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, 2015

91031 Apply geometric reasoning in solving problems

9.30 a.m. Monday 9 November 2015
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 2–11 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.

Not Achieved

TOTAL 07

ASSESSOR'S USE ONLY

Annotated Exemplar Template

Not Achieved exemplar for 91031 2015		Total score	07
Q	**Grade score**	**Annotation**	
1	N2	The candidate has only correctly identified one angle. They could not use properties of symmetry and isosceles triangles to find angles. Student could not use trigonometric relationships.	
2	N2	The candidate has identified angles correctly using the properties of angles and circle geometry. However, they have not identified the correct method and concept in a) i) and b) i and ii). Only the angle of 54° in a) ii has been correctly reasoned with concepts clearly shown. The candidate has not demonstrated knowledge of geometrical concepts and terms.	
3	A3	The candidate has selected appropriate trigonometric ratio to solve the problem in a) I and has correctly used Pythagoras to calculate a side in a) ii. To gain a higher grade the candidate would need a greater breadth of skills and methods displayed.	

QUESTION ONE

ASSESSOR'S USE ONLY

(a) A clothes drying rack has two horizontal levels on which the clothes can be hung as shown by lines AE and HI on the diagram below.

AE is parallel to HI and parallel to the ground JN.

The rack is symmetrical around the line CL.

BC = CF

Angle KCL = 24°

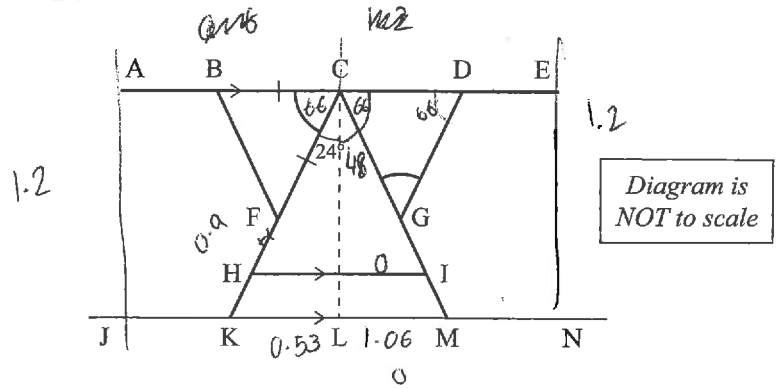


Diagram is NOT to scale

(i) Find the size of angle BCF.

Justify your answer with clear geometric reasoning.

angle BCF is 66° this is because adjacent angles on straight lines add to 180°

4

(ii) Find the size of angle DGC.

Justify your answer with clear geometric reasoning.

angle DGC is 48° this is because base angles of an isosceles triangle are equal, and angles in a triangle add to 180°

n

(iii) The height of AE above the ground is 1.2 m.

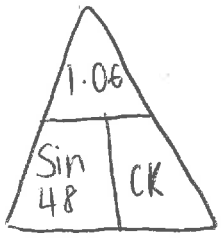
Pippa says the length KL is 0.53 m.

Show that she is correct.

n

ASSESSOR'S USE ONLY

(iv) What is the length of CK?



$CK = 1.06 \div \sin 48 = 1.426370693$

$= 1.4$ m (1dp)

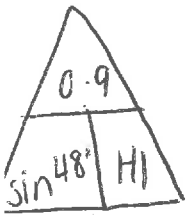
The length of CK is 1.4m (1dp) //

n

(v) CH is two-thirds of CK.

Find the length of HI.

Justify your answer with clear geometric reasoning.



$CK = 1.4$ m

$CH = \frac{2}{3}$ of $1.4 = 0.93333^{\circ}c = 0.9$ m

$HI = 0.9 \div \sin 48 = 1.211069457$

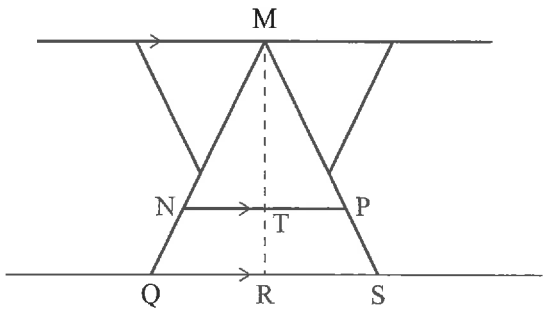
The length of HI $= 1.2$ m (1dp) //

n

(b) For another clothes drying rack:

