2018 Senior External Examination

Mathematics A

Paper Two — Question and response book

Thursday 25 October 2018

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 | 8 | – | | | | | – | |

Attach barcode here

Number of books used

Supervisor use only
Supervisor's initials

QCAA use only
Marker number

Queensland Government

QCAA Queensland Curriculum & Assessment Authority

For all Queensland schools

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 only be awarded if working is shown.**

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

Question 1

a. David invested $80 000 in an account paying 4.8% per annum interest compounding monthly.

   i. How much will he have in his account at the end of 15 years?

   ....

   ....

   ....

   ....
                                                                                                                    (KP)

   ii. How much interest will he have earned in that time?

   ....

   ....

   ....

   ....

   ....
                                                                                                                    (KP)
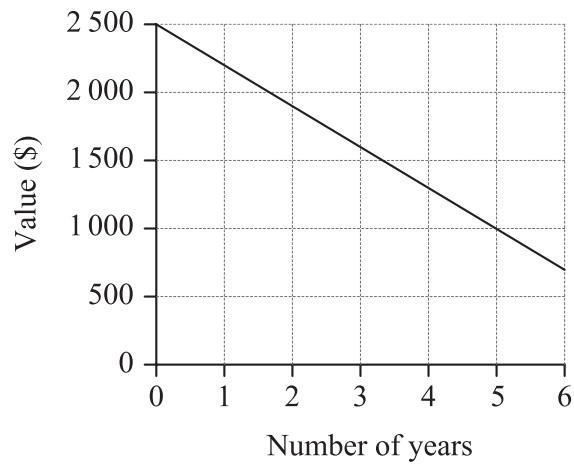
b. The purchase price for a car is $15 000.

   A deposit of $3 000 is paid and the balance repaid with 36 monthly payments of $400.

   Calculate the annual simple rate of interest.

   ....

   ....

   ....

   ....

   ....

   ....
                                                                                                                    (KP)

c. A painting was purchased for $2 500 and depreciated in value over six years as shown in the graph below.

Determine the amount of yearly depreciation.

....

....

....

....

....

....
(KP)

d. A company has decided to distribute $63 million of its after-tax profit as dividends. If the company has issued 210 million shares, calculate the dividend payable on each share.

....

....

....

....

....

....

....

....

....
(KP)

e. An investor owns 6 000 50¢ shares. These shares have been paying a steady percentage dividend of 8.82% for many years and that is expected to continue. The shares have maintained the same market value of $1.47 that the investor paid.

The investor also invested $7 500 six years ago in an account earning simple interest and that amount is currently $8 800.

Determine which investment is the best performer for the investor. Justify your decision with mathematical reasoning.

State **one strength** and **one limitation** for each of the given investment situations.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(MP)

f. A company purchased a machine for $60 000. This machine depreciates in value over time. Two methods of depreciation were considered by the company.

Method 1 — Straight line: The machine is depreciated by $6 000 per year.

Method 2 — Diminishing value: The machine is depreciated by 15% per year.

i. Find the value of the machine after 3 years using the diminishing value method.

....

....

....

....
(KP)

ii. Find out how many years it will take for the machine to reach a value of $12 000 using the straight-line method.

....

....

....

....
(KP)

iii. Determine the first year during which the value calculated using straight-line depreciation will be less than the value calculated using diminishing-value depreciation.

....

....

....

....

....

....

....

....

....

....
(MP)

Turn over for Question 2

Question 2

a. The batting order for a cricket team and the number of runs scored by each player were recorded in the table below.

Batting order	A	B	C	D	E	F	G	H	I	J	K
Number of runs	16	10	11	8	7	4	4	5	3	1	1

Determine:
i. mean

....

....

....

....
(KP)

ii. mode

....
(KP)

iii. median

....

....

....
(KP)

iv. range

....

....
(KP)

v. sample standard deviation correct to two decimal places.

