

Mathematics A

Monday 28 October 2019

Paper Two — Question and response book

1:15 pm to 4:25 pm

Time allowed

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

Examination materials provided

- Paper Two — Question and response book
- Paper Two — 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 during perusal time.

Paper Two has **four** extended-response questions.

Attempt **all** questions.

Assessment

Paper Two 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	9	–						–	
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Attach barcode here

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Number of books used

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Supervisor use only

Supervisor's initials

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QCAA use only

Marker number

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Planning space

Paper Two 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. Billy bought a home entertainment unit on a payment plan. The cash price of the unit was \$3500.
Billy had to pay 12% deposit and repay the balance at 9% p.a. flat interest in equal monthly instalments for 2 years.
Calculate the amount of each monthly repayment.

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(KP)

- b. A car is purchased for \$24 000. Use the diminishing value formula to calculate the salvage value of the car after 4 years at a depreciation rate of 15% p.a.

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(KP)

Question 1 continues over next page →

Question 2

a. Below are the final heights recorded for two athletes in eight high-jump competitions.

Carl	1.80m	1.80m	1.90m	1.90m	1.70m	1.80m	2.00m	1.60m
Richard	2.00m	1.90m	1.70m	2.10m	2.10m	1.80m	1.90m	2.10m

i. Calculate the mean height for Carl and the mean height for Richard.

Carl: Richard:
(KP)

ii. Calculate the interquartile range for Carl and the interquartile range for Richard.

Carl:
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Richard:
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(KP)

iii. Calculate the sample standard deviation for each student's heights.

Carl: Richard:
(KP)

iv. Determine which student is the most consistent and **give a reason** for your choice.

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(KP)

v. List the five-number summary for Carl and the five-number summary for Richard.

Carl:
Richard:
(KP)

vi. Draw adjacent boxplots to represent this data on the scale below.



Jump heights

(KP)

Question 2 continues over next page →

b. The following data represents the number of goals scored in 16 soccer games.

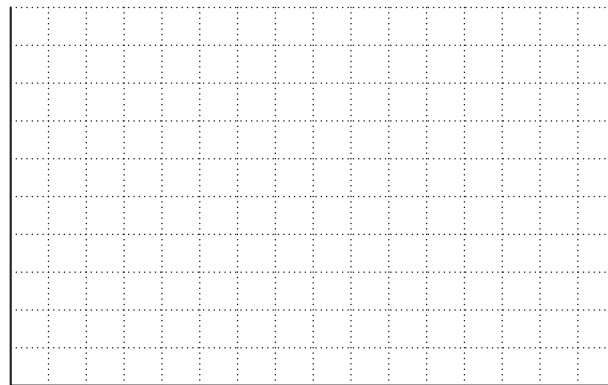
0 1 0 2 3 0 4 3 3 1 3 0 0 2 4 4

i. Complete the frequency table.

Goals scored	Tally	Frequency

(KP)

ii. Draw a frequency histogram to represent this data using the axes below.



Spare axes are provided on page 16.

(KP)

iii. Find the mean, median, mode and range for this data.

Mean:

Median:

Mode:

Range:

(KP)

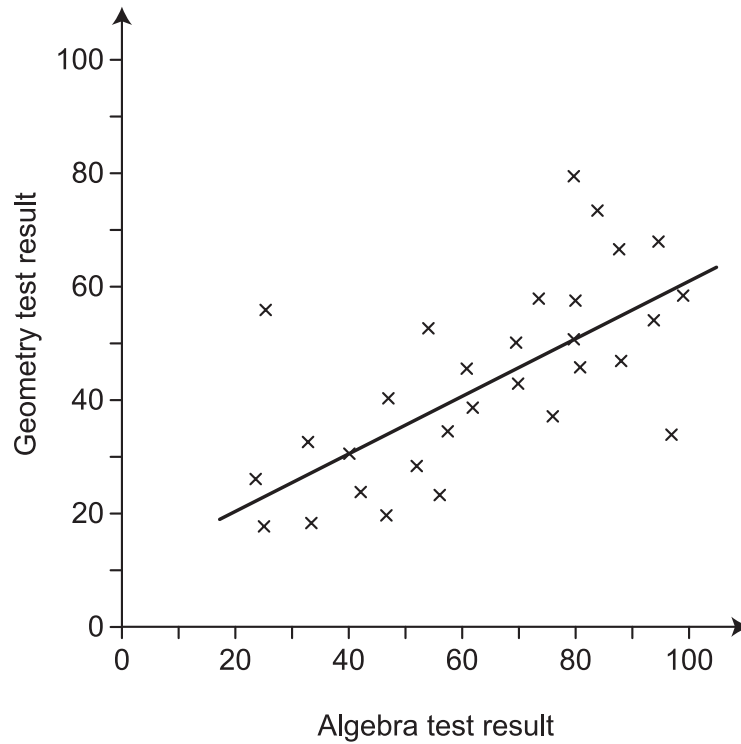
iv. Describe this data using two words, **one from each list** below.

