2017 Senior External Examination

Mathematics A

Paper One — Question and response book

Thursday 26 October 2017

9 am to 12:10 pm

Time allowed

- Perusal time: **10 minutes**
- Working time: **3 hours**

Examination materials provided

- Paper One — Question and response book
- Paper One — Resource book

Equipment allowed

- QCAA-approved equipment
- ruler (metric, parallel or rolling)
- protractor
- drawing compass
- set squares
- templates (without formulas)
- non-programmable calculator
- graphing calculator

Not allowed: Calculators with computer algebra system (CAS) functionality.

Directions

Do not write in this book during perusal time.

Paper One has **four** extended-response questions.
Attempt **all** questions.

Assessment

Paper One assesses the following assessment criteria:

- Knowledge and procedures (KP)
- Modelling and problem-solving (MP)
- Communication and justification (CJ)

Assessment standards are at the end of this book.

After the examination session

The supervisor will collect this book when you leave.

Candidate use

Print your candidate number here

1	7	–					–	

Attach barcode here

Number of books used

Supervisor use only

Supervisor's initials

QCAA use only

Marker number

Queensland Government | Queensland Curriculum & Assessment Authority

For all Queensland schools

Paper One has **four** extended-response questions. Attempt **all** questions.

Write your responses in the spaces provided. **Show full working in all responses. Partial credit can be awarded only if working is shown.**

Additional pages for responses are at the back of this book.

Question 1

a. Calculate the weekly pay of an employee earning an annual salary of $75 765. Your answer should be correct to the nearest dollar.

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(KP)

b. A real-estate agent's charges for selling a property are as follows:

- $500 advertising fee;
- 5% of the first $18 000 of the sale price; 2.5% of the remainder of the sale price.

How much does the agent charge on a sale worth $1 210 000?

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(KP)

c. An Antarctic tour is advertised at **US$5 680** per person. The exchange rate is **A$1 : US$0.75**. What is the total cost for a **couple** to go on this expedition, in Australian dollars?

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(KP)

d. Michelle earns $810.70 a week as a courier and $480.50 a week as a masseuse.

i. If the Medicare Levy is at 2%, use the tax table below to calculate the total weekly PAYG tax liability, including the Medicare Levy, for **each job**.

Taxable income	Tax on this income
$18201 – $37000	19c for each $1 over $18200
$37001 – $87000	$3572 plus 32.5c for each $1 over $37000
$87001 – $180000	$19822 plus 37c for each $1 over $87000
$180001 and over	$54232 plus 45c for each $1 over $180000

(KP)

One of Michelle's friends told her she would have more money to spend if she just worked one single job.

ii. Investigate this statement, and determine if it is true that Michelle would earn a higher weekly net income for the same total gross income in a single job.

Fully justify your decision with supporting mathematical evidence.

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(MP)

e. Steve is paid $20.50 per hour for a 35-hour week. For working wet days, he is paid a wet weather allowance of $5.65 per hour extra.

Calculate Steve's pay for a week in which he works 10 hours in the rain.

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(KP)

f. A shop marks up its T-shirts by 45% from the wholesale price.

These T-shirts were then put on sale after a 12.5% discount at a sale price of $19.

Determine the original wholesale price of the T-shirts.

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(KP)

g. In 2014, a farmer had a large property with 10 000 head of cattle. Because of drought, his stock was reduced by 25% in 2015, and floods caused a further 10% reduction in 2016.

The farmer has estimated that he needs to purchase a 50% increase on his **current** herd of cattle to regain his losses.

Determine if this percentage increase in cattle will get the farmer back to his original stock level of 10 000.

Fully justify your decision with supporting mathematical working.

State **one limitation** of this model.

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(MP)

Question 2

a. A sheep shearer recorded the following shearing totals for a 10-day period:

47	51	58	59	60	63	66	68	70	71

For this data find the:

i. mean

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(KP)

ii. median

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(KP)

iii. interquartile range.

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(KP)

b. Twenty-four households were surveyed to find the amount of their quarterly electricity account in dollars. The results are listed below.