....
(KP)

vi. Using the grid below, draw a histogram to represent this data. (KP)

Spare grids on page 16

Number of runs

Batting order
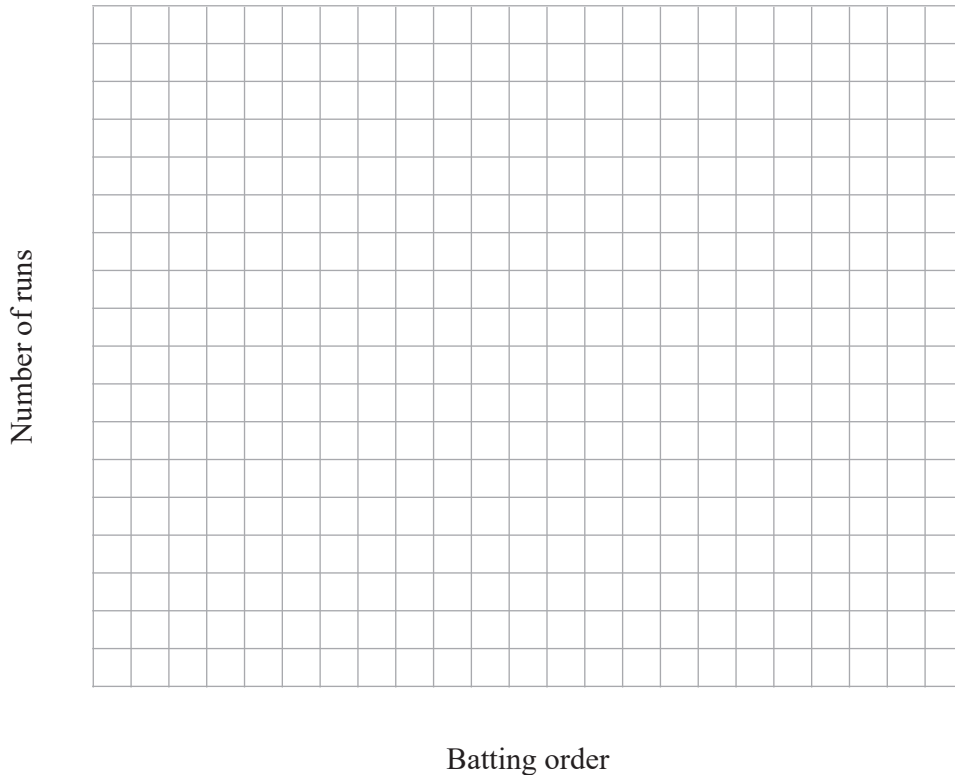
b. Identify each of the following types of data as continuous or discrete.

    i. the number of students in your class ....

    ii. the amount of rainfall that Brisbane received in June ....

(KP)

c. Three of the following questions would be classified as leading or misleading. Circle the letter of the remaining question.

    A   Where do you like to party?

    B   How much can you save by shopping online?

    C   How many days in the last week did you eat breakfast?

    D   Do you think the radio or television is the best source of local news?

(KP)

d. The following back-to-back stemplot shows the results for a class test.

Boys		Girls
9 8 8	0	6 7
5 4 4 2 2	1	2 2 5 8
9 3 1 1	2	1 3 3 4 5 5 6
5 2	3	2 2 4

Key: 1|2 = 12

i. Calculate the range and interquartile range for each group of boys and girls.

Interquartile range

Boys: Q1 = 12, Q3 = 23, IQR = 23 − 12 = 11

Girls: Q1 = 13.5, Q3 = 25.5, IQR = 25.5 − 13.5 = 12

(KP)

Range

Boys: 35 − 8 = 27

Girls: 34 − 6 = 28

(KP)

ii. Determine the five-number summary for each group of boys and girls.

Boys: min = 8, Q1 = 12, median = 14.5, Q3 = 23, max = 35

Girls: min = 6, Q1 = 13.5, median = 23, Q3 = 25.5, max = 34

(KP)

iii. Draw parallel boxplots to represent this data. (KP)

0	10	20	30	40
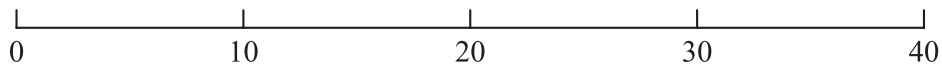
iv. Comment on which gender performed better on the class test.

(MP)

e. The waist measurement (cm) and weight (kg) of 12 people are displayed in the table below.