List 1: continuous, discrete List 1 word:

List 2: categorical, ordinal List 2 word:

(KP)

- c. A class of 30 students sat for an Algebra test and a Geometry test. The results are displayed in a scatterplot with a line of best fit below.



- i. How many students scored less than 30 on **both** the Algebra and Geometry tests?

..... (KP)

- ii. Describe the correlation between the Algebra and Geometry test results.

..... (KP)

- iii. Explain why the following statement is incorrect.

In this class all students who are near the top in Algebra are also near the top in Geometry.

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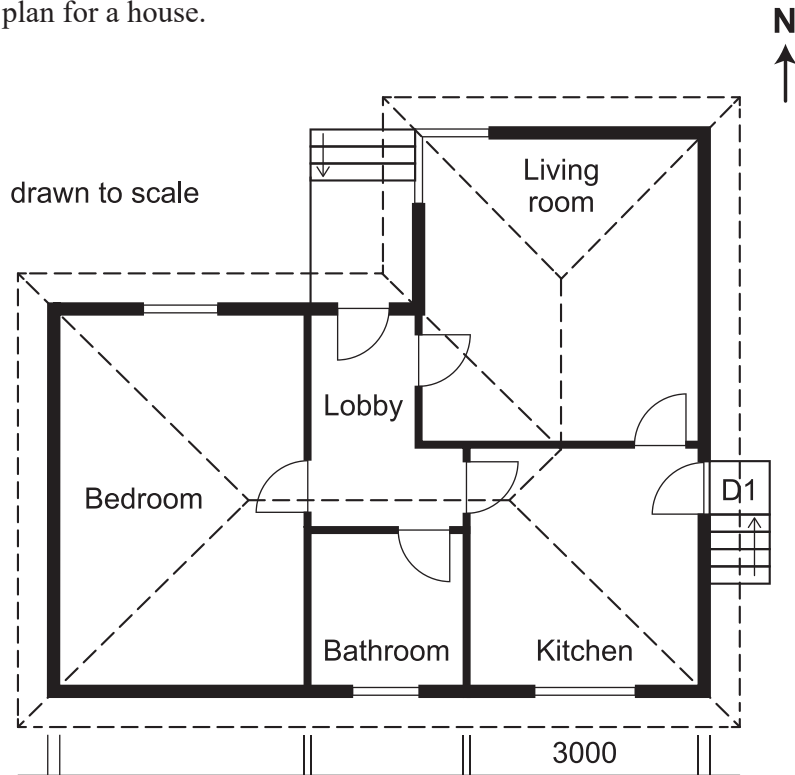
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(MP)

Question 3

a. Below is a floor plan for a house.



i. If the length of the southern wall of the kitchen is 3 m, find the scale used for this plan.

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(KP)

ii. What are the actual dimensions of the living room?

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(KP)

- iii. The floor of the bathroom is to be tiled. A 600 mm \times 600 mm tile costs \$29.80 each. Allowing an extra 10% for wastage, calculate the cost of tiling the bathroom.

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(KP)

- iv. Wallpaper is to be used to cover the southern and western walls of the bedroom. The walls are 2.4 m high. A 10 m long wallpaper roll is 0.53 m in width.

Calculate the minimum number of rolls of wallpaper needed to cover both the southern and western walls of the bedroom.