MN : NQ = a : b

Compare the area of triangles MNP and MQS.



triangles MNP and MQS are similar triangles. The area of MNP is $\frac{2}{3}$ of MQS //

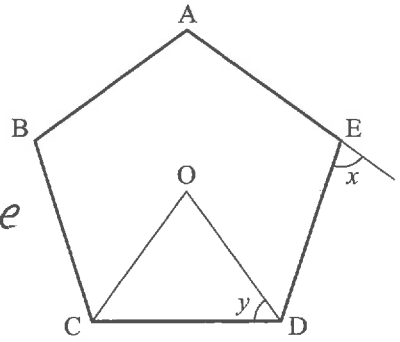
n

N2

QUESTION TWO

ASSESSOR USE ONLY

(a) ABCDE is a regular pentagon with centre O.



(i) Find the value of x and explain your answer.

value x = 108° this is because regular angles on a regular ~~pe~~ pentagon add to 540°

(ii) Find the value of y.

Justify your answer with clear geometric reasoning.

value of y = 54° this is because interior angles of a pentagon add to 108 and OD is meaning half the angle so 108 ÷ 2 = 54.

(b) A, B, and C are on the circumference of a circle with centre O. BOC is a diameter.

QCP is a tangent to the circle.

Angle ACP = 40°.

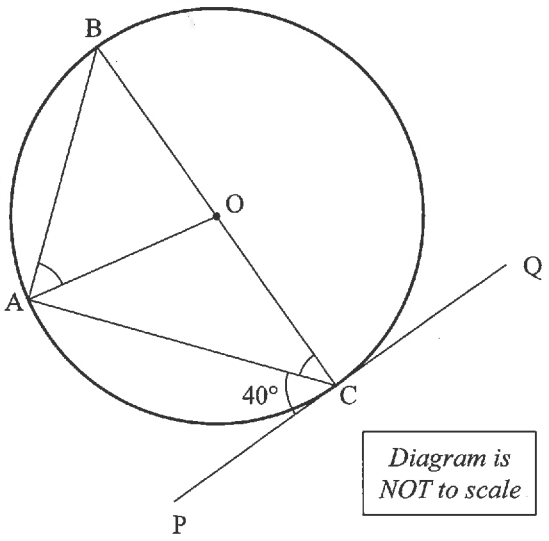


Diagram is NOT to scale

(i) Find the size of angle ACO.

Justify your answer with clear geometric reasoning.

angle ACO is 50° ~~is the~~ this is because angles on the tangent are 90°

(ii) Find the size of angle OAB.

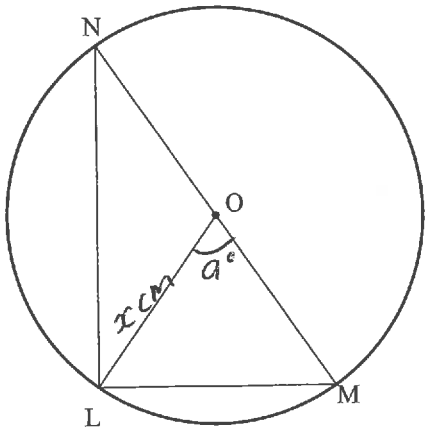
Justify your answer with clear geometric reasoning.

angle OAB is 40° this is because ~~ale~~ corresponding angles on parallel lines are equal

(iii) The points L, M, and N lie on the circumference of a circle centre O. NOM is a diameter.

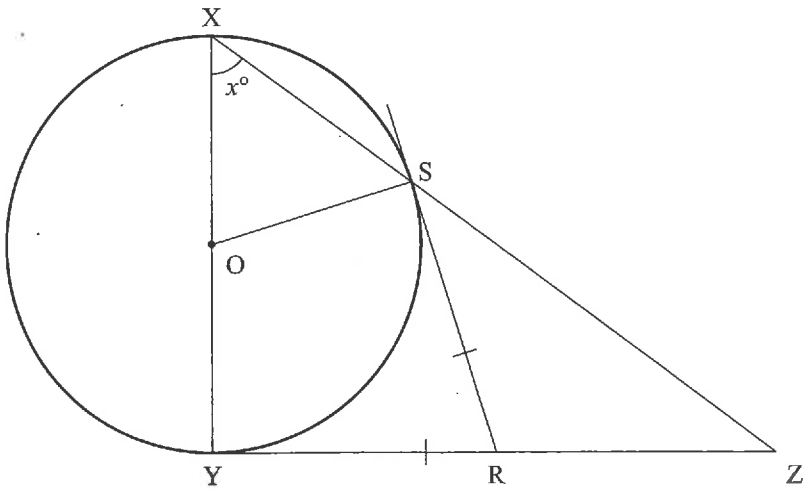
If OL = x cm and LOM = $a°$, calculate the length of NL in terms of x and a.

