Mathematics A

Paper One — Question and response book

Monday 28 October 2019

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 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 | 9 | – | | | | | – | |

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

Planning space

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 commission of a salesperson who sells $25 200 worth of goods if they are paid 7.5% commission on all sales.

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(KP)

b. Calculate the total pay for picking 60 baskets of fruit at a rate of $3.50 per basket.

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(KP)

c. A shopkeeper buys 20 kg of chocolate for $149.95 and sells it in 500 g packets at $4.10 each.

Determine the overall percentage profit or loss if 5 packets remain unsold.

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(KP)

Question 1 continues over next page ➡

d. Sue is about to attend a conference in New Zealand. The costs for the conference are:

- Registration NZD $350
- Accommodation NZD $125 per night for four nights
- Return airfare AUD $428

What is the total cost in Australian dollars if the exchange rate is AUD $1 = NZD $1.041?

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(KP)

e. Sally works in a shop where the normal weekday rate of pay is $26 per hour. On Sundays she is paid time-and-a-half.

i. How much did Sally earn in a week in which she worked on four weekdays for seven hours each and on Sunday for three hours?

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(KP)

ii. If Sally worked the same hours for 40 weeks in a year, calculate her gross yearly income.

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(KP)

Sally earned $74 in interest in her bank account for that year and could claim $452 in deductions.

iii. Calculate Sally's taxable income.

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(KP)

iv. If the Medicare Levy is set at 2%, use the tax table below to calculate the amount of tax Sally pays.

Taxable income	Tax rate
$0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5% for amounts over $37 000
$90 001 – $180 000	$20 797 plus 37% for amounts over $90 000
$180 001 and over	$54 232 plus 45% for amounts over $180 000

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(KP)

f. A car yard sold a vehicle for $11 900. This selling price included 10% GST which was applied to the vehicle after it was marked-up by 15%.

Calculate the profit the car yard made on the sale of the vehicle.

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(KP)

g. A company that manufactures drones uses $190 worth of materials and $60 in labour costs for each drone. A 45% mark-up is added before the drones are sold to a wholesaler.

The wholesaler adds $24.50 per item for transport and storage costs before selling the drones to retail outlets for $85 profit each.

The retailer applies a 50% mark-up before putting stock on the floor, and then offers either a 10% discount or $65 off the retail price.

Determine which discount offer saves more money. Fully justify your decision with mathematical reasoning.

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(MP)

Question 2

Jono wants to save water by putting a small brick into his toilet cistern (tank). The brick is a rectangular-based prism measuring 10 cm by 22 cm by 8 cm.

The cistern is also a rectangular-based prism with water to a depth of 17 cm inside. The cistern measures 20 cm across, 30 cm long and 20 cm high.

Jono's wife believes if the brick is gently placed in the water that the level will rise and overflow and hence cause a mess.

Determine whether she is correct. Fully justify your decision with mathematical reasoning.

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(MP)

Question 2 continues over next page ➡

b. A cylindrical water tank of height 5 m and diameter 3.2 m is used to take the run-off from a roof that has a total area of 150 m^2.

If the tank is 15% full at the start of summer, calculate how much rainfall (mm) is needed to fill the tank.

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(KP)

c. From a point 250 m away from the base of a building, a worker measures the angle of elevation to the top of the building to be 39°. He has 210 m of cable to lay from the base of the building to the top of the building.

Determine if the worker has enough cable to complete the job.

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(MP)

d. A house has a skillion roof with a pitch of 25° as shown in the diagram below.

