D&D Resources Ltd
Mathematics Exam Preparation Made Easy

External Achievement Standard - 91031

Practice External Assessments 1

Geometric Reasoning

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Cover design: D & D Resources Ltd.
Image: depositphotos.com.
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Printed in New Zealand by Bluestar, Wellington

ISBN 978 0 9876578 2 4

NCEA 1 Maths

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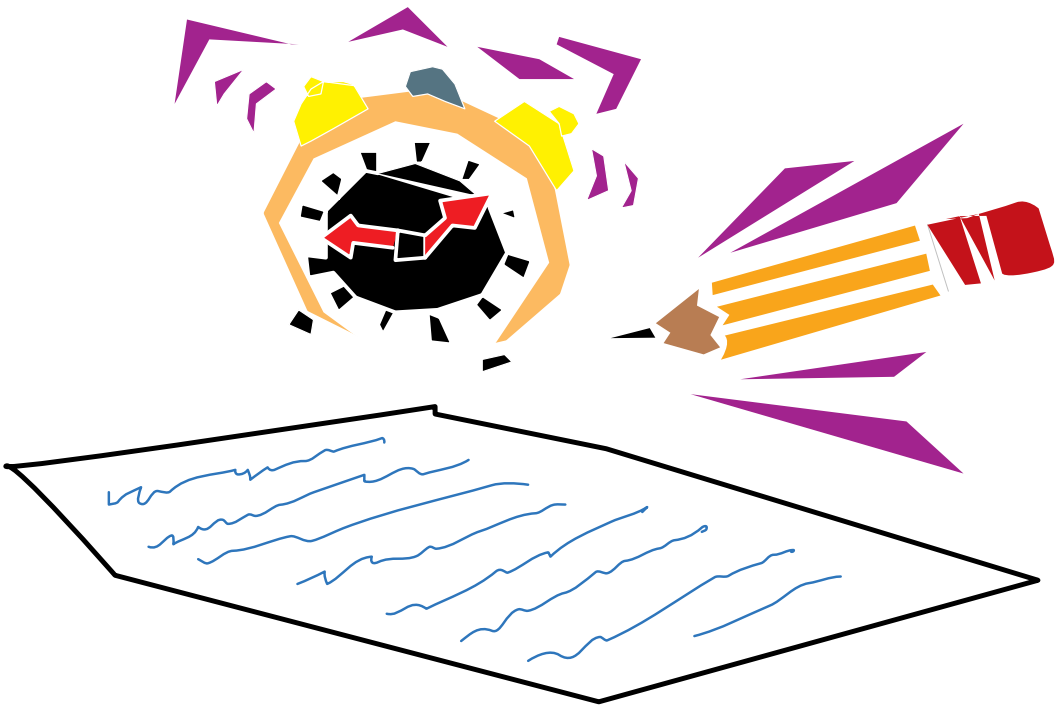


The questions in the practice assessments are NOT in order of difficulty. Attempt all questions or you may not provide enough evidence to achieve the required standard.

Achievement Standard

91031 **Apply geometric reasoning in solving problems**

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.

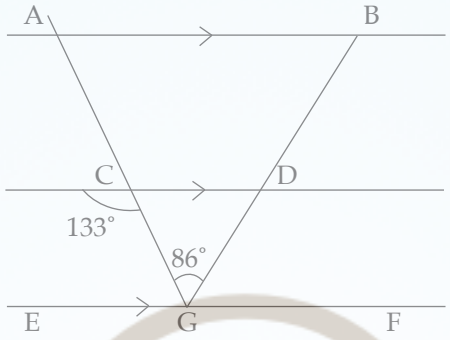
- This achievement standard is derived from Level 6 of The New Zealand Curriculum, Learning Media. The following achievement objectives taken from the Shape thread of the Mathematics and Statistics learning area are related to this achievement standard:
  - deduce the angle properties of intersecting and parallel lines and the angle properties of polygons and apply these properties
  - recognise when shapes are similar and use proportional reasoning to find an unknown length
  - use trigonometric ratios and Pythagoras' theorem in two dimensions
  - deduce and apply the angle properties related to circles.
- Apply geometric reasoning involves:
  - selecting and using a range of methods in solving problems
  - demonstrating knowledge of geometrical concepts and terms
  - communicating solutions which would usually require only one or two steps.
- Relational thinking involves one or more of:
  - selecting and carrying out a logical sequence of steps
  - connecting different concepts and representations
  - demonstrating understanding of concepts
  - forming and using a model;

  and also relating findings to a context, or communicating thinking using appropriate mathematical statements.
- Extended abstract thinking involves one or more of:
  - devising a strategy to investigate or solve a problem
  - identifying relevant concepts in context
  - developing a chain of logical reasoning, or proof
  - forming a generalisation;

  and also using correct mathematical statements, or communicating mathematical insight.
- Problems are situations that provide opportunities to apply knowledge or understanding of mathematical concepts and methods. The situation will be set in a real-life or mathematical context.
- The phrase 'a range of methods' indicates that evidence of the application of at least three different methods is required.
- Students need to be familiar with methods related to:
  - Pythagoras' theorem
  - trigonometric relationships in right-angled triangles
  - similar triangles
  - angle properties of intersecting and parallel lines
  - angle properties of polygons
  - angle properties of circles.