197	185	183	200	232	179	184	163
216	198	169	176	187	209	234	172
167	195	166	211	194	192	176	163

i. Construct an **ordered** stem-and-leaf plot to represent this data. Use the key 19/7 = $197.

(KP)

ii. Calculate the five-number summary for this data.

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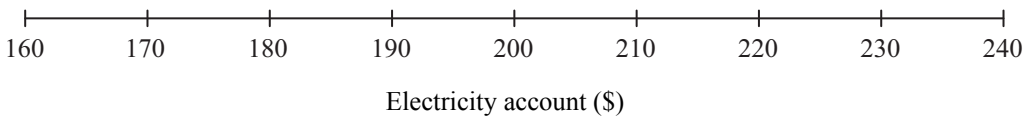
(KP)

iii. Illustrate this data using a box-and-whisker plot.

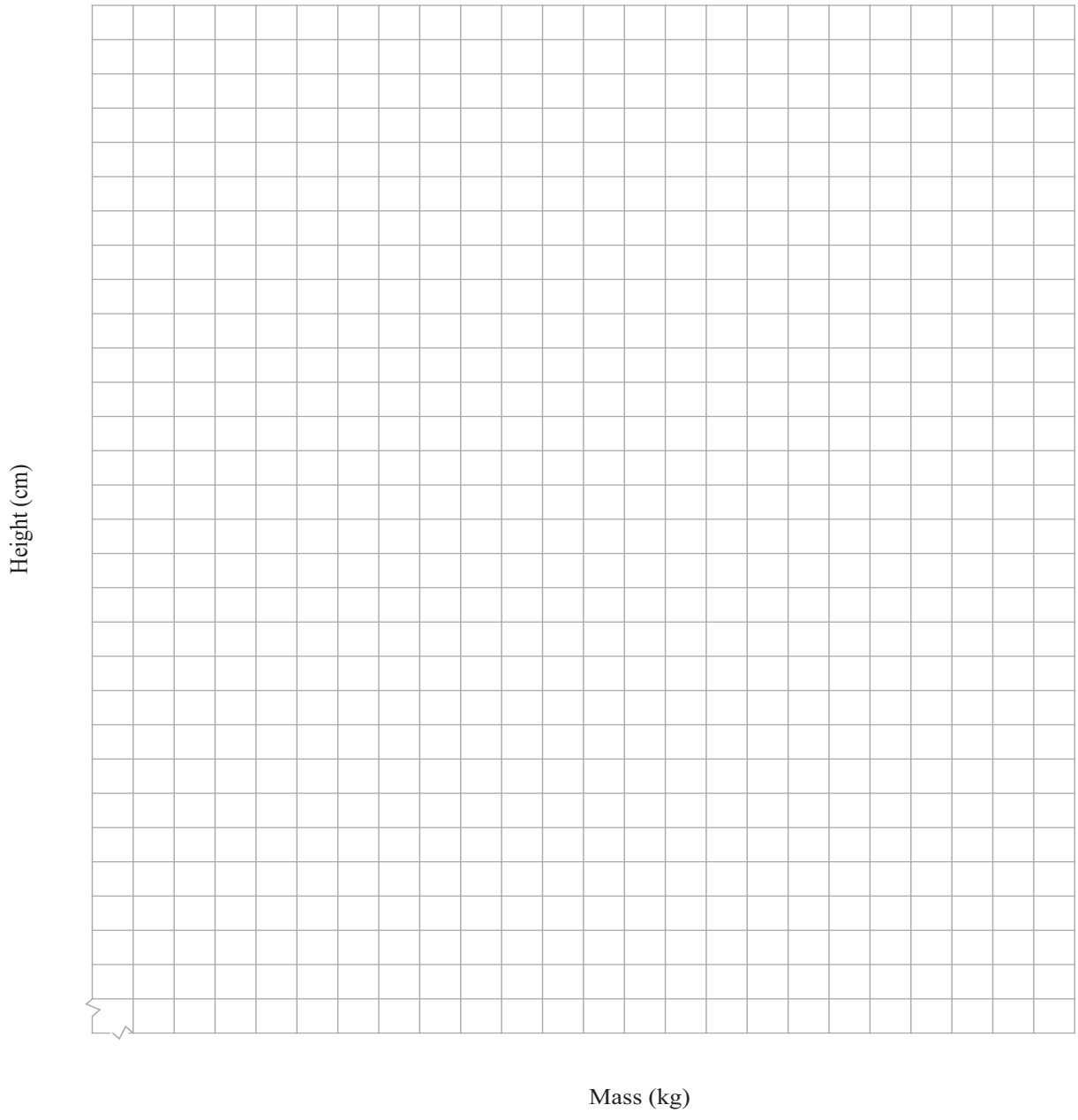


(KP)

c. The table below shows the height and mass of ten Year 11 students.

Mass (kg)	45	50	54	59	60	65	70	75	78	80
Height (cm)	120	124	130	135	142	148	160	164	170	175

i. Using the grid below, display the data on a scatterplot.



(KP)

ii. Draw a line of best fit to represent this data.

(KP)

iii. What type of correlation is this?

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(KP)

Question 3

a. A sample of 20 students must be selected from a school population of 850 students.
The school lists students in alphabetical order and all have a three-digit student number.
Describe one random sampling method that could be used to choose the students.

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(KP)

b. Three girls and two boys are members of the Environmental Committee.
Two of them are randomly chosen to represent the committee at State Council.

i. Draw a tree diagram to show all the possible pairs that could be chosen to represent the committee at State Council.

(KP)

ii. Find the probability that the pair chosen consists of two girls.

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(KP)

c. The probability that Jane wins a raffle is $\frac{5}{65}$.