B

C

not to scale

25°

G

A

D

House
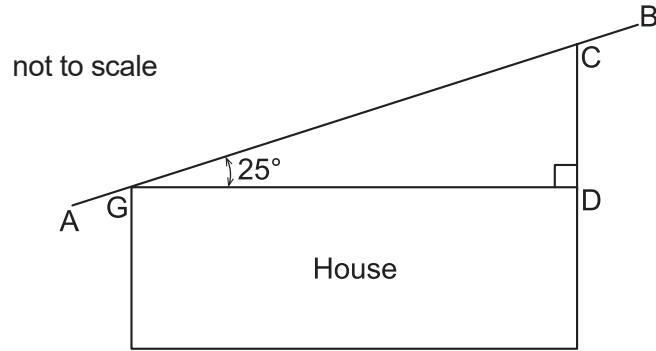
The overhangs AG and CB are both 600 mm and C is 1570 mm above the ceiling GD.

Find the length AB correct to the nearest mm.

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(KP)

e. The location of Town A is 30°S, 45°E. The location of Town B is 30°S, 105°E.

Determine if Town A is ahead or behind Town B in time, and by how much.

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(KP)

Question 2 continues over next page ➡

f. A yacht leaves a port in Vanuatu (16° S, 167° E) and sails due north to Nauru (1° S, 167° E).

   i. Find the distance the yacht sails between Vanuatu and Nauru in nautical miles.

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(KP)

The yacht averages a speed of 10 knots and must arrive in Nauru at midday on 21st November.

   ii. Determine the time the yacht must leave Vanuatu to arrive in Nauru on time.

     List **two limitations** that may affect the arrival time of the yacht.

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(MP)

Question 3

a. Consider the following box-and-whisker plots.
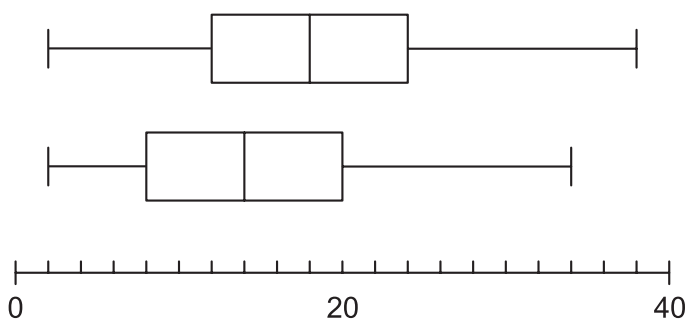
Which of these measures is the same for both datasets?

Circle the letter for the correct response.

A mean

B range

C median

D interquartile range

(KP)

b. Twelve jockeys (horse riders) had their body weights measured.

Horse number	1	2	3	4	5	6	7	8	9	10	11	12
Weight (kg)	58	56	55	54.5	54.5	54	53	52	52	52	50	48

The heaviest jockey became unwell and lost 2.5 kg in weight.

By considering the measures of central tendency, mean, median and mode, determine which measure/s would **not be affected** by the change in weight of this one jockey.

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(KP)

c. Equal numbers of primary and secondary school students were surveyed about their method of travel to school. The results are summarised in the relative frequency column graphs below.