Justify your answer with clear geometric reasoning.



ASSESSOR'S USE ONLY

(c)



The points S, X, and Y are on the circumference of a circle centre O.

XY is a diameter of the circle.

YZ and SR are tangents to the circle.

RS = RY

Angle YXZ = $x°$

Prove that YR = RZ

ASSESSOR USE ONLY

QUESTION THREE

ASSESSOR'S USE ONLY

(a) (i) A farmer wants to climb a ladder to check the water in a tank.

He uses a 3 metre ladder and places it so that the top of the ladder just reaches the top of the tank.

The top of the tank is 2.9 metres from the ground.

He wants the angle of the ladder to the ground to be less than 80°.

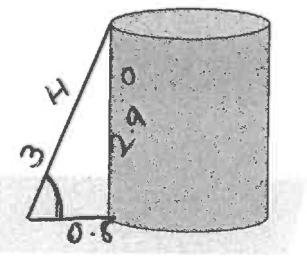
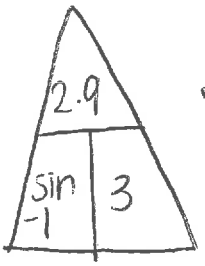


Diagram is NOT to scale

Is the ladder long enough to meet this requirement?



$\sin^{-1}(2.9 \div 3) = 75.16488842$

$= 75.2°$

yes this ladder is long enough to meet an angle of 80° and less.

r

(ii) How far is the foot of this ladder from the base of the tank?

Assume that the tank is sitting on level ground.

~~$3^2 = 2.9^2 = 2.9^2 - 3^2$~~ $3^2 - 2.9^2 = 0.59$

$\sqrt{0.59} = 0.7681145748 = 0.8$ m away. the foot of this ladder is 0.8m away from the base of the tank

u

(iii) If the farmer places the ladder at 80° to the ground, how much of the ladder is above the top of the tank?

There will be no ladder above the tank because the ladder can only create 75.2° when standing correctly with..1 over the the top of the tank.

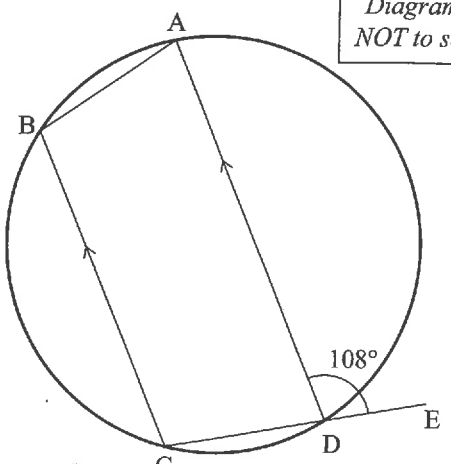
n

(b) (i) A trapezium has two sides that are parallel.

ABCD is an isosceles trapezium with its vertices on the circumference of a circle.

Angle EDA = 108°.

Diagram is NOT to scale

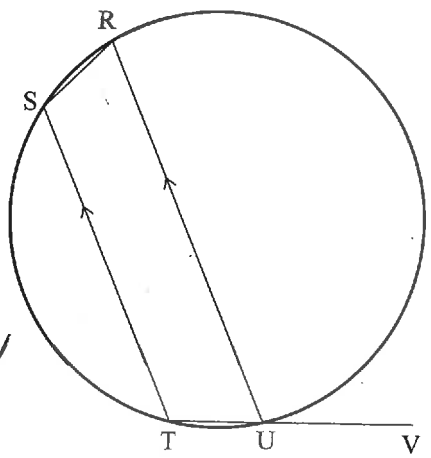


Find the size of angle ECB.

Justify your answer with clear geometric reasoning.

ECB is 54° because the interior angles are half double the exterior angles

(ii) RSTU is any trapezium with its vertices on the circumference of a circle.



Determine any geometrical facts about RSTU and prove that these are true for all such trapeziums.

Justify your answers with clear geometric reasoning.

Both ST and RU are parallel lines

(c) An aeroplane is flown 40 km on a bearing of 310° from airstrip A to airstrip B.

