

91031



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

1

SUPERVISOR'S USE ONLY

Level 1 Mathematics and Statistics, 2013

91031 Apply geometric reasoning in solving problems

9.30 am Wednesday 13 November 2013
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 2–12 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.

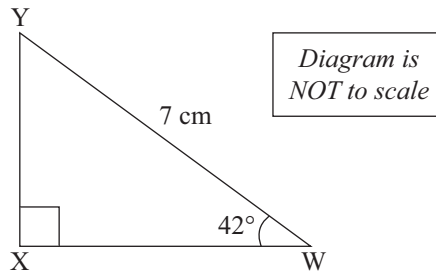
TOTAL

ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

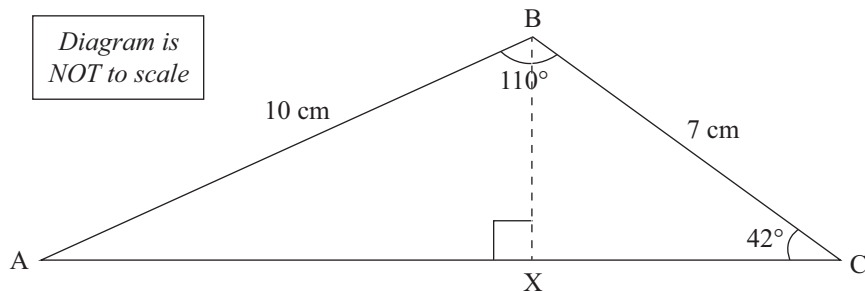
QUESTION ONE

(a) (i)



Find the length of side XW in triangle XYW .

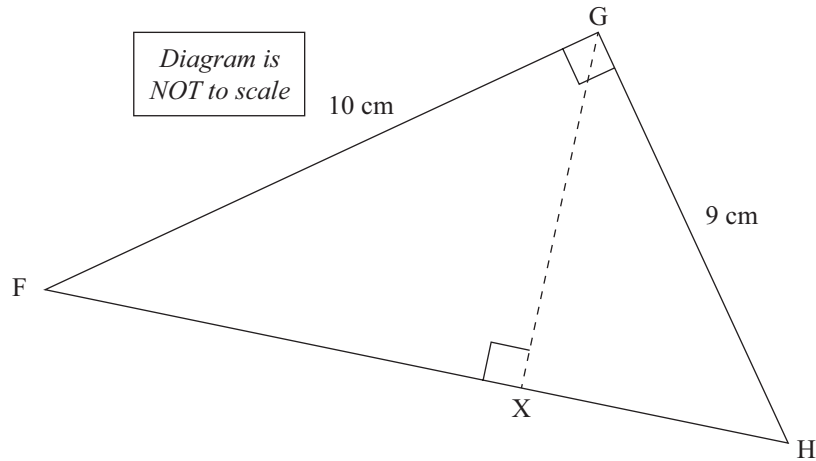
(ii) Frank wants to find the length of the side AC in a triangle that is not right-angled. He does this by dividing the triangle into 2 smaller right-angled triangles.



Find the length of side AC , using your answer for the length of XW from part (i).

Show your working clearly.

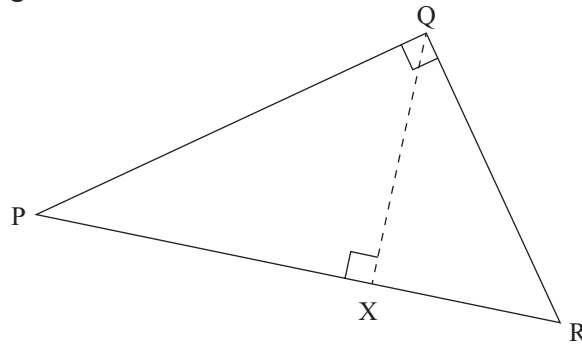
- (b) Triangle FGH is a right-angled triangle.



- (i) Show that angle GFH is 42° , to the nearest degree.

- (ii) Use trigonometry to show that Pythagoras' Rule is true for triangle FGH.

