



**D&D Resources Ltd**  
Mathematics Exam Preparation Made Easy

External Achievement Standard - 91031

# Practice External Assessments 1

## GEOMETRIC REASONING

© Copyright D & D Resources Ltd 2020 – 2021.

This book is in copyright. Subject to statutory exception and to provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of D & D Resources Ltd.

D & D Resources Ltd  
P O Box 8  
WAIHI BEACH 3642

Phone (07) 862 8599  
Email [admin@ddresources.co.nz](mailto:admin@ddresources.co.nz)  
Web [www.ddresources.co.nz](http://www.ddresources.co.nz)  
(orders, queries and feedback)

Cover design: D & D Resources Ltd.  
Image: [depositphotos.com](http://depositphotos.com).  
Author: [livejournalist.guseff@gmail.com](mailto:livejournalist.guseff@gmail.com)

Printed in New Zealand by Bluestar,  
Wellington

ISBN 978 0 9876578 2 4

**NCEA 1 Maths**

## Contents

Apply Geometric Reasoning in Solving Problems Achievement Standard – Page 3

Apply Geometric Reasoning in Solving Problems PEA 1 – Page 4

Apply Geometric Reasoning in Solving Problems PEA 2 – Page 10

Apply Geometric Reasoning in Solving Problems PEA 3 – Page 16

Apply Geometric Reasoning in Solving Problems PEA 4 – Page 22

Apply Geometric Reasoning in Solving Problems PEA 5 – Page 28

Apply Geometric Reasoning in Solving Problems PEA 6 – Page 34

Apply Geometric Reasoning in Solving Problems PEA 7 – Page 40

Apply Geometric Reasoning in Solving Problems PEA 1 Answers – Page 46

Apply Geometric Reasoning in Solving Problems PEA 2 Answers – Page 48

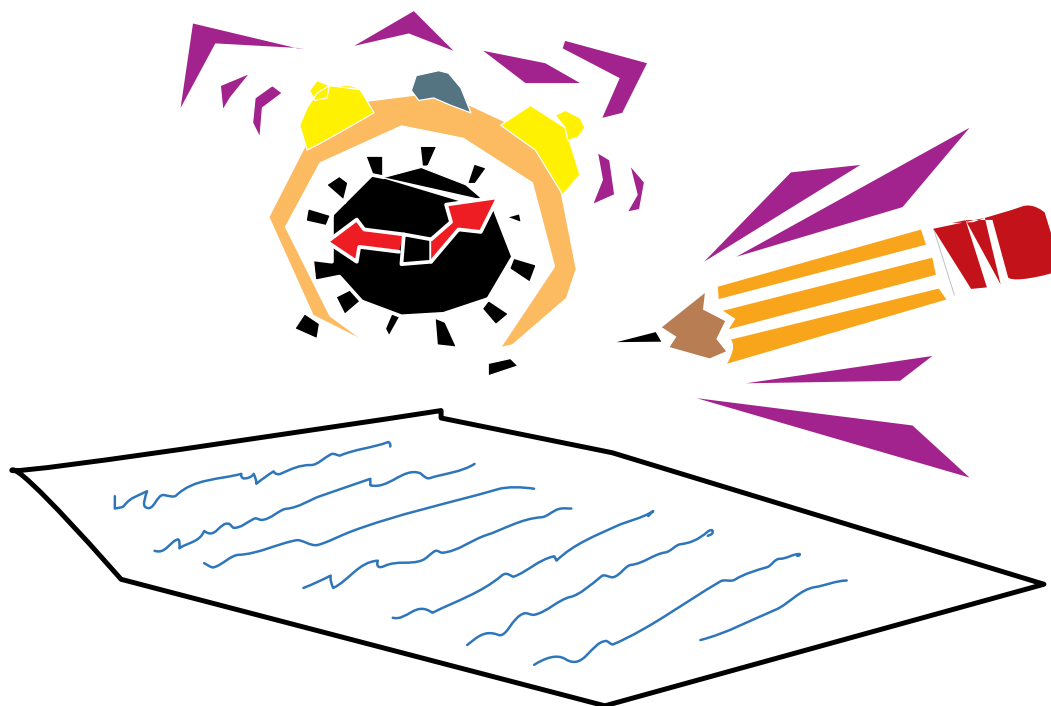
Apply Geometric Reasoning in Solving Problems PEA 3 Answers – Page 50

Apply Geometric Reasoning in Solving Problems PEA 4 Answers – Page 52

Apply Geometric Reasoning in Solving Problems PEA 5 Answers – Page 55

Apply Geometric Reasoning in Solving Problems PEA 6 Answers – Page 58

Apply Geometric Reasoning in Solving Problems PEA 7 Answers – Page 61



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
<ul style="list-style-type: none"> <li>Apply geometric reasoning in solving problems.</li> </ul>	<ul style="list-style-type: none"> <li>Apply geometric reasoning, using relational thinking, in solving problems.</li> </ul>	<ul style="list-style-type: none"> <li>Apply geometric reasoning, using extended abstract thinking, in solving problems.</li> </ul>

- ◆ 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.