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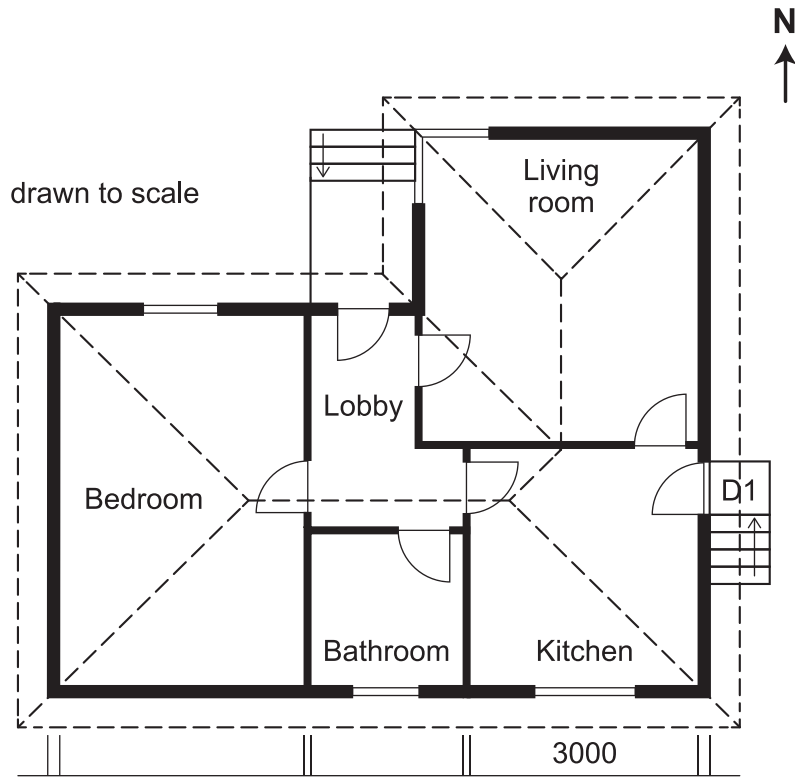
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(KP)

Question 3 continues over next page \rightarrow



Note: This is a duplicate image from page 6.

- v. Determine the amount of concrete needed for the footings of this house if they are 350 mm wide and 200 mm deep.

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(KP)

vi. Calculate the amount of concrete needed for the slab of this house if it is to be 10 cm deep.

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(KP)

vii. The builder has estimated the concrete for the **slab** and **footings** will cost \$2300.

Concrete costs \$300/m³. Make an informed decision as to whether the builder has allowed sufficient money to pay for the concrete.

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(MP)

Question 3 continues over next page →

- b. After pegging out a rectangular shed, a builder measures one pair of opposite sides of the shed to be 4.8 m and the other pair of opposite sides to be 3.6 m.

Use diagrams and mathematical reasoning to explain how the builder can be sure that the shed is rectangular.

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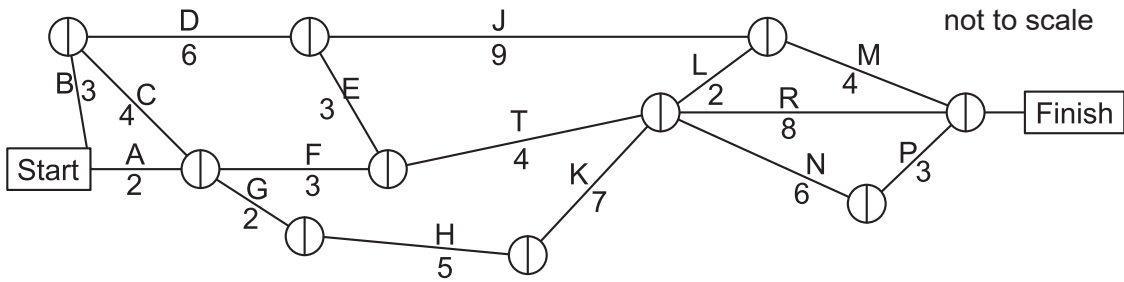
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(MP)

Question 4

a. The following network shows the completion time for a project in days.



i. Find the minimum time to complete the project.