Waist (cm)	74	75	80	82	84	89	94	101	101	106	114	126
Weight (kg)	72	59	67	62	84	67	89	91	98	97	112	117

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

Spare grids on pages 17 and 18

Weight (kg)

Waist (cm)
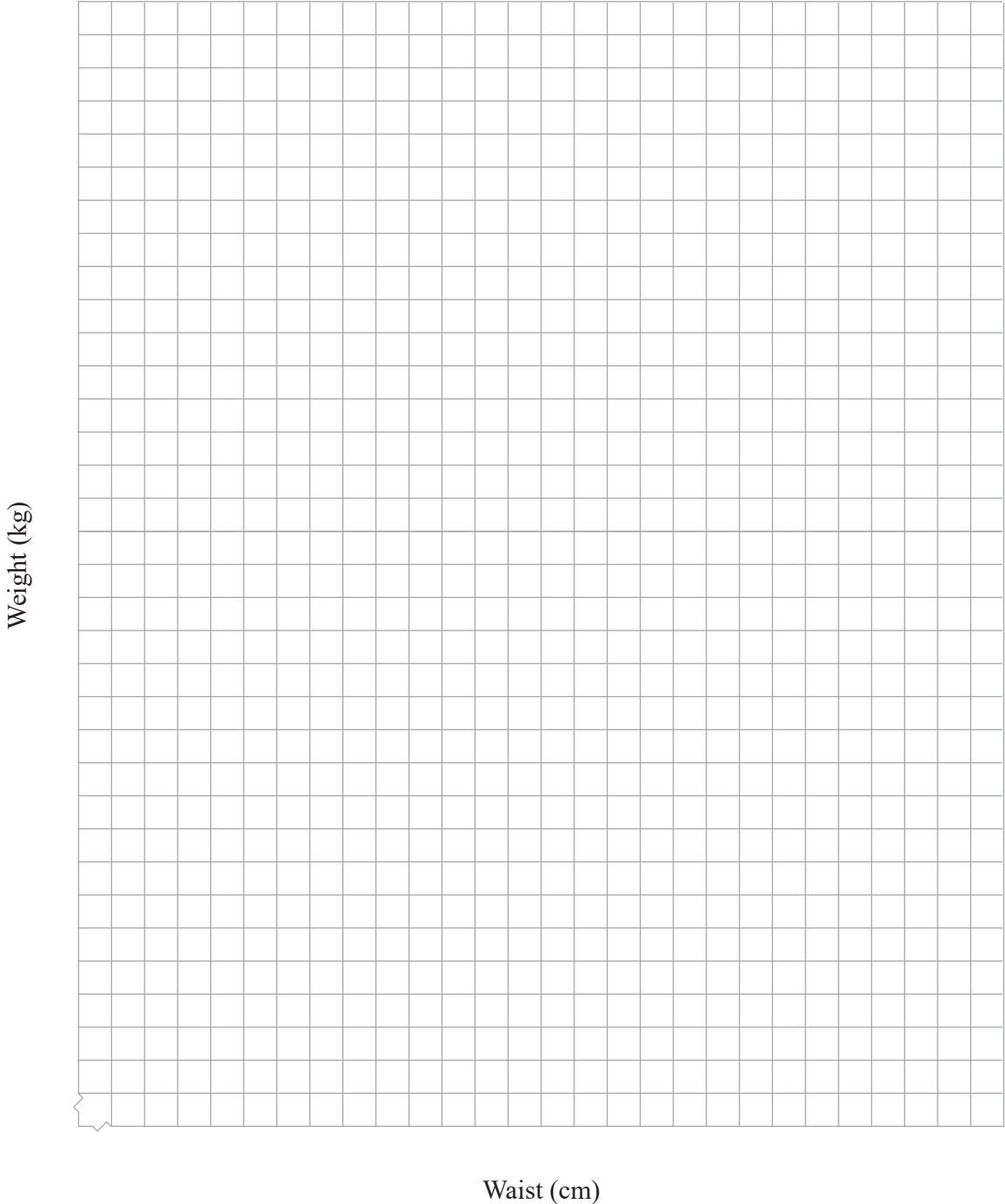
Question 3

a. This is a site plan, **drawn to scale**, of Lot 4, Gene Drive.