- (c) Frank uses the method below to prove Pythagoras' Rule for any right-angled triangle. He starts with this diagram:



First he uses the whole triangle, PQR:

$$\frac{PQ}{PR} = \cos(\angle QPR)$$

Then, he uses triangle PXQ:

$$\frac{PX}{PQ} = \cos(\angle QPR)$$

Therefore $\frac{PQ}{PR} = \frac{PX}{PQ}$

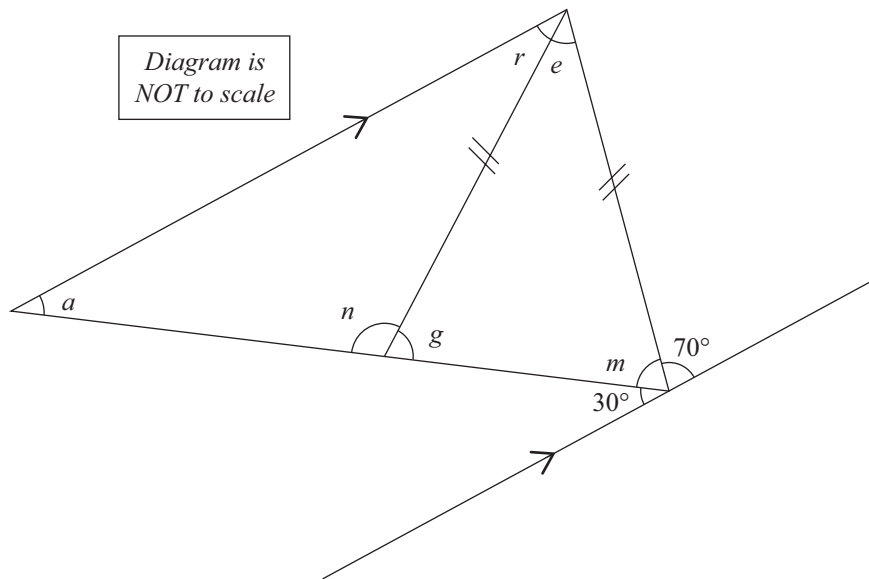
So $PQ^2 = PX \cdot PR$ (ie PX multiplied by PR)

- (i) In a similar way, show that $QR^2 = RX \cdot PR$

- (ii) Use the results above to prove Pythagoras' Rule for triangle PQR.

QUESTION TWO

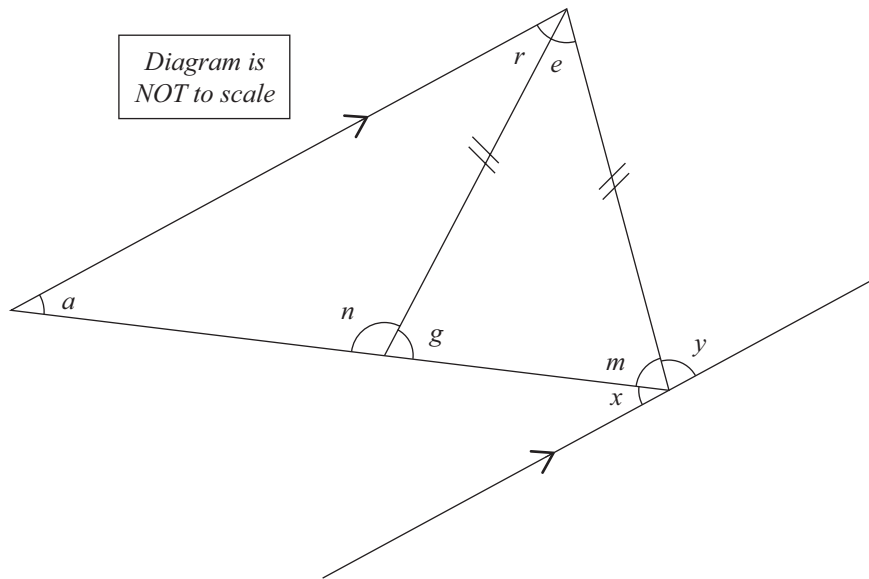
(a)



Find the size of angle e .

Explain your method clearly, and give geometric reasons for each step.

