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, 2016

91031 Apply geometric reasoning in solving problems

9.30 a.m. Thursday 17 November 2016
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 2–14 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

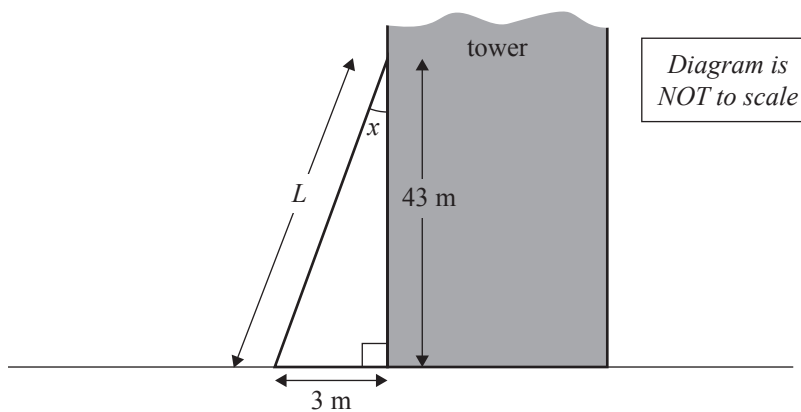ASSESSOR'S USE ONLY

THE SKY TOWER

www.wotif.co.nz/New-Zealand.d133.Destination-Travel-Guides

Auckland's Sky Tower is the tallest man-made structure in the Southern Hemisphere.

QUESTION ONE

(a)   The base of the tower is supported by 8 legs.

These legs are L metres long and are 3 metres away from the tower at ground level.

The legs join the tower 43 m above ground level.

(i)   Calculate the length, L, of the leg from the ground to the tower.

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_____

_____

(ii)   Use trigonometry to calculate the size of angle x, where the leg joins the tower.

(iii)   The legs of the tower go below ground level.

The horizontal distance from the tower to the bottom of the leg under the ground is 4.05 metres.

Diagram is NOT to scale

86°

3 m

ground level

p

4.05 m
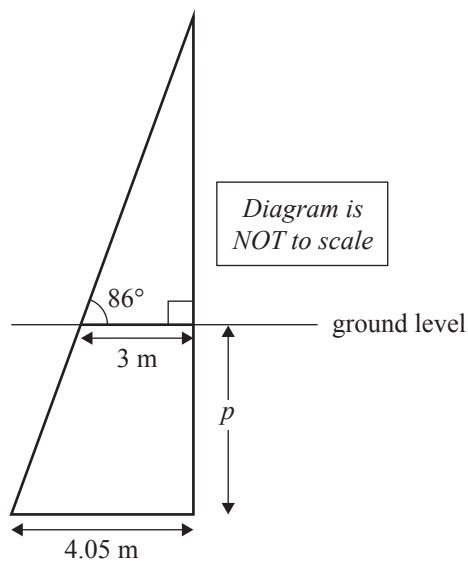
Calculate p, the vertical distance that the legs are built into the ground.

Show your working clearly.

(b) The centres of the 8 circular legs form a regular octagonal shape.

The tower has a diameter of 12 metres and each leg has a diameter of 2 metres.

The distance from the outside edge of the tower to the centre of the legs at the ground is 4 metres.

Diagram is
NOT to scale

4 m

2 m

12 m

d
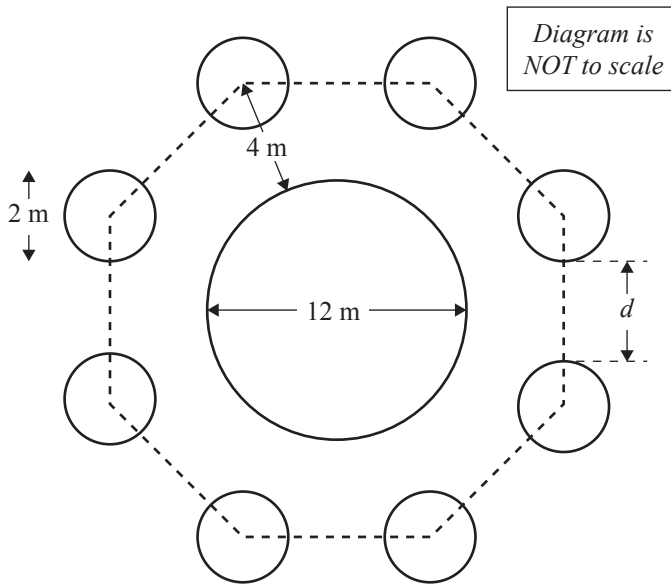
Calculate the shortest distance, d, between adjacent legs at ground level.