If Jane bought 12 tickets in the raffle, what is the total number of tickets that must have been sold?

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(KP)

d. Kate and Kris are playing a card game where one card is randomly chosen from a standard pack of cards.

Determine if Kate is correct when she tells Kris he has more chance of drawing a heart than a picture card (King, Queen or Jack).

Justify your decision with mathematical reasoning.

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(MP)

e. Which of the following would be **least** affected by the addition of an extreme score to a dataset that has a large number of entries?

(Circle the letter of the correct response.)

A Range

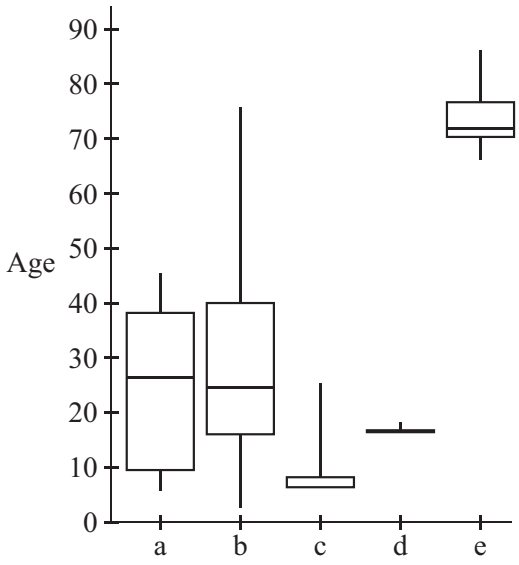
B Interquartile range

C Mode

D Mean

(KP)

f. Below are five box-and-whisker plots which illustrate the age data of five groups of 20 people passing a street corner.



Match **each group** (1, 2, 3, 4, 5) to its **appropriate box-and-whisker plot** (a, b, c, d, e)

Group	Box-and-whisker plot
1	A teacher taking nineteen Year 2 students to the shops
2	A group of elderly citizens
3	A random group of twenty citizens
4	A group of twenty Year 11 students on an excursion
5	Five families of four people, each with two adults and two primary- school-aged children

Group	Box-and-whisker plot
1	
2	
3	
4	
5	

(KP)

Question 4

Use the chart on the following page to respond to Question 4a. A copy of the chart is reproduced at the back of this book if required.

a. After being out on a friend's boat you are heading up the coast on a bearing of 330° T and at a speed of 12 knots. At this time Cape Moreton is at a bearing of 269° T. Two hours later it is now at a bearing of 197° T.

