2014 Senior External Examination

Mathematics A
Paper Two — Question book

Thursday 30 October 2014
1:15 pm to 4:25 pm

Time allowed

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

Examination materials provided

- Paper Two — Question book
- Paper Two — Resource book
- Paper Two — Response 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

You may write in this book 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

Take this book when you leave.
Planning space
Paper Two has four extended-response questions. Attempt all questions.
Write your responses on the labelled pages in the response book. Show full working in all responses. Partial credit can only be awarded if working is shown.

Question 1

a. Calculate the simple interest earned on an investment of $15000 at 4.5% p.a. for 3 years.  

(KP)

b. Calculate the value, after 2 years, of an investment of $40000 which is invested at 8% p.a. compounded quarterly.  

(KP)

c. Sue and Jack want to give $16000 to their granddaughter in 6 years. To achieve this, determine the single sum they must invest now at 3.85% p.a. compounded annually.  

(KP)

d. Heather buys 500 shares in a company at a market value of $4.50 per share.
   i. If there are fixed brokerage fees of $25.60 and stamp duty of 15 cents per $100 or part thereof, calculate the total cost for Heather to buy the shares.  
   ii. The company pays a dividend of 90 cents per share. Calculate the percentage yield on the shares.  

(KP)

e. A dishwasher has a cash price of $799. A buyer pays a deposit of $150 and agrees to make monthly repayments of $35 over two years. What is the flat rate of interest per annum being charged on the balance?  

(KP)

f. The Peak family invests $20000 for three years in a credit union account which pays interest at 5% p.a. interest compounded half yearly.
   The Troff family purchases 10000 shares worth $2.00 each. Annual dividends are calculated on this value. Each share pays a dividend of 5.4% in the first year, 4.8% in the next year and 11.8% in the third year of ownership.
   Which family will receive the best return on their money over three years, and by how much?  

(MP)

g. A courier company purchased a delivery van in December 2009 for $80000. In December each year, beginning in 2010, the value of the van depreciates.
   i. Using the diminishing value method at a rate of 12% p.a., what will the van’s value be in December 2014?  
   ii. The company decided to use straight-line depreciation where the van depreciates at a rate of $9600 per year. What will the van’s value be in December 2014?  
   iii. Which method of depreciation has reduced the value of the van more in the given period of time? Explain why there is a difference in the expected values of the van in December 2014.  

(KP)
Question 2

a. The diagram below shows the floor plan of a two-bedroom cottage.

Find the area of the veranda in square metres.

b. The floor plan of a holiday cabin is shown below.

The outside width of the cabin, AB, is 5600 mm. What is the scale of the drawing?
c. A family decides to pave around the swimming pool as shown below.

![Diagram of pool](image)

i. Given that the area of the pool is 19 square metres, calculate the area to be paved. (KP)

ii. The pavers chosen by the family are rectangular with dimensions 12 cm x 25 cm. What is the minimum number of pavers needed to cover the required area? (KP)

iii. The pavers are sold in packs of 400 at a cost of $360 per pack. By considering how many packs need to be ordered, work out the cost of the pavers. (KP)

d. Jeff is building a house on a sloping block of land. His builder has told him that the steeper the slope, the more it will cost to build the house. The following table gives the costs for building on sloping land.

<table>
<thead>
<tr>
<th>Angle of slope</th>
<th>Cost</th>
</tr>
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<tbody>
<tr>
<td>Less than 10°</td>
<td>$85000</td>
</tr>
<tr>
<td>10° to 14°</td>
<td>$95000</td>
</tr>
<tr>
<td>14° to 16°</td>
<td>$110000</td>
</tr>
<tr>
<td>Over 16°</td>
<td>$120000</td>
</tr>
</tbody>
</table>

The house is to take up half the block. A, B, C, D and E are evenly spaced horizontally. The builder has taken the following readings (in metres) from the building site.

![Diagram of building site](image)

Jeff originally wanted the house to span from B to D, but thought there may be a better place for the house to save him money.

Provide the cost of all three options for Jeff on where to put the house and make a recommendation on which one he should choose. (MP)
Question 3

a. The spinner below is used to determine the number of squares moved in a game. What is the probability that, on a single spin, the outcome is a number greater than 4?

b. The graph below compares the blood pressures of volunteers in a medical study. A trial group undertook a structured program of exercise and diet and a control group maintained their previous routines.

Initially, researchers were only going to publish the ranges and interquartile ranges for both groups. They then decided to publish the data as a parallel box-and-whisker plot. Explain why they made this change.
c. A Year 12 class consists of 18 students: 10 boys and 8 girls. Of these students, 6 boys and 5 girls hold a motor vehicle driver licence.

i. Complete the contingency table shown below in your response book to represent this information.