Show your working clearly.

(c) A simplified diagram of the position of the legs is shown below as a regular octagon. Point O is at the centre of the octagon.
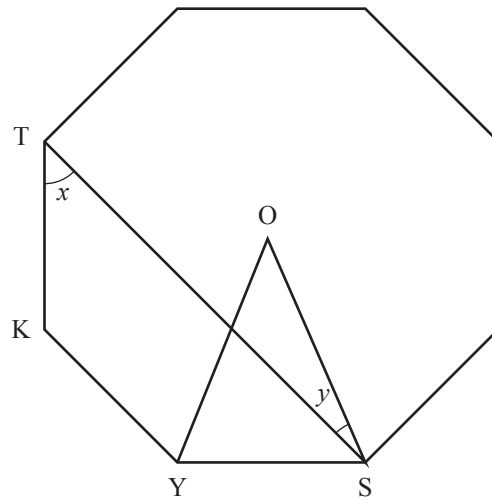
Show that angle *y* is half the size of angle *x*.

Justify your answer with clear geometric reasoning.

QUESTION TWO

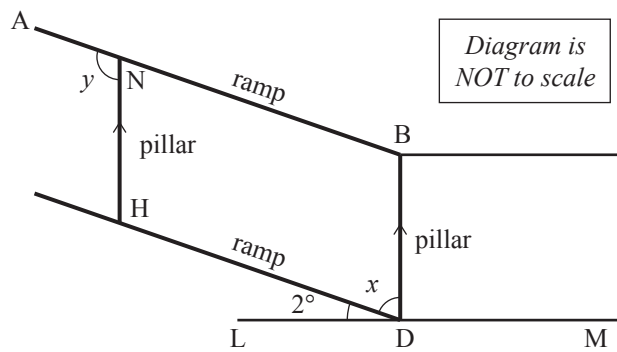Below the Sky Tower is a car park made of ramps.

The ramps are at a 2° angle.

There are vertical pillars regularly placed along the ramps for strength.

(a)   All pillars are parallel to each other. LM is horizontal.

A

y   N

ramp

pillar

B

Diagram is NOT to scale
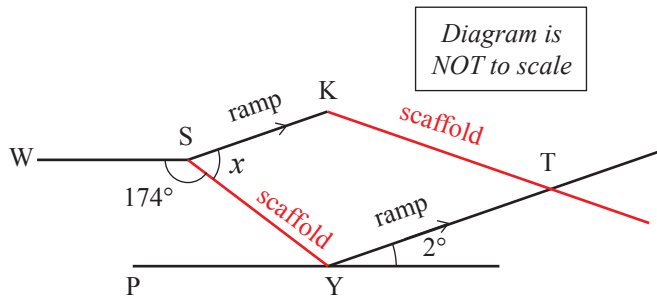
H

ramp

pillar

x

2°

L   D   M

(i)   Calculate the size of angle *x* in the diagram above.

Justify your answer with clear geometric reasoning.

(ii)   Calculate the size of angle *y* in the diagram above.

Justify your answer with clear geometric reasoning.

(iii) Part of the ramp had extra scaffolding added for support, as shown in the diagram below. The lines SK and YT are parallel.

Angle WSY is 174°.

The lines WS and PY are both horizontal.

Diagram is NOT to scale

Calculate the size of angle x in the diagram above.

Justify your answer with clear geometric reasoning.

(iv) From the side, the carpark looks like the diagram below.

Angle EGJ is 176°.

IK and LM are horizontal.

Diagram is NOT to scale

Prove that the lines AB and CD are parallel.

Justify your answer with clear geometric reasoning.

(b) The length along the slope between two pillars is L metres.

The diagonal distance between the top of one pillar and the base of the next higher pillar is 10 m.

AB and CD are horizontal.