Scale 1 : 250

Lot 4

Proposed house

Gene Drive
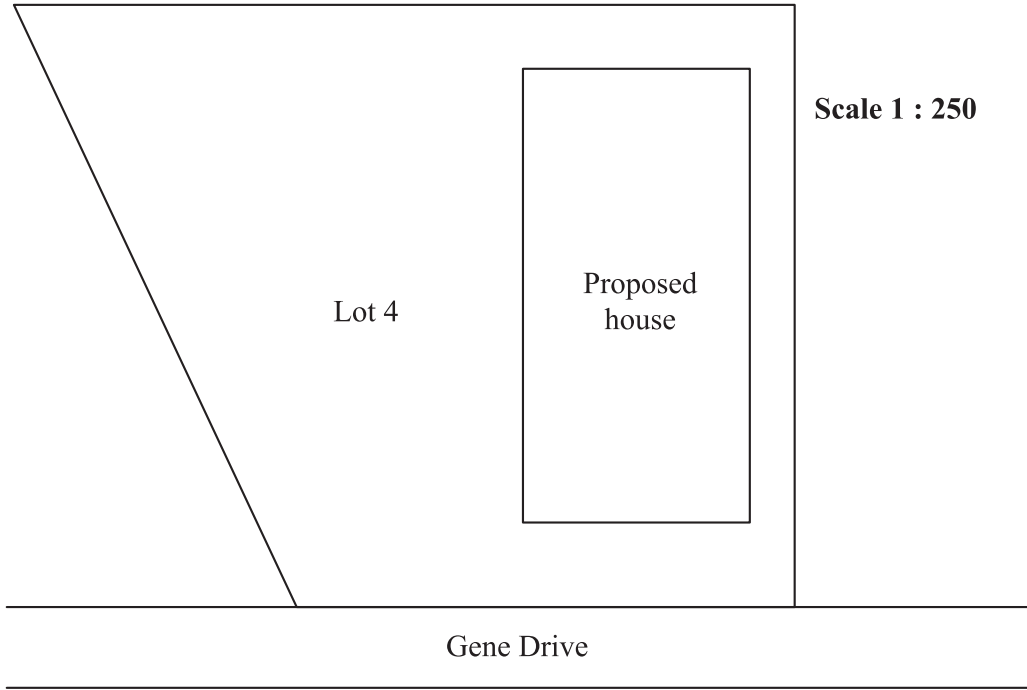
i. Calculate the volume of concrete required for footings for the house if the footings are 0.5 metres deep and 0.6 metres wide.

...

....

....

....

....

....

....

....

....

....

....

....

(KP)

ii. A fence is to be erected along all boundaries of Lot 4 except for the boundary on Gene Drive. How many metres of fencing will be needed to build this fence?

....

....

....

....

....

....

....

....

....

(KP)

iii. Lot 4 is in the shape of a trapezium. By measurement and calculation, determine the actual area of Lot 4 in square metres.

....

....

....

....

....

....

....

....

....

....

(KP)

b. A sedan car is 5 metres long and 1.5 metres high. Determine the maximum scale that could be used to redraw the rectangular shape of the car on an A3 piece of paper.

An A3 piece of paper measures 297 mm by 420 mm. A margin of at least 7 mm must be drawn around each edge of the paper.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(KP)

c. Consider the house plan **drawn to scale** below.

Scale 1 : 100

Carpet is to be laid in the bedroom, living room and hallway of this house in rolls 4 metres wide. Carpet can be purchased at a cost of $69.80 per linear metre. A quote for $1 470 was obtained to purchase the carpet. Show mathematical working to determine if this quote is reasonable.

....

....

....

....

....

....

....

....

....

....

....

....

(MP)

Question 4

a. Five musicians are to record an album that involves nine activities.

The activities and their immediate predecessors are shown in the table below.

The duration of each activity is not yet known.

Activity	Immediate predecessors
A	—
B	—
C	—
D	A
E	B
F	C
G	D, E
H	F
I	G, H

i. Use the information in the above table to complete the network below by including activities *G*, *H* and *I*.
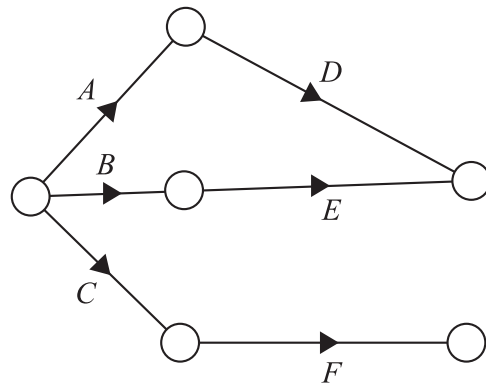
Spare diagram on page 19

(KP)

ii. There is only one critical path for this project. Determine how many **non-critical** activities there are.

....

