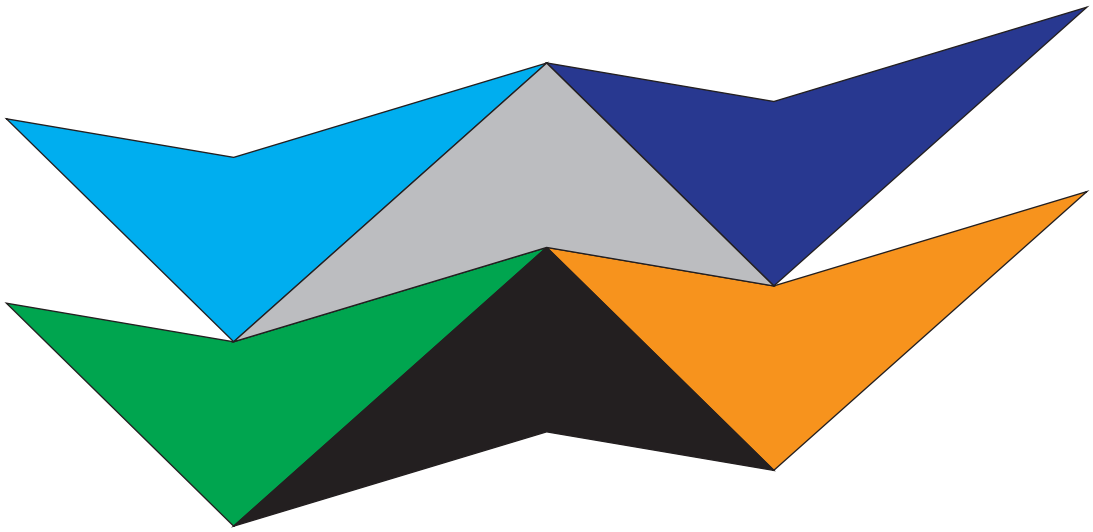
_____

_____

_____

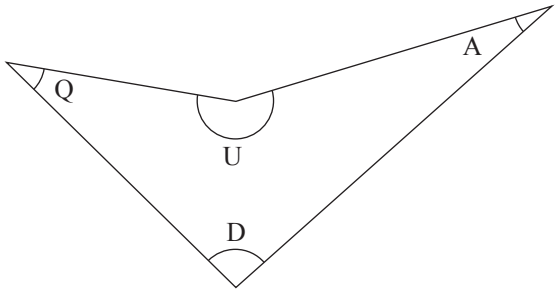
(b) Kei te mōhio a Ahmed ka rōpinepine tētahi tapawhā. Ko te tikanga o tēnei ka whakamahia pea ki te uhi i tētahi mata me te kore āputa. Kua hoatu tētahi tauira ki raro nei:

MĀ TE KAIMĀKA ANAKE



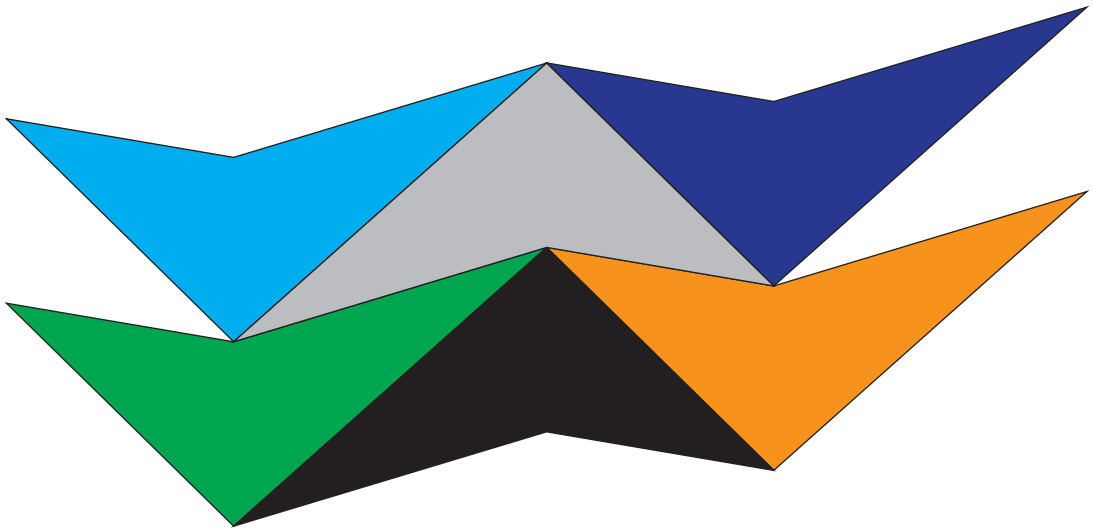
I te hoahoa nei, kua rōpinepinetia ētahi tāruatanga e ono o te āhua ōrite. Kua rerekē te kauruku o ngā āhua e ono kia kite ai koe ka pēhea te rōpinepine e mahia ai.