Your friend worries that the boat has only about 100 litres of petrol left and uses 40 litres of petrol per hour when travelling at a speed of 12 knots.

You decide to immediately return to Noosa Heads but are concerned that there may be insufficient petrol to make the direct journey. Your friend suggests it may be better to head to Point Cartwright to refuel and then continue from Point Cartwright to Noosa Heads.

Determine which option you should choose.

Justify your decision with mathematical reasoning.

State **one strength** and **one limitation** of the mathematical model.

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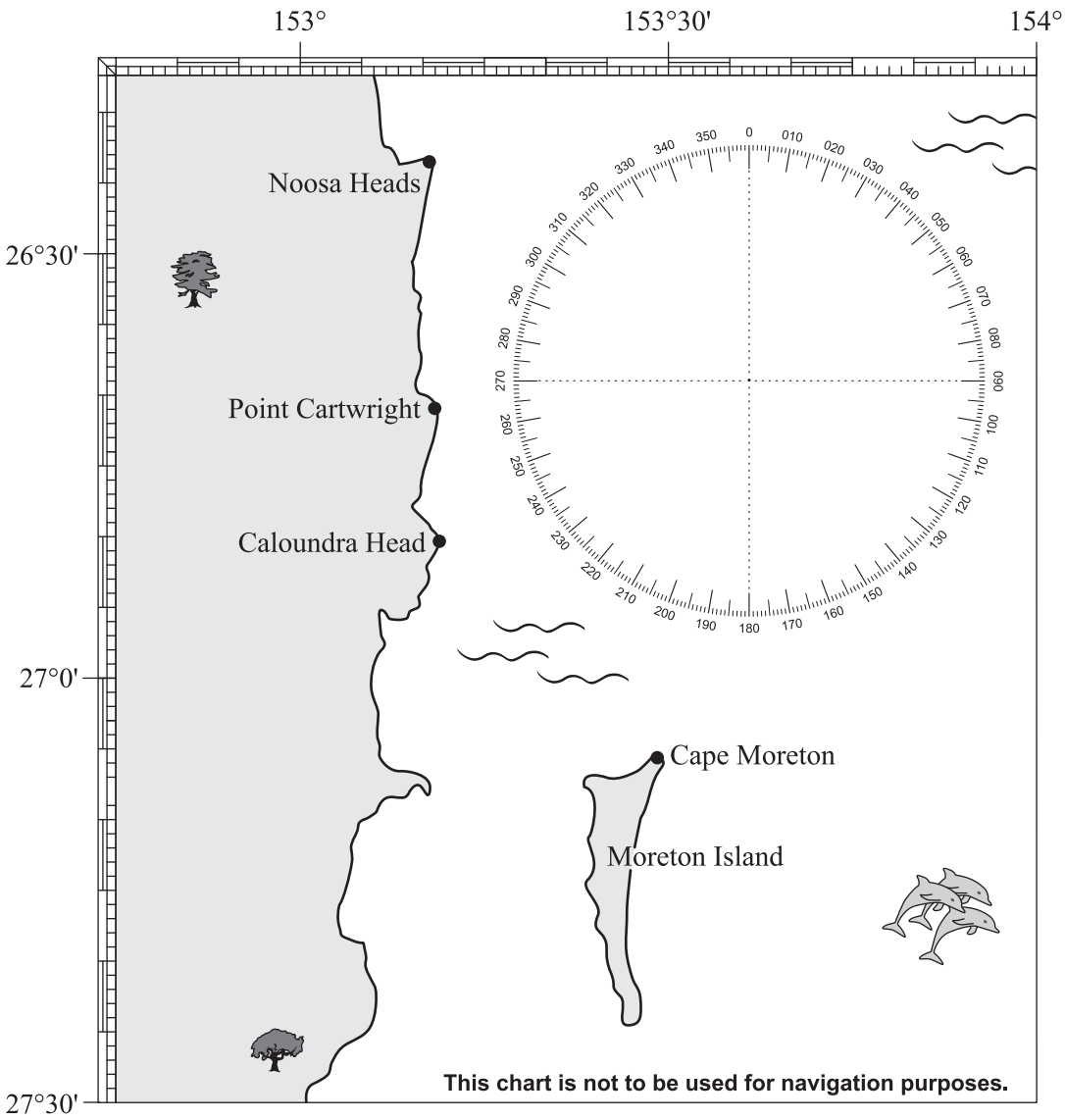
(MP)