Primary school
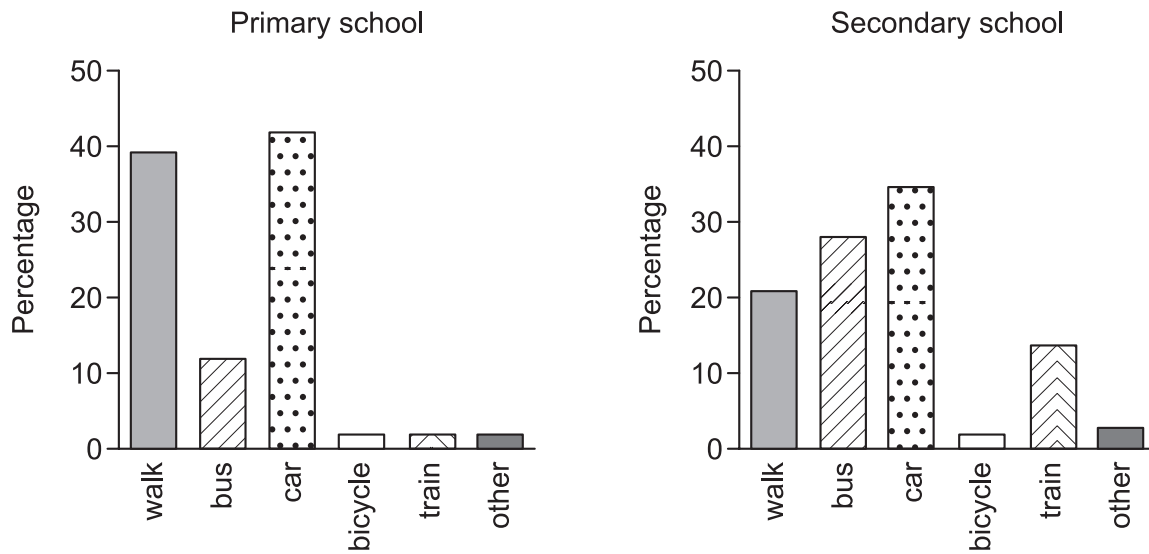
Secondary school

i. For **two different** methods of travel to school, compare the habits of primary and secondary school students.

1. ....

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2. ....

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(KP)

ii. If there were 2000 primary school students surveyed, determine how many of these students travelled to school by car.

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(KP)

iii. Determine the probability that a secondary school student catches the bus to school.

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(KP)

d. The council checks all 20 houses in a street for the number of pets in each house. The results are in the table below.

Number of pets in each house	0	1	2	3	4
Number of houses	9	5	3	2	1

i. Find the probability that a house has three pets.

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(KP)

ii. Find the probability that a house has **fewer** than two pets.

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(KP)
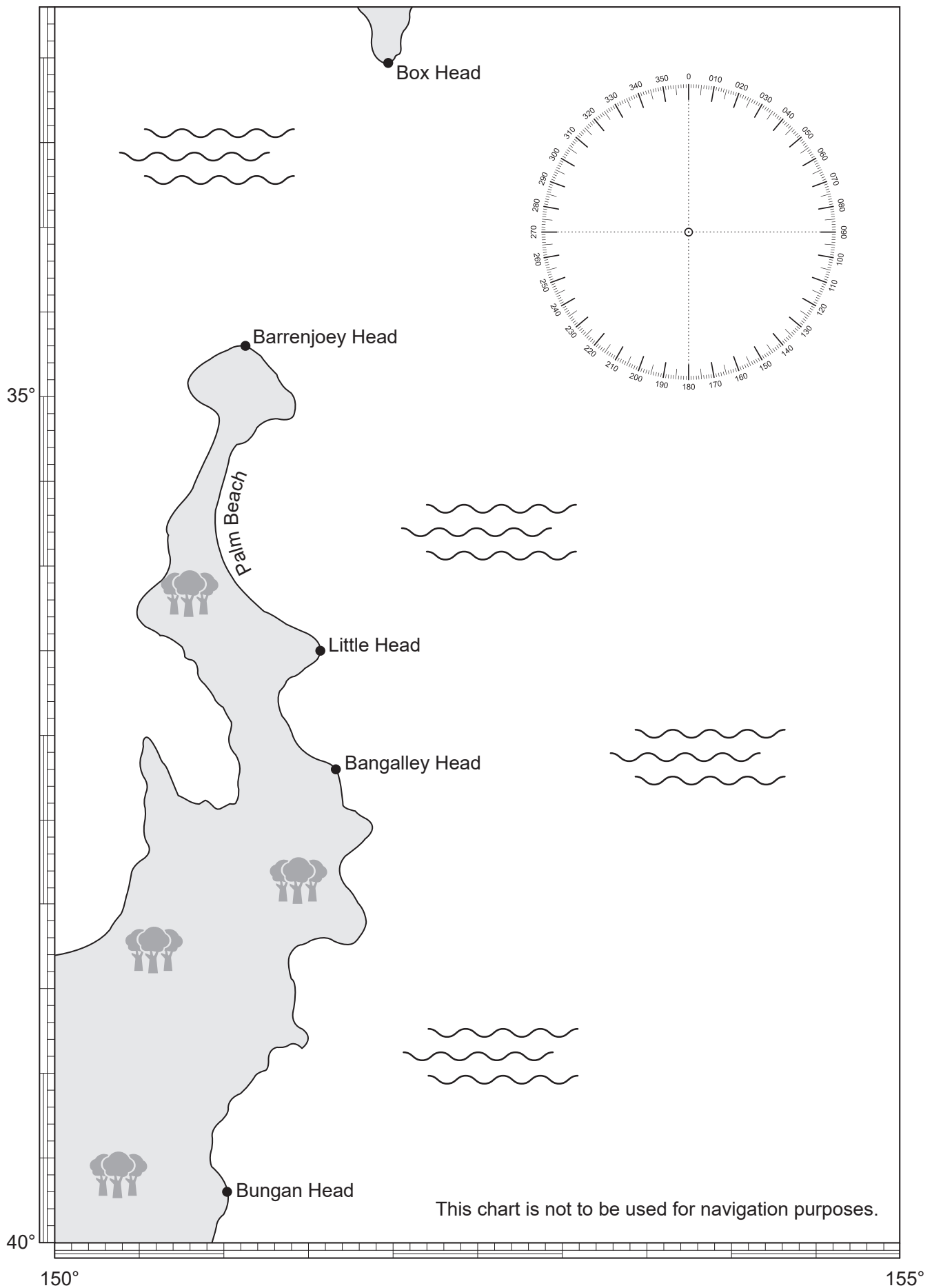
e. Of 15 people surveyed about what type of exercise they undertake, 6 said they walk, 4 said they run and 8 said they neither walk nor run.