QUESTION TWO

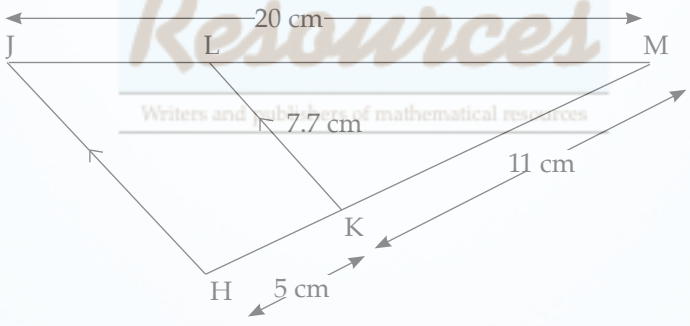
(a) Jamie is investigating the angles in the diagram below. Lines AB, CD and EF are parallel.



(i) Calculate angle DGF. Give geometric reasons.

(ii) Jamie knows that ABCD is an isosceles trapezium. Use geometric reasoning to explain why.

(b) Ari is investigating this problem. Lines HJ and KL are parallel to each other.
JM = 20 cm, HK = 5 cm, KM = 11 cm, KL = 7.7 cm.
Calculate the perimeter of the trapezium HJLK.



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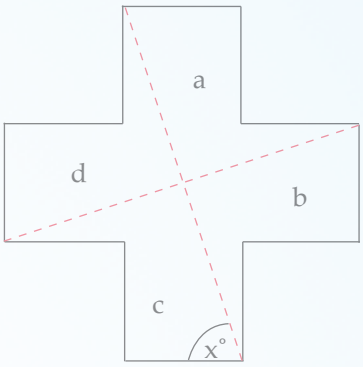
QUESTION THREE

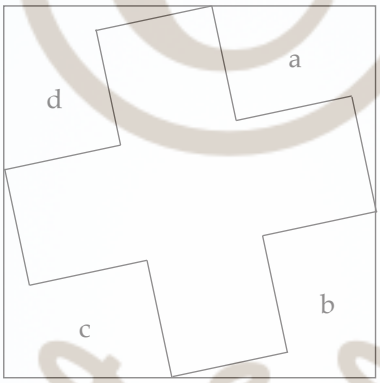
(a) Jeremy has found a puzzle in a book. It is a cross where each length is 5 cm.
Two dotted lines have been drawn on the cross to cut it into four equal shapes as shown in the diagram.



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

(ii) The four pieces, a, b, c and d are cut out and reassembled to form a new cross within a square, as shown in the diagram.

What is the area of the square? Justify your answer.



(iii) Suppose each side of the cross is n cm long. Find a formula for working out the area of any square formed when the pieces are reassembled to form a new cross within a square.

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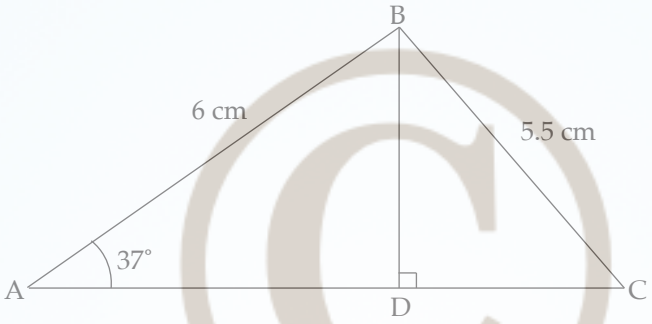
91031 **PEA 6**

You are advised to spend 60 minutes answering this assessment.

You should show ALL working and answer ALL parts of ALL questions.

QUESTION ONE

(a) Matai draws a triangle ABC and adds a line from B to the base AC, to create an altitude BD.



(i) Find the length of CD.

(ii) Show that angle ABC is not right-angled. Justify your answer.

(iii) Find the area of triangle ABC. Show your working clearly.

