NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1, 2003

Mathematics: Use geometric reasoning to solve problems (90153)

National Statistics

Assessment Report

Assessment Schedule

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National Statistics

Number of Results	Percentage achieved			
	Not Achieved	Achieved	Merit	Excellence
37,486	31.8%	50.0%	16.1%	2.2%

Assessment Report

Every candidate for a National Certificate of Educational Achievement examination paper is expected to:

- read the question and do what the question asks
- allow adequate time to complete answers
- be accurate: check and/or proofread
- use appropriate technical terms
- bring the correct equipment
- write and/or draw clearly
- use pen if work is to be eligible for reconsideration.

General Comments

1. There were many opportunities available for candidates to 'find unknowns' and hence gain Achievement in the standard. Those candidates who attempted most questions usually achieved the standard, but those who only attempted the first Questions [One (a), (b) and (c)] and ignored the later opportunities to show evidence often did not achieve. Candidates should be encouraged to attempt as much of the assessment task as possible to ensure they have the best opportunity to succeed, even if only aiming for Achievement in the standard.

   As in 2002, candidates had trouble correctly naming angles. Candidates need to be encouraged to define angles with three letters, eg use $\angle ABC$ so as to avoid ambiguity that may arise when a label such as 'angle B' is used.

   Candidates often made numerical errors in finding angles.

2. Candidates were good at finding angles, but their reasoning was not clear, incomplete or ambiguous. Relevant reasons are needed and the correct words should be known – the only abbreviations that should be used are those widely accepted. A 'shot-gun' approach of listing as many reasons as can be remembered, and a student's own 'shorthand' of reasons, were unacceptable.

   Candidates must understand that all questions require two (or more) steps of reasoning and reasons for each step are required. As a back up, candidates should be encouraged to provide reasoning for all questions in assessment tasks for this standard. Even though reasons were not asked for in Question One (a) and (b), in some cases the reasons provided here could have enabled candidates to gain Achievement with Merit if they had not provided enough evidence in the question where reasons were asked for.

The use of similar triangles to solve Question Two (c) was overlooked by many, who chose to apply trigonometry, possibly reflecting their lack of preparation in similar triangles. While a trigonometric approach was accepted, candidates more often than not had difficulty in providing their reasons for use of SOH, CAH, TOA (or simply forgot to), so only gained credit towards Achievement in this question. It is important that candidates understand the requirement for Achievement with Merit ie 'find unknowns using a process with 2-step reasoning' no matter which approach they use to find unknowns.

3. At Achievement with Excellence level most candidates chose not to attempt Question Three, which provided them the opportunity to gain Excellence. While there were some very correct and often elegant proofs, most candidates who attempted Question Three did not appear to be familiar with proofs and simply wrote sentences describing the situation with few or no geometrical reasons. The need for logical setting out with steps that are linked, and how to state a final comment which concludes the proof, should be understood by candidates attempting to gain Achievement with Excellence.

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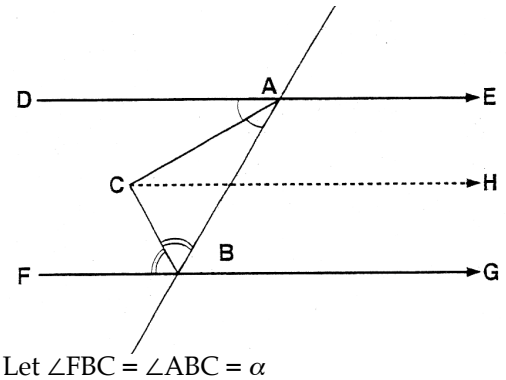
Evidence Statement

	Criteria	No.	Code	Evidence	Judgement	Sufficiency
Achievement	Find unknowns using two-step processes.	One (a) (b) (c)	A A A Reasons A	$\angle a = 207°$ $\angle b = 129°$ $\angle$LED = 102° (opposite angles of a rhombus). $\angle c = 39°$ (base angles of isosceles triangle).	Allow other valid reasons – must have two reasons.	**Three A**
Achievement with Merit	Find unknowns using a process with two-step reasoning.	Two (a) (b) (c)	A/M A/M A/M	$\angle$IGC = 100° (vertically opposite). $\angle$IFC = 80° (interior angles of a quadrilateral). $\angle$GKE = 40° (base angles of isosceles triangle). $\angle$LKJ = 140° (angles on a line). (Δ GJD and Δ GKE are similar triangles). Scale factor $= \frac{9}{4}$ KE $= \frac{9}{4} \times 6.1 = 13.725$ m or KM $= 9\cos 40^{o} = 6.89$ m (right-angled triangle). KE $= 2 \times 6.89 = 13.79$ m (axis of symmetry).	Allow other valid chains of reasoning. Units not required. Any rounding.	Achievement plus **two** M OR **three** M Replacement evidence (reasons) can be taken (but only once) from One (a), One (b) or One (c).

	Criteria	No.	Code	Evidence	Judgement	Sufficiency
Achievement with Excellence	Investigate a conjecture or present a proof involving at least three steps of reasoning in analysing shapes or designs.	Three		Let ∠DAC = ∠BAC = α Let ∠FBC = ∠ABC = β Let ∠BCA = θ $2\alpha + 2\beta = 180°$ (cointerior angles of parallel lines) $\alpha + \beta = 90°$ $\theta = 90°$ (angle sum of triangle). AB is a diameter of circle ACB (angle in the semicircle). OR  Let ∠FBC = ∠ABC = α Let ∠DAC = ∠CAB = β Then $2\alpha + 2\beta = 180°$ (cointerior angles of parallel lines) $\alpha + \beta = 90°$ Draw CH // AE ∠FBC = ∠BCH (alternate angles of parallel lines). ∠DAC = ∠ACH (alternate angles of parallel lines). ACB = $\alpha + \beta = 90°$ AB is a diameter of circle ABC (angle in the semicircle).	Allow other valid proofs. Allow definition on diagram.	**Merit plus E**
			A		2 relevant and correct numeric statements.	
			M		A + 2 geometric reasons.	
			E		Complete proof, all steps shown with geometric reasons.	

Judgement Statement

Judgement statements (formerly referred to as sufficiency statements) help students understand how their overall results for each standard were arrived at.

Achievement	Achievement with Merit	Achievement with Excellence
Find unknowns using two-step processes **(A)**	*Find unknowns using a process with two-step reasoning* **(M)**	*Investigate a conjecture or present a proof involving at least three steps of reasoning in analysing shapes or designs* **(E)**
3 × **A**	Achievement ***plus*** 2 × **M** *or* 3 × **M**	Merit ***plus*** **E**

Note: Insufficient evidence to support a judgement above **(X)**