i. Complete the contingency table below to represent this data.

		Walk		
		Walk	Do not walk	**Totals**
Run	Run			4
	Do not run		8	
	Totals	6		15

A spare table is provided on page 19.

ii. Find the **probability** that a person who runs also walks. (KP)

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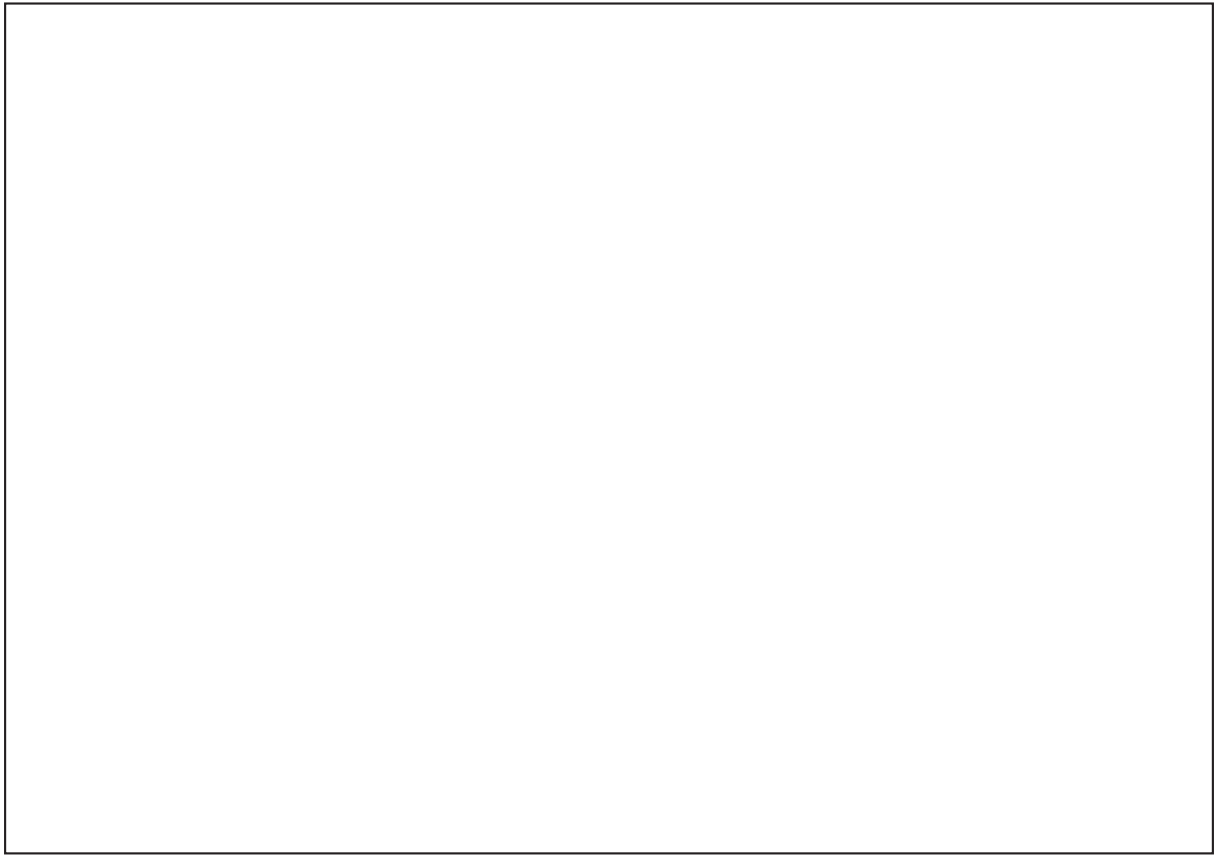
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(KP)