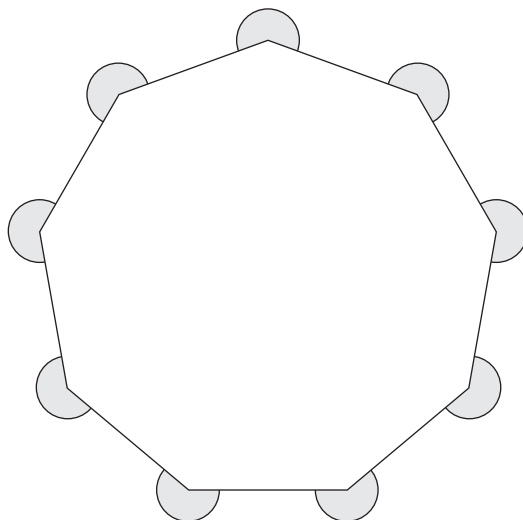
(b)



Find an expression for the size of angle r , in terms of angles x and y .

Explain your method clearly, and give geometric reasons for each step.

- (c) The shape below is a regular nonagon, a 9-sided shape.



The “edge angles” of the nonagon are the angles on the outside of each vertex. They are shaded in grey on the diagram.

- (i) How large is **each** “edge angle” in a regular nonagon?

Explain your method clearly, and give geometric reasons for each step.

- (ii) Show that the expression for the total of the “edge angles” of **any** polygon with n sides is:

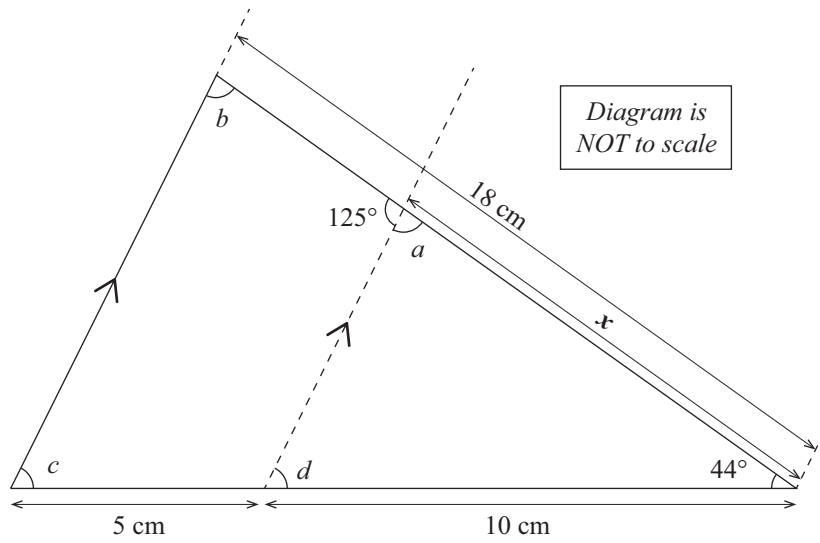
$$\text{Total of the “edge angles” (in degrees)} = 180(n + 2)$$

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QUESTION THREE

(a)

(i) Find the size of angle c .

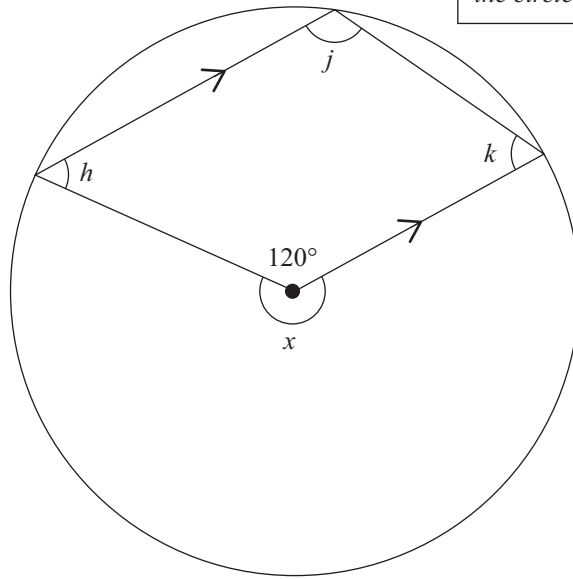
Explain your method clearly, and give geometric reasons for each step.

(ii) Find the length marked x in this diagram.

Explain your method clearly, and give geometric reasons.

(b)

Diagram is NOT to scale.
The dot is the centre of the circle.



(i) Show that angle $j = 120^\circ$.

Explain your method clearly, and give geometric reasons for each step.

(ii) Find the sizes of angle h and angle k .

- (iii) Explain how we know from parts (i) and (ii) that the quadrilateral on the previous page must actually be a rhombus.

You may wish to use the diagram below, which has the corners labelled.