....

....

....

....

....

(KP)

b. The graph below displays the **waiting times** for planes from when they first entered Brisbane airspace until they were given clearance to land. Landing (service) times are not shown.

JQ 486	
VA 469	
VA 341	
QF 2415	
VA 1225	
QF 1550	
QF 542	
QF 2325	
QF 1598	
VA 786	
VA 378	

Time axis: 5   10   15   20   25

Time (minutes after 7 am)

i. Determine which plane had the shortest wait time and state how long that waiting period was.

....
(KP)

ii. What was the maximum number of planes that had to wait for clearance to land at any given time?

....
(KP)

c. At a toll booth, cars arrive at a rate of 120 per minute and on average it takes 5 seconds to be served. Determine how many service points would be required in order for the queue not to grow.

....

....

....

....

....

....
(MP)

End of Paper Two

Spare grids (if required)

Number of runs
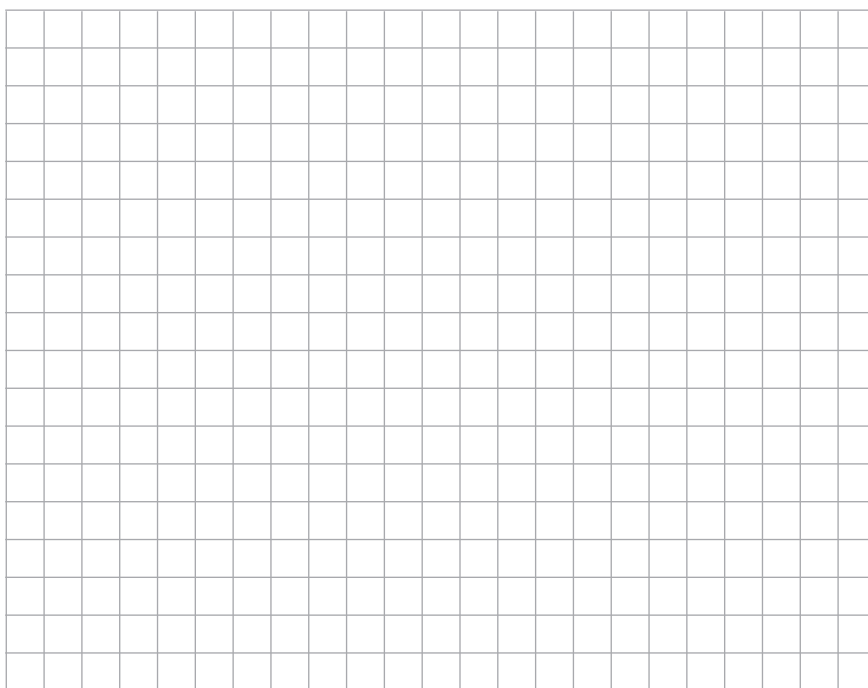
Batting order

Number of runs
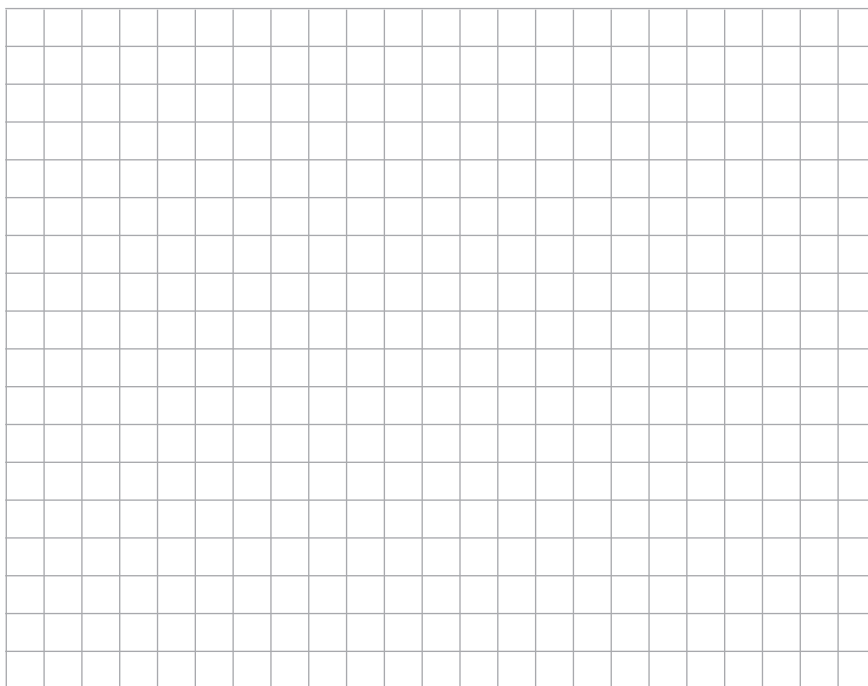
Batting order

Spare grids (if required)
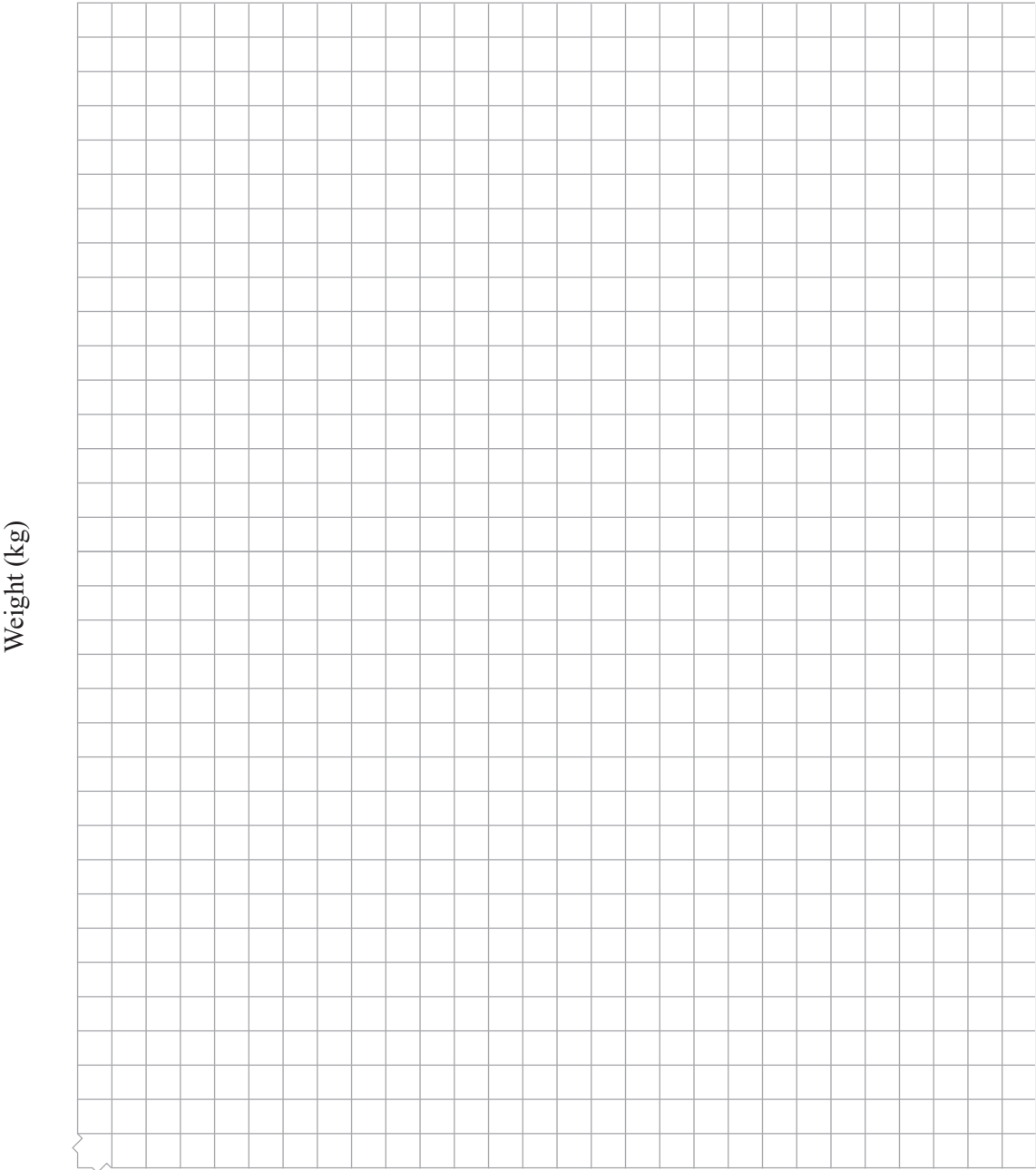
Weight (kg)