iii. Find the **percentage** of walkers who do not run.

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(KP)

f. At a holiday resort, the probability of a day being sunny is 0.8 and the probability of a rainy day is 0.2.

    i. Draw a probability tree diagram to represent a three-day holiday at the resort.

Spare space is provided on page 19. (KP)

    ii. Find the probability that over a three-day period, there are two sunny days and one rainy day in any order.

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(KP)

g. Two girls and a boy plan a swimming race against each other. The girls are each twice as likely as the boy to win the race.

Determine the probability that the boy will win the race.

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(KP)

Turn over for Question 4

Question 4

Refer to the map on the opposite page.

A yacht leaves Barrenjoey Head and sails at 10 knots on a bearing of 120°T for 6 hours before anchoring at point P.

a. Mark point P on the map on the opposite page.

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(KP)

The yacht then travels from point P until it is due south of Box Head, and due East of Little Head. This is point Q.

b. Mark point Q on the map on the opposite page.

(KP)

The yacht leaves point Q and sails on a course of 160°T. At the same time a second yacht leaves Bungan Head sailing on a course of 050°T.

c. The magnetic variation in this area was 12°05′E in 1974. It has increased 2′E annually.

Determine on what compass course the second yacht must sail when it leaves Bungan Head.

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(KP)

The two yachts meet at point R.

d. Mark point R on the map on the opposite page where both yachts meet.

(KP)

e. Give the position coordinates of this meeting point R.

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(KP)

f. By first determining the distances sailed for both yachts on this leg of the journey only (from Q to R), determine which yacht sailed the furthest to reach the meeting point R.