Whakamāramatia, mā te whakamahi i te whakaaro āhuahanga, he aha i pono ai ka rōpinepine tētahi tapawhā. Ka taea te kōrero mō te hoahoa whai tapanga i raro, mō te rōpinepine i runga rānei.



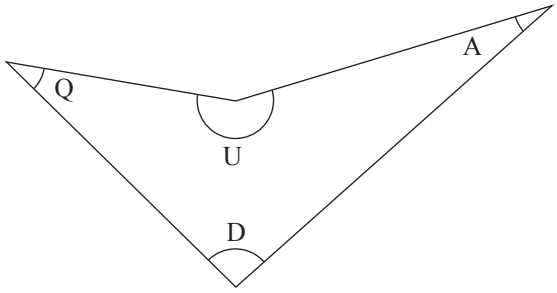
ASSESSOR'S USE ONLY

(b) Ahmed knows that any quadrilateral will tessellate. This means that it can be used to cover a surface leaving no gaps. An example is given below:



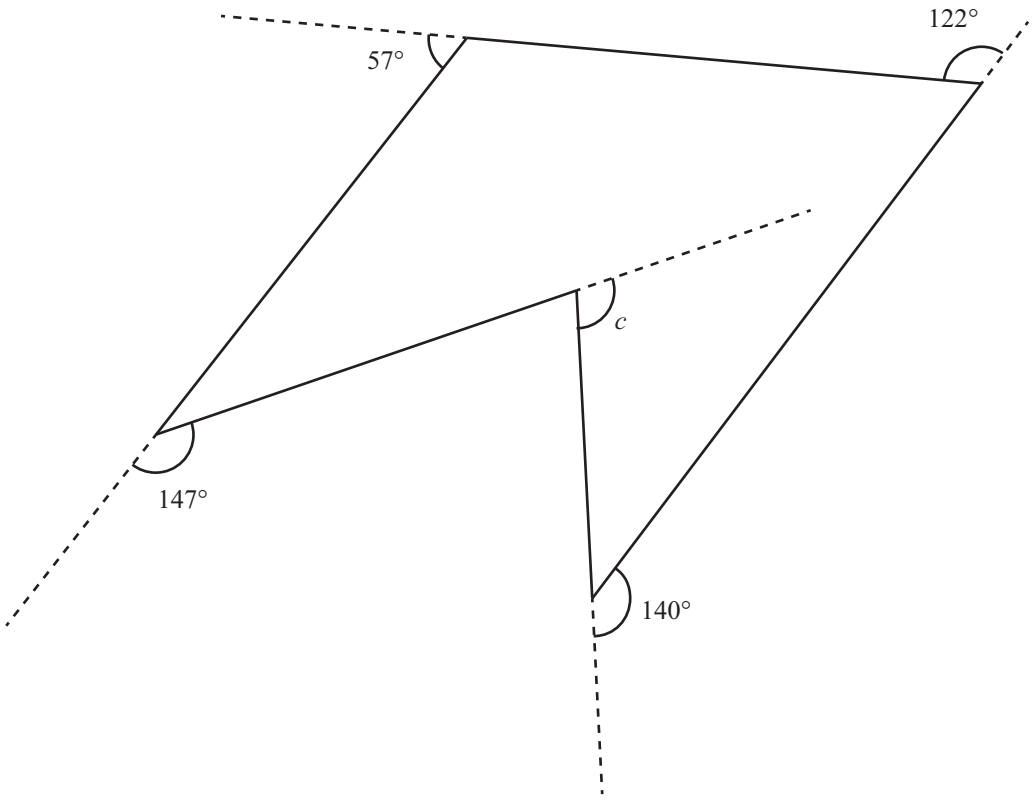
In this diagram, six copies of the same shape have been tessellated. The six shapes have been coloured differently so that you can see how the tessellation takes place.