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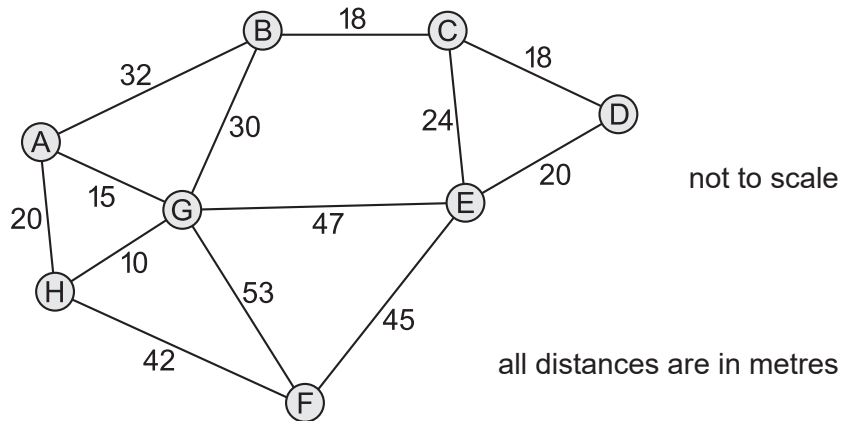
(KP)

ii. State the critical path.

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(KP)

b.



The above network shows connecting paths for a cable network. It costs \$65 per metre to lay the cable. Use a minimum spanning tree to determine the least cost to connect this network.

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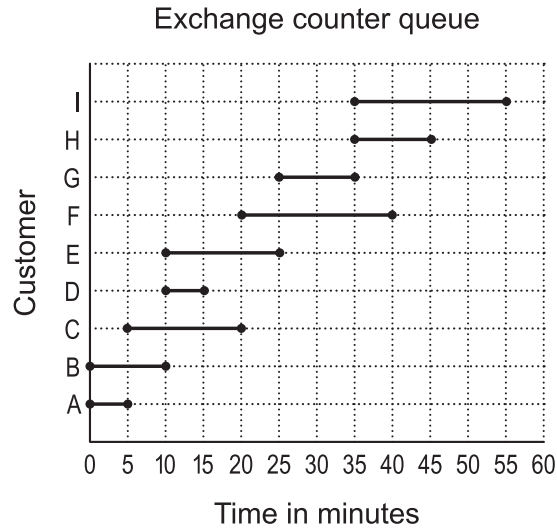
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(KP)

Question 4 continues over next page →

c. The graph below illustrates the waiting time in a queue across a 60-minute period.



i. How many customers were waiting to be served 19 minutes after the start of the 60-minute period?

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(KP)

ii. What is the longest time a customer has to queue before being served?

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(KP)

d. Spectators arrive at the rate of 60 per minute at a football game. If it takes 20 seconds to check each person through security, how many service points are needed if queues are not to grow?

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(KP)

e. The table below shows the distances in metres between exhibits at a garden show.

	A	B	C	D	E	F	G
A	–	50	70	85	–	–	–
B	–	–	30	–	70	–	–
C	–	–	–	50	65	–	–
D	–	–	–	–	45	90	60
E	–	–	–	–	–	40	–
F	–	–	–	–	–	–	80

i. Construct a network diagram to represent the information displayed in the table.

(KP)

ii. All exhibits are to be visited only once. This means that visitors enter the show and progress through the exhibits to the exit without revisiting exhibits. Determine if the minimal spanning tree will identify the route that satisfies these conditions. Fully justify your decision with mathematical reasoning and a network diagram.

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(MP)

- f. A drive-through fast food outlet has two service lanes but only one operator. It takes one minute for the operator to take the order and then a further two minutes to give the customer the order at the service window.

Up to five cars can fit between the order window and the service window in each service lane.

When the outlet opens at 6:00 am there are three cars waiting in each service lane to order.

For the first ten minutes after opening, a car arrives every minute. Following this, a car arrives every two minutes.

- i. **Respond to this question on page 15. A spare grid is provided on page 17.**

Graph a scenario for the first 30 minutes the outlet opens.

(KP)

- ii. Determine the first time the queue becomes empty.

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(KP)

- iii. Calculate the average waiting time between 6:00 am and 6:30 am.