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(MP)
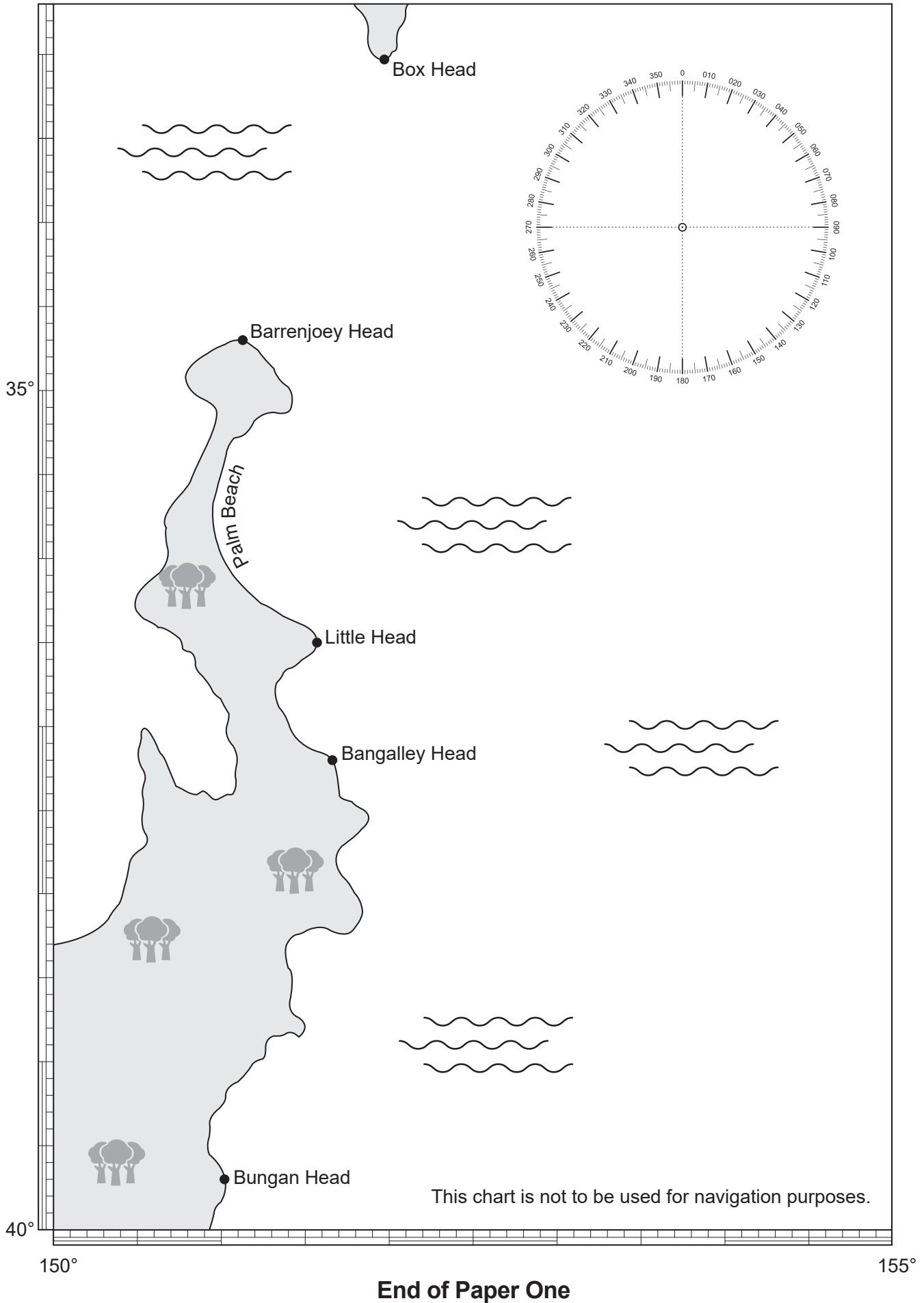
Box Head

Barrenjoey Head

35°

Palm Beach

Little Head

Bangalley Head

Bungan Head

This chart is not to be used for navigation purposes.

150°

40°

155°

End of Paper One

Additional page for responses (if required)

Question ☐

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Additional page for responses (if required)

Question [   ]

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Additional page for responses (if required)

Question [　　]

Spare table (if required)

		Walk		
		Walk	Do not walk	**Totals**
Run	Run			4
	Do not run		8	
	Totals	6		15

Spare space (if required)

Spare map (if required)

Box Head

Barrenjoey Head

Palm Beach

Little Head

Bangalley Head

Bungan Head

This chart is not to be used for navigation purposes.

35°

40°

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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.