Waist (cm)

Weight (kg)

Waist (cm)

Additional page for responses (if required)

Question 4.a.i

Question [ ]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

Additional page for responses (if required)

Question ☐

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

Additional page for responses (if required)

Question ☐

Additional page for responses (if required)

Question ☐

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....
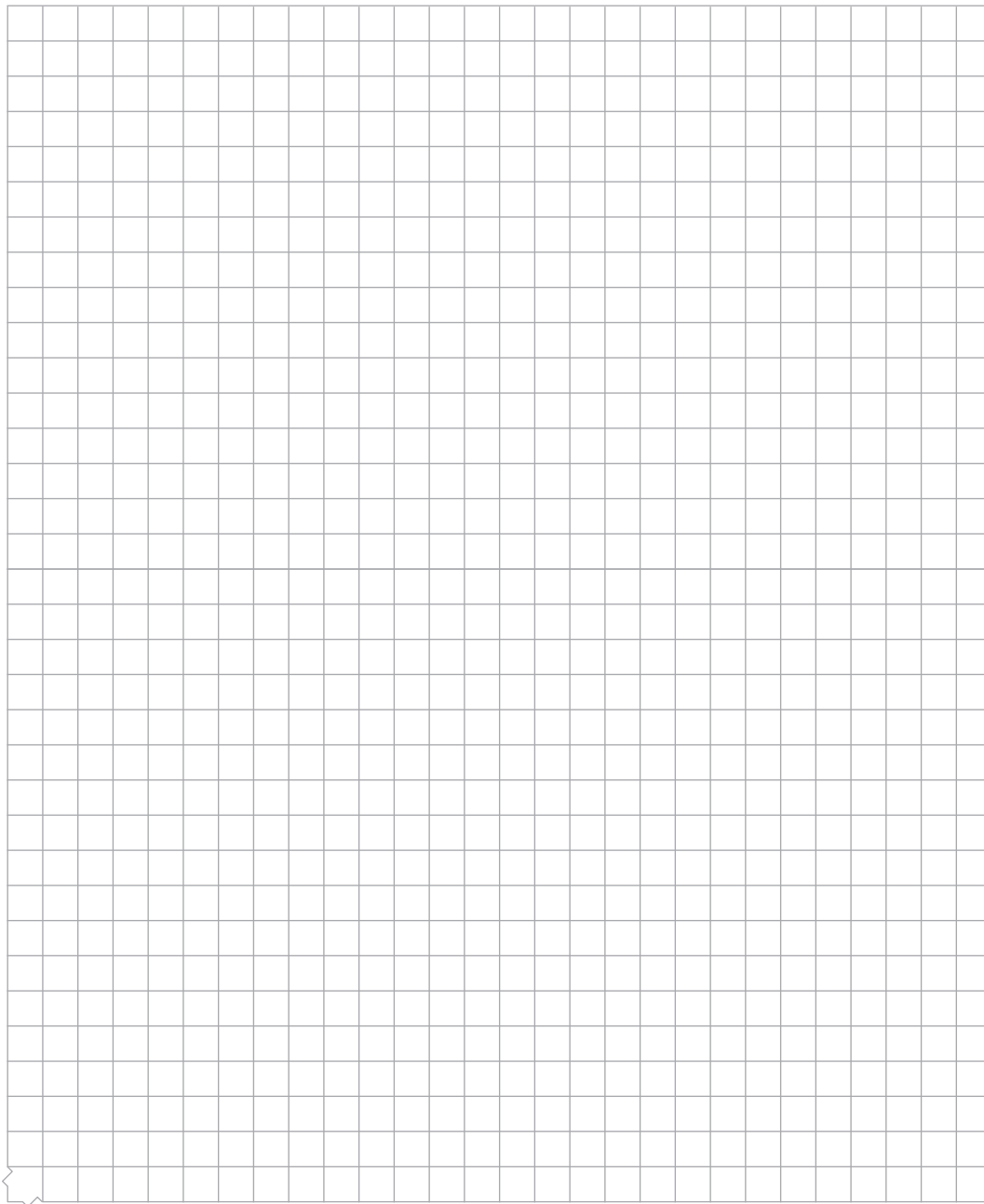
Assessment standards from the Mathematics A Senior External Syllabus 2006

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.