Explain, using geometric reasoning, why it is true that any quadrilateral will tessellate. You may wish to refer to the labelled diagram below or to the tessellation above.



MĀ TE KAIMĀKA ANAKE

(c) Ka tuhi a Ahmed i tētahi taparima me te tuhi i ngā koki o waho (e whakaaturia ā-ira ana).



Ka whiriwhiri a Ahmed i te rahi o te koki c e whakaaturia ana i raro nei.

$c = 360° – 57° – 147° – 140° – 122°$

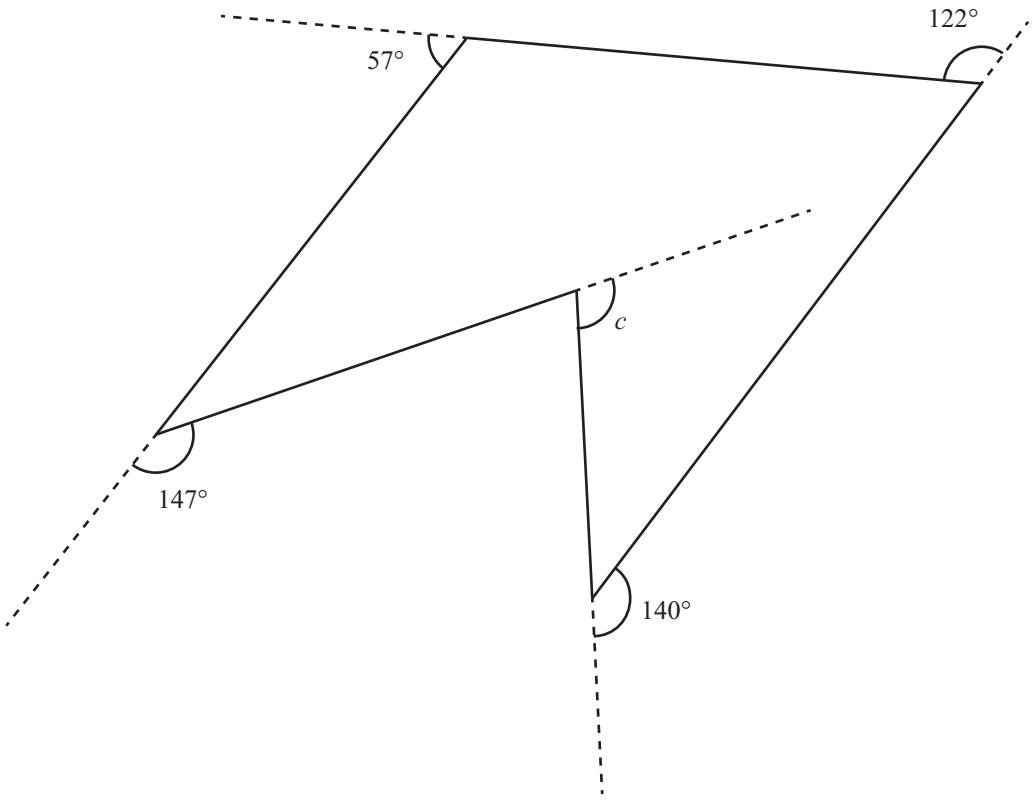
$c = –106°$

(i) Homai te whakaaro āhuahanga mō tana tātaitanga.

