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

- QSA-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 five 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
Question 1

a. The diminishing balance method of depreciation is used to calculate depreciation on a computer valued at $2500 at the start of the 2010 financial year. The rate of depreciation is 40% p.a.
What is the value of the computer at the start of the 2013 financial year?

(KP)

b. The price of a caravan increases as shown in the graph below. In January 2001, Tanya started saving a fixed amount of money each month to buy a caravan. The straight line on the graph below represents Tanya’s savings.

i. During which year was Tanya first able to afford a caravan?

ii. If Tanya used her savings to buy a caravan in January 2007, how much money did she have left?

iii. At what annual rate does the caravan increase in price?

(KP)

iv. Could Tanya afford to buy a caravan now? Justify your decision with mathematical calculations.
State any strengths and limitations of the model.

(MP)
Question 2

a. A pencil is randomly selected from a bag of coloured pencils, its colour recorded and returned to the bag. This process is repeated a number of times and the results recorded in the table below.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>🍒🍒🍒</td>
<td>?</td>
</tr>
<tr>
<td>Blue</td>
<td>🍂 🍂</td>
<td>?</td>
</tr>
<tr>
<td>Green</td>
<td>🍄 🍄</td>
<td>?</td>
</tr>
<tr>
<td>Yellow</td>
<td>🍎 🍎</td>
<td>?</td>
</tr>
<tr>
<td>Purple</td>
<td>🍇 🍇 🍇</td>
<td>?</td>
</tr>
</tbody>
</table>

i. Complete the frequency column in the table in your response book.

ii. Based on these results, what is the probability that a blue pencil will be chosen on the next selection?

(KP)

b. An ice-cream shop sells three different flavours of ice-cream: chocolate, strawberry and vanilla.

A boy buys an ice-cream on two different days. He chooses the one flavour at random. What is the probability that he chooses chocolate on both days?

(KP)
c. A survey was conducted of cars entering a carpark to identify if they had their headlights on, and whether the driver was male or female. Some of the data collected is shown in the two-way table below.

<table>
<thead>
<tr>
<th>Headlights on</th>
<th>Headlights off</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male drivers</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>Female drivers</td>
<td>8</td>
<td>62</td>
</tr>
<tr>
<td>Total</td>
<td>B</td>
<td>105</td>
</tr>
</tbody>
</table>

i. Determine the values of A and B.
ii. What was the total number of cars surveyed?
iii. What fraction of the cars had female drivers?
iv. Of the cars with female drivers, what percentage had headlights on?

(KP)

d. Five males and three females are living in a house, but not all will be able to stay.

i. Two people will be randomly selected to leave the house.
   Complete the following tree diagram (reproduced in your response book) by writing the probabilities on all branches.

   (KP)

ii. Helen is one of the females living at the house. Before the two people are randomly selected to leave, Helen calculates that she has a good chance of remaining in the house. Do you agree with Helen’s conclusion? Justify your response with mathematical calculations.

(MP)
Question 3

Clearly show all chart work in the response book and provide all intermediate calculations.

a. A tourist boat sets sail from Lindeman Island Resort at 9 am on a bearing of 190° T. When it is directly west of the western tip of Thomas Island, it turns to sail directly to Thomas Island. The boat remains at Thomas Island for 30 minutes.
   i. Mark point P on the chart provided to show where the boat turns to sail east to Thomas Island.
   ii. The boat then sails from Thomas Island to the western tip of Shaw Island.
       On what true bearing must the boat sail?
   iii. Use the magnetic variation given in the compass rose on the chart to find on what compass bearing the tourist boat must sail from Thomas Island to the western tip of Shaw Island in 2013.

b. The tourist boat remains at Shaw Island for 1 hour 30 minutes. It then returns directly to Lindeman Island Resort.
   If the tourist boat has maintained a steady speed of 8 knots between destinations, what is its expected time of arrival back at Lindeman Island Resort?

Question 4

a. For the directed network shown below, from which vertex can vertex O not be reached?

(KP)
b. Water will be pumped from a dam to eight locations on a farm. The pump and the eight locations (including the house) are shown as vertices in the network diagram below. The numbers on the edges joining the vertices give the shortest distances, in metres, between locations.