Diagram is
NOT to scale
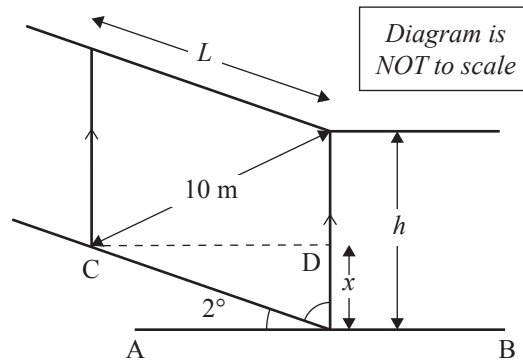
(i) Find the height, x, in terms of the length L.
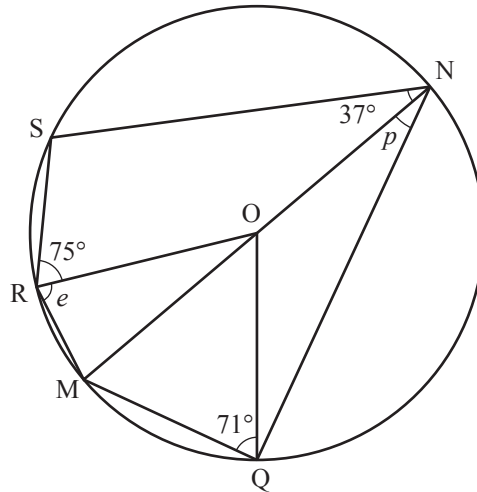
Show your working clearly.

(ii) Calculate h, the height in metres of a pillar, in terms of L.

Show your working clearly.

QUESTION THREE

(a)   In the diagram below, the line MN passes through the centre of the circle, O.

Angle MQO is 71°, angle SNO is 37° and angle SRO is 75°.

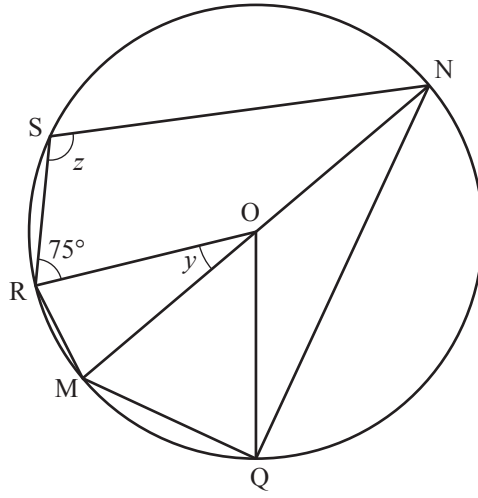*Diagram is NOT to scale*

(i)   Find the size of angle *p*.

Justify your answer with clear geometric reasoning.

_____

_____

_____

_____

(ii)   Find the size of angle *e*.

Justify your answer with clear geometric reasoning.

_____

_____

_____

_____

(iii) In the diagram below, angle SRO is 75°.

Diagram is
NOT to scale

Find an expression for z in terms of y.

Justify your answer with clear geometric reasoning.

(b)   Devonport is at a bearing of 059° and 3.54 km from the Sky Tower.

The flags on the Auckland Harbour Bridge are at a bearing of 322° and 2.45 km from the Sky Tower.

Flags on Auckland
Harbour Bridge

*Diagram is
NOT to scale*

Devonport

2.45 km

3.54 km

N

Sky Tower
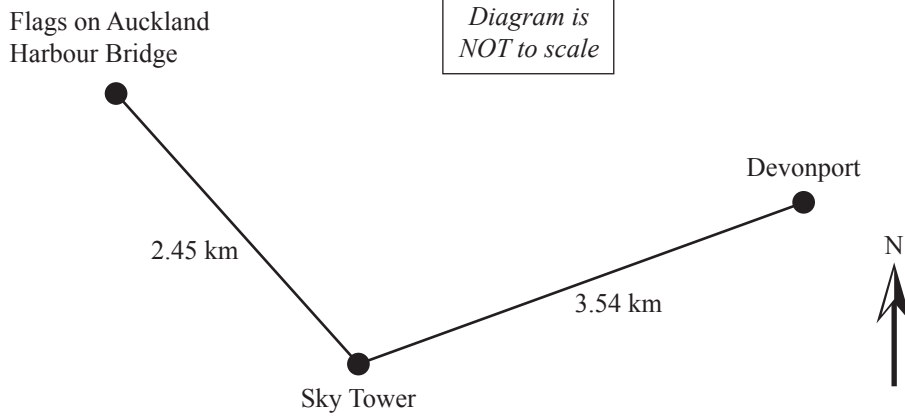
Calculate the bearing from the flags on the Auckland Harbour Bridge to Devonport.

Show your working clearly.

QUESTION
NUMBER

QUESTION
NUMBER

QUESTION
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