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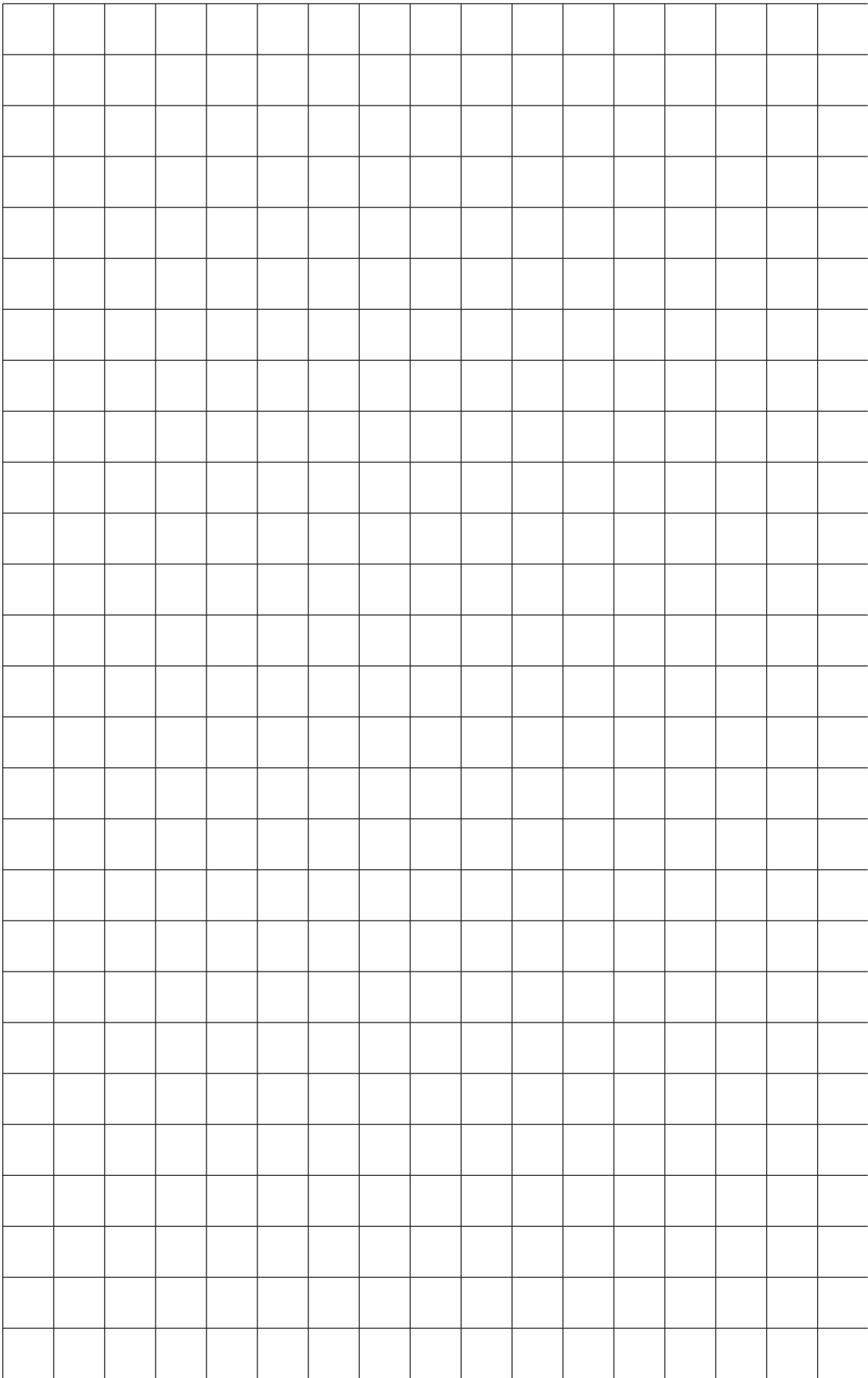
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(KP)