153°
153°30'
154°
26°30'
27°0'
27°30'
Noosa Heads
Point Cartwright
Caloundra Head
Cape Moreton
Moreton Island
This chart is not to be used for navigation purposes.

b. At 9 am a boat, sailing on a course of 270° T, sights a lighthouse at 000° T.
At 10.30 am, the bearing of the lighthouse is 045° T.
The boat is cruising at 18 knots.
If the boat continues on this course at the same constant speed, determine the expected true bearing of the lighthouse from the boat at 11 am.

(KP)

End of Paper One

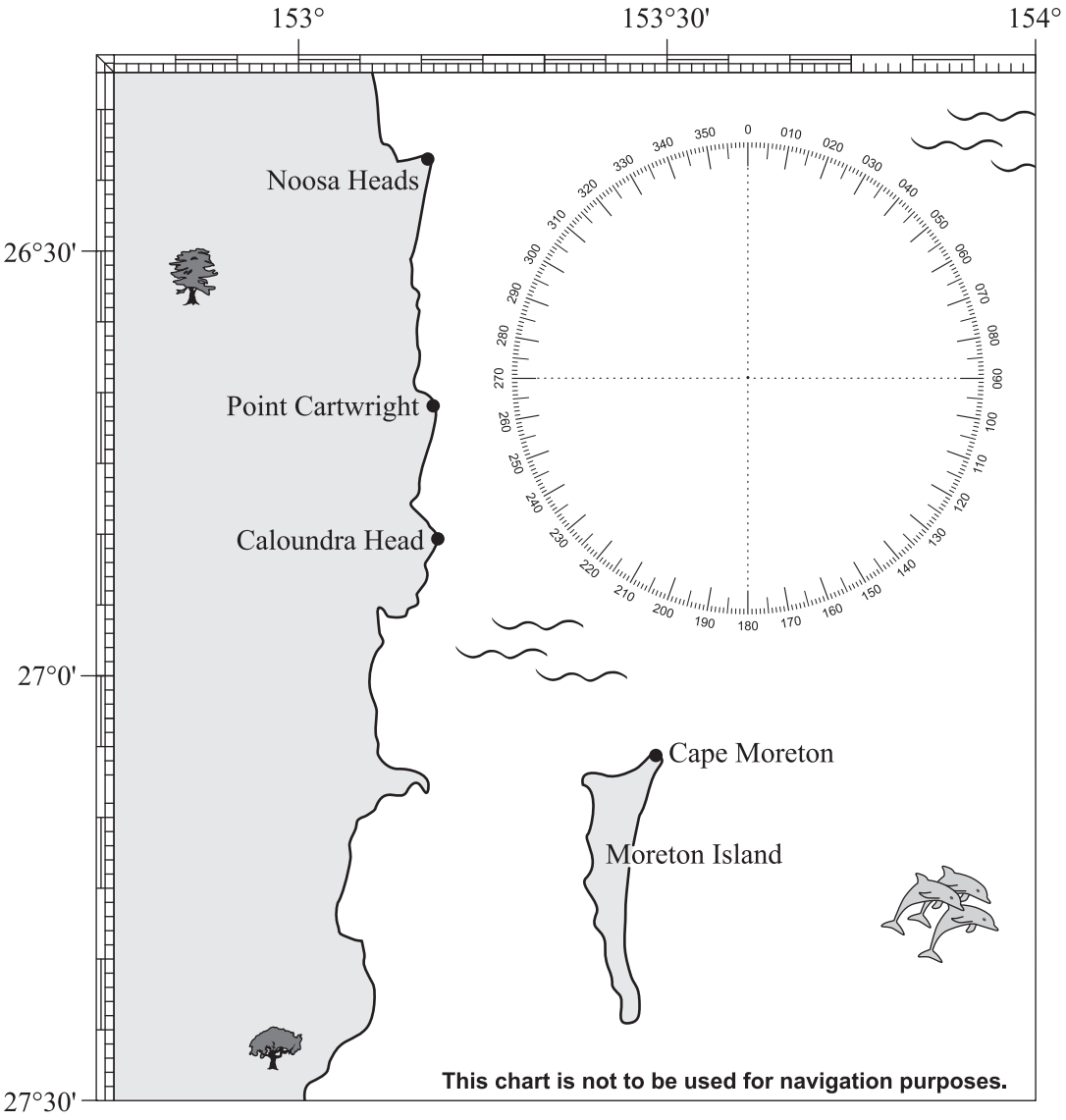
Additional page for responses (if required)