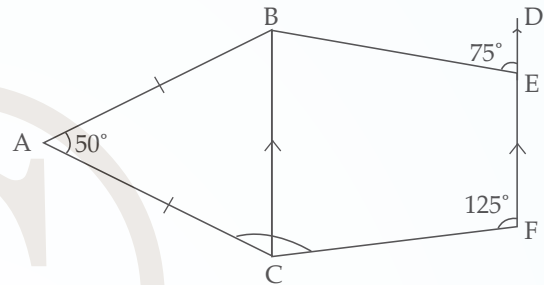
You are advised to spend 60 minutes answering this assessment.

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

### QUESTION ONE

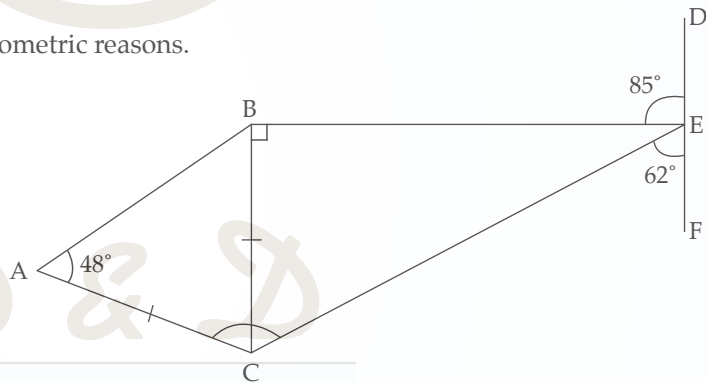
- (a) The diagram below shows the frame for a road bike.  $BC$  and  $DF$  are parallel and  $AB = AC$ .

Find the size of angle  $ACF$ . Give geometric reasons.



- (b) (i) This diagram shows the frame for a mountain bike. The length of the chain stay  $AC$  is the same as the length of the frame  $BC$ .

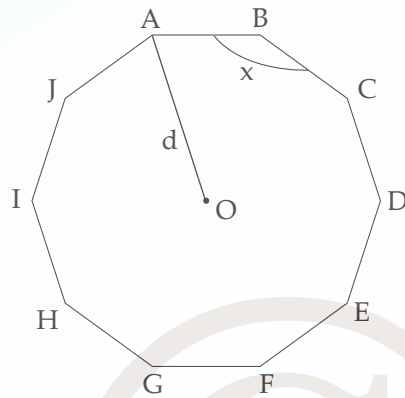
Find the size of angle  $ACE$ . Give geometric reasons.



- (ii) Assuming the seat stay,  $AB$ , is  $w$  cm long, find an expression in terms of  $w$  for length  $BE$ , the distance from the base of the seat to the handlebars.

### QUESTION THREE

(a) A decagon has 10 sides. Damien constructs a regular decagon.



(i) What is the size of angle ABC, labelled  $x$ ? Show your working.

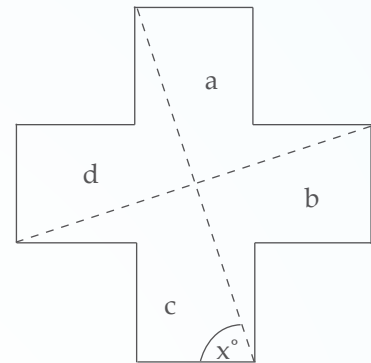
(ii) Find an expression, in terms of  $d$ , for the perimeter of the decagon if the distance from centre  $O$  to each vertex is  $d$  cm.

(iii) A tessellation is a pattern in which shapes fit together perfectly with no gaps. Damien thinks that a tessellation could be formed using regular decagons and pentagons. Explain clearly whether this would work.

### QUESTION THREE

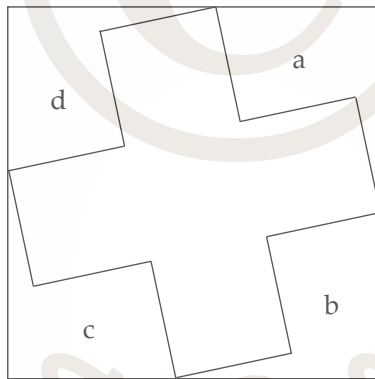
- (a) Jeremy has found a puzzle in a book. It is a cross where each length is 5 cm. Two dotted lines have been drawn on the cross to cut it into four equal shapes as shown in the diagram.