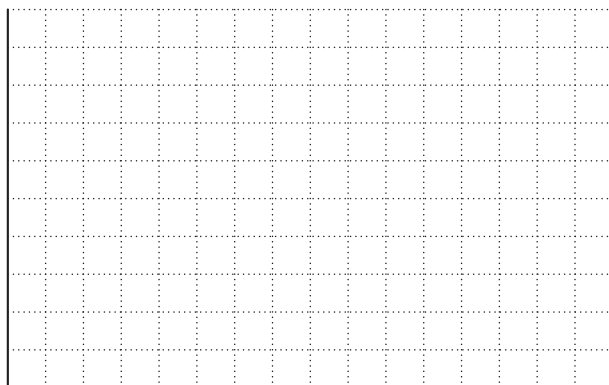
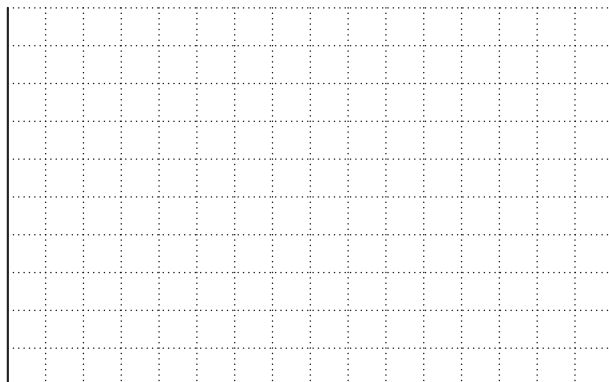
End of Paper Two

Question

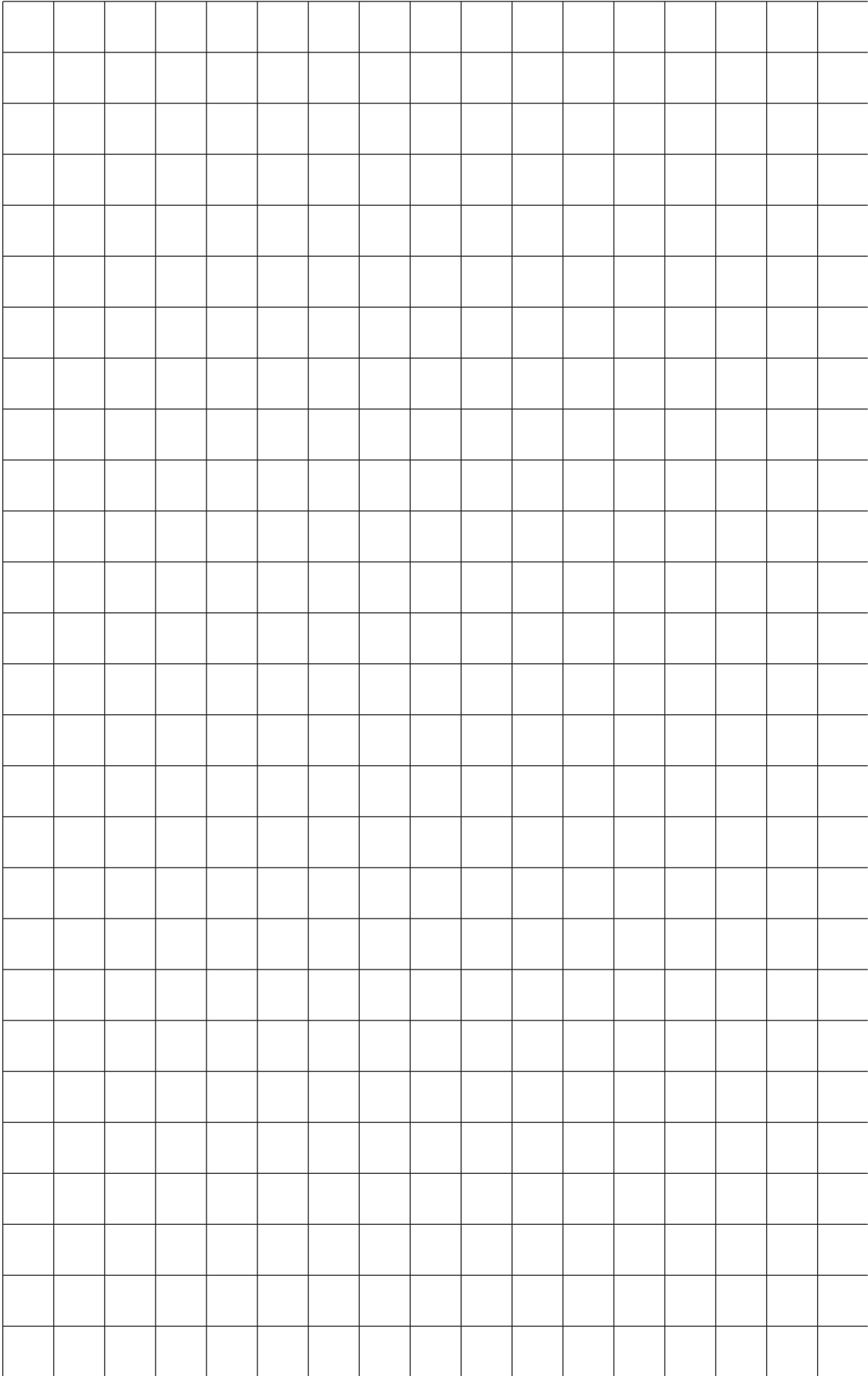
4f i.