The total length of pipe that supplies water from the pump to the eight locations on the farm is laid along some of the edges in the network.

Calculate the minimum length of pipe needed to supply water to all locations on the farm.

(KP)

c. The table below lists the six tasks in a project, the predecessor/s of each task and the earliest start time (in hours) of each task.

<table>
<thead>
<tr>
<th>Task</th>
<th>Predecessor</th>
<th>Earliest start time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>A</td>
<td>8</td>
</tr>
<tr>
<td>D</td>
<td>B</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>C</td>
<td>22</td>
</tr>
<tr>
<td>F</td>
<td>D, E</td>
<td>35</td>
</tr>
</tbody>
</table>

Draw a network diagram to represent the project.

(KP)
d. A fast-food outlet has two people serving. The queuing behaviour of the customers is observed over a period of 15 minutes.

<table>
<thead>
<tr>
<th>Time (mins)</th>
<th>Arrivals</th>
<th>Customer served (Server 1)</th>
<th>Customer served (Server 2)</th>
<th>Customers queued</th>
<th>Queue length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>E, F</td>
<td>C</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>E</td>
<td>E</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>G</td>
<td>E</td>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>H</td>
<td>E</td>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>G</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I</td>
<td>G</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>J, K, L</td>
<td>I</td>
<td>J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>I</td>
<td>J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>K</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>N, O</td>
<td>K</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>P, Q, R</td>
<td>K</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>S</td>
<td>N</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>T</td>
<td>P</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>U</td>
<td>Q</td>
<td>R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

i. Complete the Customers queued and Queue length columns in your response book.

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

(KP)

iii. Determine if the manager of the fast-food outlet had the correct number of staff serving to ensure that no customer queued for more than three minutes.
Justify your decision.

(MP)
Question 5

a. Bill borrows $420000 to buy a house. Interest is charged at 5.7% p.a. compounded monthly. How much does Bill owe at the end of the first month, after he has made a $4000 repayment? (KP)

b. Chen buys a new refrigerator. The advertised price was $2700. He chooses to pay a deposit of $500 and monthly repayments of $115 over two years. Find the annual flat rate of interest. (KP)

c. Dave wants $10500 for a holiday. He decides to invest $200 at the end of each month by placing it into an account earning 6% p.a. compounded monthly. He will do this for four years. Using the formula below, determine whether Dave will reach his target so he can go on holiday in four years. Determine by how much Dave will fall short of or exceed his goal. Justify your decision with mathematical calculations. (MP)

\[ A = M \left\{ \frac{(1 + r)^n - 1}{r} \right\} \]

\( M = \) contribution paid at the end of each period

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

|----------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| **Knowledge and procedures** | **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.  

| **Modelling and problem solving** | **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 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.** |
<table>
<thead>
<tr>
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<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Communication and justification (CJ)</td>
<td>The overall quality of a candidate’s achievement across the full range within each context consistently demonstrates:</td>
<td>The overall quality of a candidate’s achievement across a range within each context generally demonstrates:</td>
<td>The overall quality of a candidate’s achievement in some contexts generally demonstrates:</td>
<td>The overall quality of a candidate’s achievement sometimes demonstrates evidence of the use of the basic conventions of language and mathematics.</td>
<td>The overall quality of a candidate’s achievement rarely demonstrates use of the basic conventions of language or mathematics.</td>
</tr>
<tr>
<td></td>
<td>• accurate use of mathematical terms and symbols</td>
<td>• accurate use of mathematical terms and symbols</td>
<td>• accurate use of basic mathematical terms and symbols</td>
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<tr>
<td></td>
<td>• accurate use of language</td>
<td>• accurate use of language</td>
<td>• accurate use of basic language</td>
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<td></td>
<td>• organisation of information into various forms suitable for a given use</td>
<td>• organisation of information into various forms suitable for a given use</td>
<td>• organisation of information into various forms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• use of mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions</td>
<td>• use of mathematical reasoning to develop simple logical arguments in support of conclusions, results and/or decisions</td>
<td>• use of some mathematical reasoning to develop simple logical arguments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• justification of procedures.</td>
<td></td>
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</tbody>
</table>