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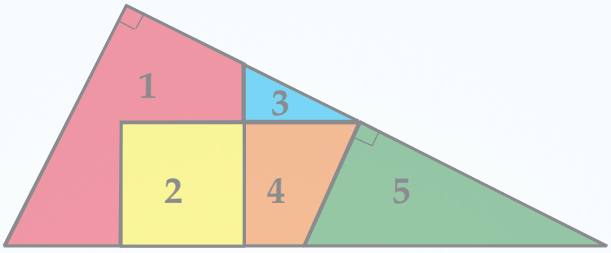
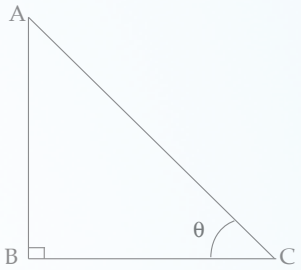
QUESTION TWO

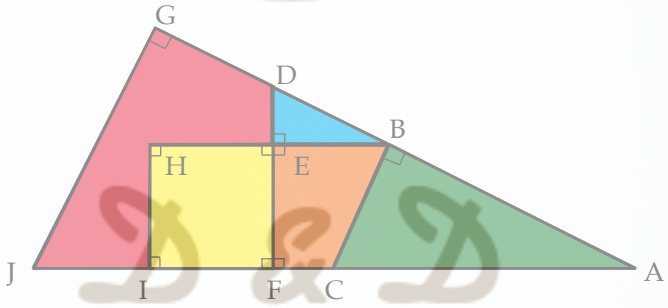
(a) Emma enjoys doing dissection puzzles.
She has created a large right-angled triangle from a five piece puzzle.



(i) Puzzle piece 5 is a right-angled triangle, in which length AB is twice length BC.
Show that angle ACB, labelled $\theta = 63.4°$.



Emma labels the points of intersection, as shown in the diagram below, for the large right-angled triangle she has created.



(ii) Name three other angles that are the same size as angle ACB and give a geometrical reason for each.

(iii) If the area of triangle ABC is 11.56 cm^2, and BC is half the length of GJ, find the length of AJ.

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Answers – 91031 PEA 3

Quest.	Evidence	Achievement	Merit	Excellence
		Apply geometric reasoning.	Apply geometric reasoning involving relational thinking.	Apply geometric reasoning with extended abstract thinking.
ONE		TWO of:	TWO of:	ONE of:
(a) (i)	tan A = 37 ÷ 138 , A = 15°	• correct angle found.		
(a) (ii)	Angle of elevation = 30°. Distance from lighthouse = 37 ÷ tan 30 = 64 m. Fisherman A has moved 138 – 64 = 74 m.	• distance from lighthouse found.	• problem solved with clear, logical working.	
(a) (iii)	Angle LAB = 30° BX is perpendicular to LA. AX = cos 30 x 100 = 86.6 m BX = sin 30 x 100 = 50 m LX = 138 – 86.6 = 51.4 m BL = $\sqrt{50^2 + 51.4^2}$ = 71.7 m	• length AX or BX found with evidence of working.	• at least two lengths found with evidence of working.	• problem solved with clear, logical working.
(b) (i)	Length BK = 2.1 – 1.8 = 0.3 m EF = 0.3 ÷ tan 13 = 1.3 m		• length EF found with working.	
(b) (ii)	Floor diag. EH = $\sqrt{1.3^2 + 2.2^2}$ = 2.56 m Ducting DE = $\sqrt{2.56^2 + 2.1^2}$ = 3.3 m Angle plastic ducting makes with floor: sin E = 2.1 ÷ 3.3 and E = 39.5°	• floor diagonal found with evidence of working.	• length of ducting, DE, found with evidence of working.	• both ducting and angle found with clear, logical working.
TWO		TWO of:	TWO of:	ONE of:

(a) (i)	AEC = 50° (alt. *L*s, // lines)
	CE = AC (isos. Δ ACE)
	AC = BD (opp. sides of a parallelogram)
	Therefore CE = BD.
		• angle AEC found with reason given.	• clear explanation given with geometric reasons.	

(a) (ii)	AE = 2 x cos 50 x 7 = 9 cm DE = AE = 9 cm Angle AED = 130° (*L*s on a line) AD = 2 x sin 65 x 9 = 16.3 cm	• length AE found with evidence of working.	• length AE found and progress towards finding length AD.	• length of diagonal AD found with clear, logical working.

(b) (i)	QSR = 28° (*L* sum of a Δ)
	PQS = 28° (alt *L*s, // lines) or
	PQS = 28° (coint *L*s, // lines)
		• angles correctly found.	• angles found with clear reasoning.	

(b) (ii)	QPS = SQR (given)
	PQS = QSR = 28° (alt *L*s, // lines)
	PSQ = QRS = 42° (*L* sum of a Δ)
	Therefore triangles PQS and QRS are similar.
		• incomplete explanation given as to why triangles PQS and QRS are similar.	• clear explanation given as to why triangles PQS and QRS are similar.	

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