Spare axes (if required)



Spare grid (if required)



Additional page for responses (if required)

Question

Dotted lines for writing responses.

Assessment standards from the Mathematics A Senior External Syllabus 2006

Criterion	A	B	C	D	E
<p>Knowledge and procedures (KP)</p>	<p>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:</p> <ul style="list-style-type: none"> • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate and proficient use. 	<p>The overall quality of a candidate's achievement across a range within the contexts of application, technology and complexity, generally demonstrates:</p> <ul style="list-style-type: none"> • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate use. 	<p>The overall quality of a candidate's achievement in the contexts of application, technology and complexity, generally demonstrates:</p> <ul style="list-style-type: none"> • accurate recall and use of basic definitions and rules • use of some technology • accurate use of basic procedures. 	<p>The overall quality of a candidate's achievement in the contexts of application, technology and complexity, sometimes demonstrates:</p> <ul style="list-style-type: none"> • accurate recall and use of some definitions and rules • use of some technology. 	<p>The overall quality of a candidate's achievement rarely demonstrates knowledge and use of procedures.</p>
<p>Modelling and problem solving (MP)</p>	<p>The overall quality of a candidate's achievement across the full range within each context, and across topics generally demonstrates mathematical thinking which includes:</p> <ul style="list-style-type: none"> • interpreting, clarifying and analysing a range of situations, and identifying variables • selecting and using effective strategies • informed decision making <p>... and sometimes demonstrates mathematical thinking which includes:</p> <ul style="list-style-type: none"> • selecting and using procedures to solve a wide range of problems • initiative in exploring the problem • recognising strengths and limitations of models. 	<p>The overall quality of a candidate's achievement across a range within each context, and across topics, generally demonstrates mathematical thinking which includes:</p> <ul style="list-style-type: none"> • interpreting, clarifying and analysing a range of situations, and identifying variables • selecting and using strategies <p>... and sometimes demonstrates mathematical thinking which includes:</p> <ul style="list-style-type: none"> • selecting and using procedures required to solve a range of problems • informed decision making. 	<p>The overall quality of a candidate's achievement demonstrates mathematical thinking which includes:</p> <ul style="list-style-type: none"> • interpreting and clarifying a range of situations • selecting strategies and/or procedures. 	<p>The overall quality of a candidate's achievement demonstrates mathematical thinking which includes following basic procedures and/or using strategies.</p>	<p>The overall quality of a candidate's achievement rarely demonstrates mathematical thinking which includes following basic procedures and/or using strategies.</p>

(continued)

Criterion	A	B	C	D	E
Communication and justification (C)	<p>The overall quality of a candidate's achievement across the full range within each context consistently demonstrates:</p> <ul style="list-style-type: none">• 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.	<p>The overall quality of a candidate's achievement across a range within each context generally demonstrates:</p> <ul style="list-style-type: none">• 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.	<p>The overall quality of a candidate's achievement in some contexts generally demonstrates:</p> <ul style="list-style-type: none">• 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.	<p>The overall quality of a candidate's achievement sometimes demonstrates evidence of the use of the basic conventions of language and mathematics.</p>	<p>The overall quality of a candidate's achievement rarely demonstrates use of the basic conventions of language or mathematics.</p>

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Manager

Publishing Unit

Email: publishing@qcaa.qld.edu.au

Queensland Curriculum & Assessment Authority

PO Box 307, Spring Hill QLD 4004 Australia

Level 7, 154 Melbourne Street, South Brisbane

T +61 7 3864 0299

www.qcaa.qld.edu.au