Question [ ]

Additional page for responses (if required)

Question 

Spare chart (if required)



Assessment standards from the Mathematics A Senior External Syllabus 2006

Criterion	A	B	C	D	E
Knowledge and procedures (KP)	The **overall quality** of a candidate's achievement across the full range within the contexts of application, technology and complexity, and across topics, **consistently demonstrates**: • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate and proficient use.	The **overall quality** of a candidate's achievement across a range within the contexts of application, technology and complexity, and across topics, **generally demonstrates**: • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate use.	The **overall quality** of a candidate's achievement in the contexts of application, technology and complexity, **generally demonstrates**: • accurate recall and use of basic definitions and rules • use of some technology • accurate use of basic procedures.	The **overall quality** of a candidate's achievement in the contexts of application, technology and complexity, **sometimes demonstrates**: • accurate recall and use of some definitions and rules • use of some technology.	The **overall quality** of a candidate's achievement **rarely demonstrates** knowledge and use of procedures.
Modelling and problem solving (MP)	The **overall quality** of a candidate's achievement across the full range within each context, and across topics **generally demonstrates** mathematical thinking which includes: • interpreting, clarifying and analysing a range of situations, and identifying variables • selecting and using effective strategies • informed decision making … *and* sometimes **demonstrates** mathematical thinking which includes: • selecting and using procedures to solve a wide range of problems • initiative in exploring the problem • recognising strengths and limitations of models.	The **overall quality** of a candidate's achievement across a range within each context, and across topics, **generally demonstrates** mathematical thinking which includes: • interpreting, clarifying and analysing a range of situations, and identifying variables • selecting and using strategies … *and* sometimes **demonstrates** mathematical thinking which includes: • selecting and using procedures required to solve a range of problems • informed decision making.	The **overall quality** of a candidate's achievement **demonstrates** mathematical thinking which includes: • interpreting and clarifying a range of situations • selecting strategies and/or procedures.	The **overall quality** of a candidate's achievement **demonstrates** mathematical thinking which includes following basic procedures and/or using strategies.	The **overall quality** of a candidate's achievement rarely **demonstrates** mathematical thinking which includes following basic procedures and/or using strategies.

(continued)

Criterion	A	B	C	D	E
Communication and justification (CJ)	The **overall quality** of a candidate's achievement across the full range within each context **consistently demonstrates**: • accurate use of mathematical terms and symbols • accurate use of language • organisation of information into various forms suitable for a given use • use of mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions • justification of procedures.	The **overall quality** of a candidate's achievement across a range within each context **generally demonstrates**: • accurate use of mathematical terms and symbols • accurate use of language • organisation of information into various forms suitable for a given use • use of mathematical reasoning to develop simple logical arguments in support of conclusions, results and/or decisions.	The **overall quality** of a candidate's achievement in some contexts **generally demonstrates**: • accurate use of basic mathematical terms and symbols • accurate use of basic language • organisation of information into various forms • use of some mathematical reasoning to develop simple logical arguments.	The **overall quality** of a candidate's achievement **sometimes demonstrates** evidence of the use of the **basic** conventions of language and mathematics.	The **overall quality** of a candidate's achievement **rarely demonstrates** use of the **basic** conventions of language or mathematics.

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