(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.

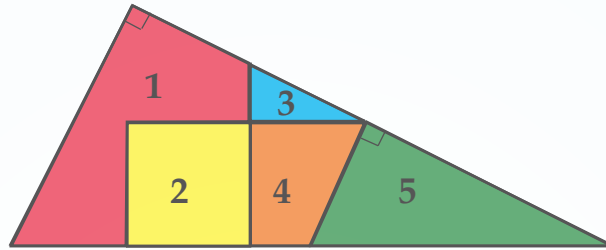
What is the area of the square? Justify your answer.



- (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.

## QUESTION TWO

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

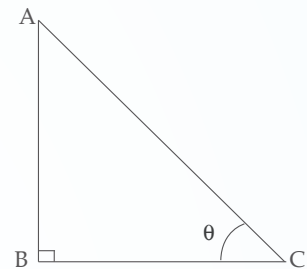


- (i) Puzzle piece 5 is a right-angled triangle, in which length AB is twice length BC.  
Show that angle ACB, labelled  $\theta = 63.4^\circ$ .

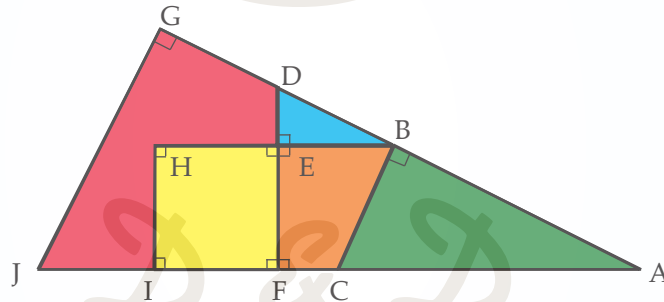
---

---

---



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 have the same size as angle ACB and give a geometrical reason for each.

---

---

---

Writers and publishers of mathematical resources

- (iii) If the area of triangle ABC is  $11.56 \text{ cm}^2$ , and BC is half the length of GJ, find the length of AJ.

---

---

---

---

---

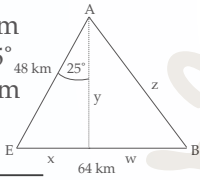
---

---

---

# Answers – 91031

# PEA 2

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)	$d^2 = 64^2 - 36^2$ $d = 52.9 \text{ km (1 dp)}$ Extra distance = 17 km.	• correct answer.		
(b)	$\cos A = \frac{36}{64}$ , $A = 55.8^\circ \text{ (1 dp)}$ Bearing = $90^\circ + 55.8^\circ$ = $145.8^\circ$ or $146^\circ$	• correct angle.	• correct bearing.	
(c)	Taller building = $(x + 8)\text{m}$ Distance between buildings = $8 \div \tan 31^\circ = 13.3 \text{ m}$ Cable length = $8 \div \sin 31^\circ = 15.5 \text{ m}$ Cable is 2.2 m longer.	• one correct length.	• two correct lengths.	• problem solved.
(d) (i)	Angle NAE = $155^\circ$ (Ls at a point) Bearing = $025^\circ$ (coint. Ls, // lines)	• angles found.	• clear explanation with reasons.	
(d) (ii)	$x = 48 \times \sin 25^\circ$ $x = 20.285... \text{ km}$ $y = 48 \times \cos 25^\circ$ $y = 43.502... \text{ km}$ $w = 64 - 20.3$ $= 43.7 \text{ km}$ $z = \sqrt{43.5^2 + 43.7^2}$ $= 61.7 \text{ km (1 dp)}$ Total distance = 174 km. 	• one length calculated.	• two lengths calculated.	• total distance calculated with working.
TWO		TWO of:	TWO of:	ONE of:
(a) (i)	$\angle CGE = 47^\circ$ (coint. Ls, // lines) $\angle DGF = 47^\circ$ (Ls on a line)	• angles found only.	• correct angles and reasons.	
(a) (ii)	$\angle GCD$ and $\angle GDC = 47^\circ$ (alt. Ls // lines) $\angle ACD$ and $\angle CDB = 133^\circ$ (Ls on a line) $\angle CAB$ and $\angle DBA = 47^\circ$ (corresp. Ls, // lines) ABCD is an isosceles trapezium.	• angles found only.	• clear reasoning given.	
(b)	BAF, BCD and DEG are similar triangles. If angle BAF = $\theta$ , then angles CBD and GDE = $\theta$ $\tan \theta = \frac{x}{AF}$ and $\tan \theta = \frac{EG}{x}$ Since $\frac{x}{AF} = \frac{EG}{x}$ , $AF \times EG = x^2$			• correct proof with logical reasoning.