(ii) Whakamāramatia te tikanga o te inenga tōraro o te koki c, me te kī āhea tēnei ka tūpono ai.

ASSESSOR'S USE ONLY

(c) Ahmed draws a pentagon and draws the exterior angles (shown dotted).



Ahmed works out the size of angle c as shown below.

$c = 360° – 57° – 147° – 140° – 122°$

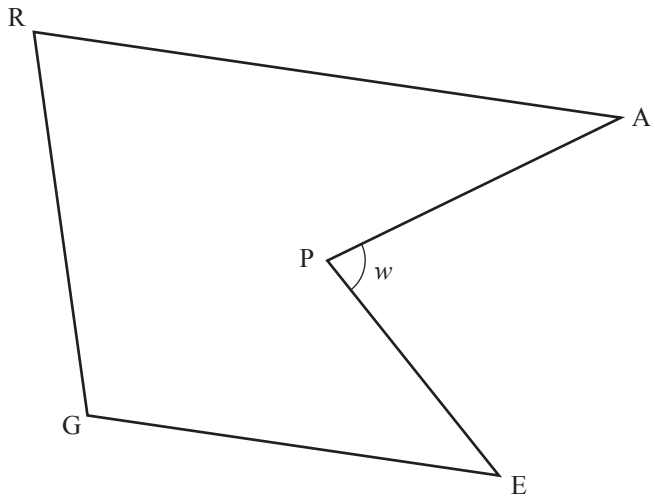
$c = –106°$

(i) Give the geometric reason for his calculation.

(ii) Explain the meaning of the negative measurement of the angle c, and state when this will occur.

(d) I tēnei taparima, ko te koki EGR + te koki GRA = 180°.

MĀ TE KAIMĀKA ANAKE



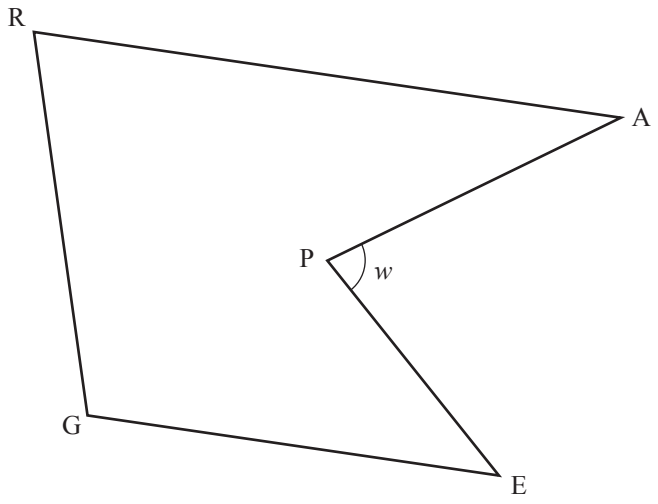
(i) Ka pēhea te hāpono a tēnei he whakarara a GE me RA?

(ii) Hāponotia ka tohua te koki APE (e tapaina hoki ko *w* i runga) mā te whārite:

Koki APE = koki PAR + koki PEG.
Āta whakamāramahia ō whakaaro āhuahanga.

ASSESSOR'S USE ONLY

(d) In this pentagon, angle EGR + angle GRA = 180°.



(i) How does this prove that lines GE and RA are parallel?

(ii) Prove that the angle APE (also labelled *w* above) is given by the equation:

Angle APE = angle PAR + angle PEG.

Explain your geometric reasoning clearly.

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

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, 2014

91031 Apply geometric reasoning in solving problems

9.30 am Tuesday 18 November 2014
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.

91031M

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.