It then turns and flies 45 km due north to airstrip C.

The plane then heads directly to airstrip D, which is 135 km due north of its starting point at airstrip A.

For the final leg of the flight path of the plane, how far does it need to fly, and what is the bearing of the final leg of the flight path?

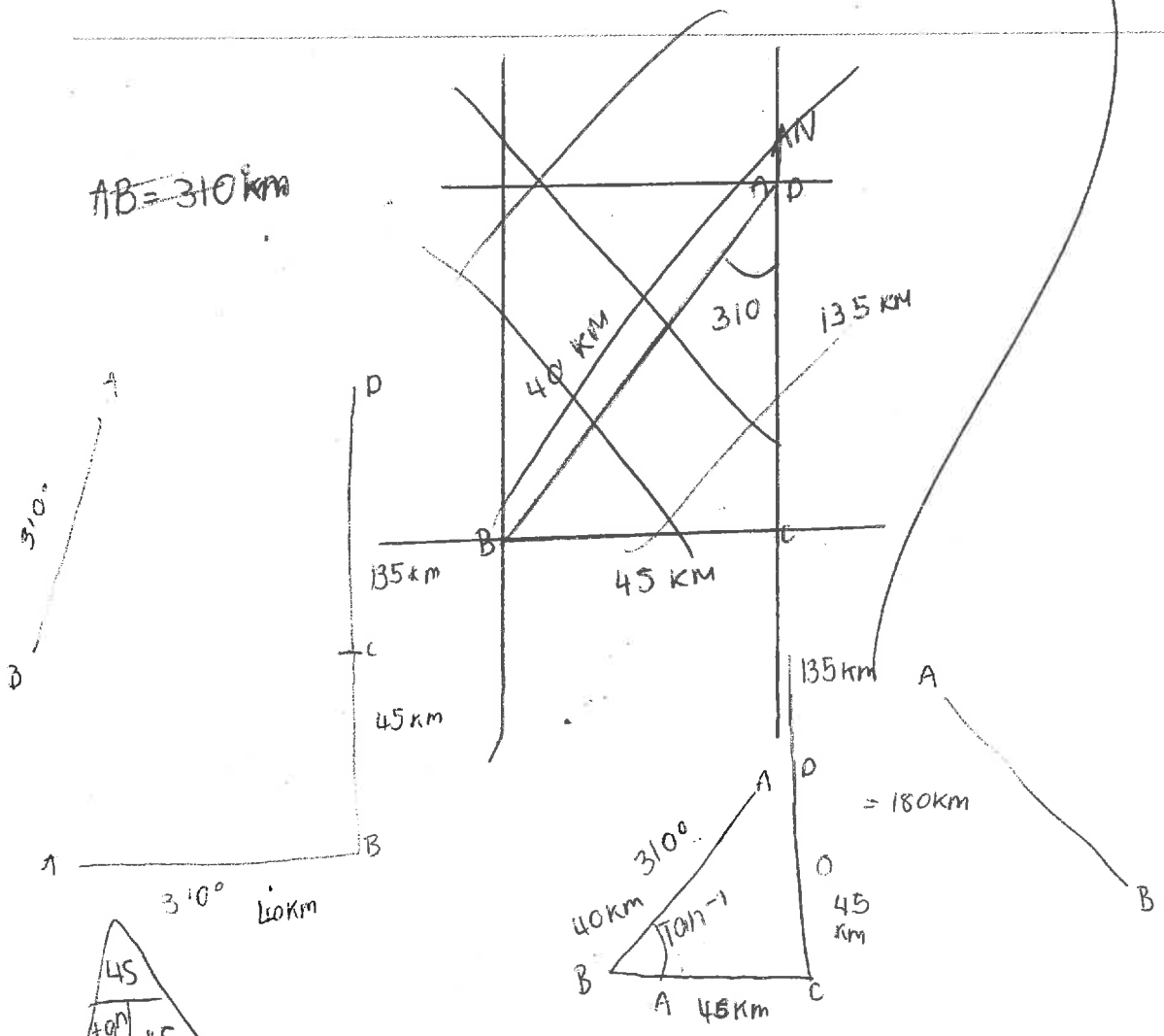
AB = bearing of 310°

total distance 180 km (45 + 135)

~~tan⁻¹(45÷45) = 45°~~

180 km distance

045° bearing



ASSESSOR'S USE ONLY

n

A3