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holds driver licence</td>
<td>6</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Does not hold driver licence</td>
<td>?</td>
<td>3</td>
<td>?</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>8</td>
<td>18</td>
</tr>
</tbody>
</table>

ii. What is the probability that a student chosen at random from the class holds a driver licence? (KP)

iii. What is the probability that a girl chosen at random from the class holds a driver licence? (KP)

iv. What is the percentage of boys in the class without a driver licence? (KP)

v. What fraction of the class are girls without a driver licence? (KP)

d. A park ranger catches and tags 64 parrots in a national park. A week later she catches another 40 parrots in the same park and finds that 16 of them are tagged. Calculate the estimated number of parrots in the park. (KP)
Question 4

a. A person plans to travel from Proston to Kilkivan. The map below shows the distances, in kilometres, between towns.

Find the shortest path from Proston to Kilkivan and state the distance.

b. The diagram below shows the distance in metres between cabins in a holiday park. The owner of the holiday park wants to construct paths between the cabins.
If the cost of the pathways is $15 per metre, use a minimum spanning tree to find the lowest cost of constructing the pathways.
c. The network below shows activities in minutes to perform a complex task.

![Network Diagram]

i. Determine and draw the critical path on the diagram in your response book.  

(ii. State the minimum time required to complete all tasks. (KP)

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d. The graph below illustrates the waiting and service times at a bank during a typical 20-minute period.

![Graph of Waiting and Service Times]

i. Calculate the average waiting time.  

(ii. If all service times were to be increased by 2 minutes, how long will Customer C wait before being served? (KP)
e. Lunch hour at a fast food restaurant follows a similar pattern every day. Observation has shown that four people arrive together at the beginning of lunch and then a new customer arrives every minute. It takes 2 minutes to serve each customer and a customer will leave the restaurant without being served if the customer sees more than three people ahead of them in the queue waiting to be served.

At the start of the 5th minute of the lunch hour the manager begins serving. The manager only intends to serve for 10 minutes.

Graph this information on the graph paper in your response book.

Determine if the manager’s decision to start serving at the start of the 5th minute is sufficient to reduce the queue so no customers will leave without being served. Discuss what would have occurred had the manager not served customers, and whether the manager’s 10 minutes serving time was sufficient to prevent any subsequent customers leaving.

Discuss any strengths and limitations of the manager’s decision.

(MP)

End of Paper Two
### Assessment standards from the Mathematics A Senior External Syllabus 2006

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<tbody>
<tr>
<td>Knowledge and procedures (KP)</td>
<td>The overall quality of a candidate's achievement across the full range within the contexts of application, technology and complexity, and across topics, <strong>consistently demonstrates</strong>: • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate and proficient use.</td>
<td>The overall quality of a candidate’s achievement across a range within the contexts of application, technology and complexity, and across topics, <strong>generally demonstrates</strong>: • accurate recall, selection and use of definitions and rules • use of technology • recall and selection of procedures, and their accurate use.</td>
<td>The overall quality of a candidate’s achievement in the contexts of application, technology and complexity, <strong>generally demonstrates</strong>: • accurate recall and use of basic definitions and rules • use of some technology • accurate use of basic procedures.</td>
<td>The overall quality of a candidate’s achievement in the contexts of application, technology and complexity, <strong>sometimes demonstrates</strong>: • accurate recall and use of some definitions and rules • use of some technology.</td>
<td>The overall quality of a candidate’s achievement rarely demonstrates knowledge and use of procedures.</td>
</tr>
<tr>
<td>Modelling and problem solving (MP)</td>
<td>The overall quality of a candidate’s achievement across the full range within each context, and across topics <strong>generally demonstrates</strong> 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 <strong>demonstrates</strong> 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.</td>
<td>The overall quality of a candidate’s achievement across a range within each context, and across topics, <strong>generally demonstrates</strong> mathematical thinking which includes: • interpreting, clarifying and analysing a range of situations, and identifying variables • selecting and using strategies … and sometimes <strong>demonstrates</strong> mathematical thinking which includes: • selecting and using procedures required to solve a range of problems • informed decision making.</td>
<td>The overall quality of a candidate’s achievement <strong>demonstrates</strong> mathematical thinking which includes: • interpreting and clarifying a range of situations • selecting strategies and/or procedures.</td>
<td>The overall quality of a candidate’s achievement <strong>demonstrates</strong> mathematical thinking which includes following basic procedures and/or using strategies.</td>
<td>The overall quality of a candidate’s achievement rarely demonstrates mathematical thinking which includes following basic procedures and/or using strategies.</td>
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| 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.** |