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

Assessment standards are at the end of this book.

After the examination session

Take this book when you leave.
Planning space
Extended response

Paper Two has five extended-response questions. Each question assesses Knowledge and procedures (KP) and Modelling and problem solving (MP) or a combination of both. Communication and justification (CJ) will be assessed by an overall judgment of your responses.

Attempt all questions.

Write your responses in the response book.

Question 1

a. Jennifer is a florist who has just purchased a second-hand delivery van for $15500 with the intention of replacing it in three years.

i. Calculate the trade-in value of the van in three years time if it depreciates at the rate of $2500 per annum.

ii. The new van Jennifer is planning to buy in three years is worth $29575 today and the inflation rate is 2.9% per annum. How much will this van cost in three years?

iii. How much extra money will Jennifer need to be able to buy the new van in three years if she sells her second-hand van at the calculated trade-in value? (KP)

b. In the 2009–10 financial year, the Australian Taxation Office issued the following table to calculate tax payable on the taxable incomes of wages and salary earners.

<table>
<thead>
<tr>
<th>Taxable income</th>
<th>Tax on this income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1–$6000</td>
<td>Nil</td>
</tr>
<tr>
<td>$6001–$34000</td>
<td>15c for each $1 over $6000</td>
</tr>
<tr>
<td>$34001–$80000</td>
<td>$4200 plus 30c for each $1 over $34000</td>
</tr>
<tr>
<td>$80001–$180000</td>
<td>$18000 plus 40c for each $1 over $80000</td>
</tr>
<tr>
<td>$180000 and over</td>
<td>$58000 plus 45c for each $1 over $180000</td>
</tr>
</tbody>
</table>

i. Jayce’s gross fortnightly income as an assistant manager of a large commercial business is $3645 with PAYG tax of $875 per fortnight. In the 2009–10 financial year, Jayce had allowable deductions totalling $6425. Calculate the tax payable on his 2009–10 taxable income.

ii. If the Medicare levy is 1.5% of taxable income, calculate the amount of Jayce’s tax refund. (KP)

c. Tom and Claire have invested $5000 in a term deposit account which offers 6.2% per annum simple interest for two years.

i. Calculate the amount of simple interest that they will earn over the two years. (KP)

ii. How much money would Tom and Claire need to invest in a savings account earning 6.2% per annum compounding half-yearly over the two-year period to earn the same amount of interest as their term deposit account? Show full working to justify your response. (MP)
Question 2

a. Consider the following set of scores:

13 15 16 23 23 29 30 30 91

i. Calculate the mean and median of this set of scores.

ii. What is the effect on the mean and median by removing the outlier?

b. There are 100 students in Astrid’s college class. She conducted an experiment to measure the weights of a random sample of 20 of these students.

The cumulative frequency graph displays the results of Astrid’s experiment.

i. Of the 100 students in Astrid’s class, how many would you expect to weigh less than 70kg?

ii. From the cumulative frequency graph, estimate the interquartile range.

iii. If a student was selected at random from the group, what is the probability that they would weigh at least 80kg?

(KP)
c. The RACQ is investigating whether there is a relationship between the age of a car and its minimum stopping distance. They tested six cars of different ages and determined the minimum stopping distance that the cars can achieve at 50 km/h. The results are shown in the following table.

<table>
<thead>
<tr>
<th>Age of the car in months</th>
<th>Stopping distance in metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>28</td>
</tr>
<tr>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>65</td>
<td>38</td>
</tr>
<tr>
<td>97</td>
<td>36</td>
</tr>
<tr>
<td>34</td>
<td>37</td>
</tr>
<tr>
<td>43</td>
<td>35</td>
</tr>
</tbody>
</table>

i. **Respond to Question 2c (i) using the graph paper on page 17 of your response book.** Prepare a scatter plot of the data and suggest a straight line of best fit through it. (KP)

ii. After analysing this data, a representative of the RACQ makes the following claim:

   _As a car gets older, its stopping distance increases._

Discuss the limitations of the model and the conclusion reached by the RACQ representative.

**Show full working to justify your response.** (MP)

### Question 3

a. From the yacht the _Pink Lady_, the navigator spots a lighthouse L on a bearing of 030°T as shown below.

A tugboat can be seen from the lighthouse on a bearing of 135°T and 9km from L.

i. Calculate the distance between the tugboat and the _Pink Lady_.

ii. Determine the bearing of the _Pink Lady_ from the tugboat. (KP)
b. **Respond to Question 3b on pages 18 and 19 of your response book.**  
   All chart work must be clearly shown.  
   A fishing boat departs Port Wilson and sails until it reaches a point, T, with latitude 15°25’S and longitude 136°15’E.  
   i. Clearly mark point T on the chart.  
   ii. Correct to the nearest nautical mile, how far is Point Flinders from point T?  

   *(KP)*

c. **Respond to Question 3c on pages 20 and 21 of your response book.**  
   All chart work must be clearly shown.  
   One morning in 2010 at 9:45 am, a fishing trawler is observed from Point Marlin bearing 270°T.  
   At the same time, the navigator on board the trawler observes Port Nelson bearing 135°M.  
   At 1 pm, Snapper Heads bears 105°M and Port Nelson 055°M from the trawler.  
   Calculate the average speed of the trawler over this period of time.  
   **Show full working to justify your response.**  

   *(MP)*

---

**Question 4**

a. Jack is a senior project manager for the Brisbane City Council. Jack has organised his current project (in days) into the following network.

![Network Diagram]

i. **Respond to Question 4a using the network on page 22 of your response book.**  
   Find the minimum time to complete the project.  

   *(KP)*

ii. State the critical path.  

   *(KP)*

iii. Jack has subcontracted part of the building work. The subcontracted teams are able to speed up the project to enable an earlier completion time.  
   The activities that can be reduced in time are B, C, D, H and L and the maximum reduction in time is two days for each activity. The cost of reducing the time of each activity is $65000 per day.  
   Determine the minimum time, in days, for the project to be completed and its associated minimum additional cost.  
   **Show full working to justify your response.**  

   *(MP)*
b. Respond to Question 4b using the network on page 23 of your response book.

Ted operates a technology business. At the local college, Ted is installing fibre optic cabling and connecting all buildings as indicated in the following network. All distances are given in metres.

i. Find the minimum spanning tree of the network and state its length.

ii. If the cost of providing the cabling is $45 per metre, what would be the minimum cost of providing fibre optic cabling to each building? (KP)

c. The management of a large food store is testing a self-serve check-out and has collected the following data during a busy 10-minute period. The store currently has one self-serve check-out.

<table>
<thead>
<tr>
<th>Time</th>
<th>Customer served</th>
<th>Arrivals</th>
<th>Queue length</th>
<th>People in queue</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A</td>
<td>—</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>B, C</td>
<td>2</td>
<td>B, C</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>D</td>
<td>3</td>
<td>B, C, D</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>—</td>
<td>2</td>
<td>C, D</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>E</td>
<td>3</td>
<td>C, D, E</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>—</td>
<td>2</td>
<td>D, E</td>
</tr>
<tr>
<td>6</td>
<td>C</td>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>C</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>C</td>
<td>G, H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>D</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>E</td>
<td>I, J, K</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

i. Respond to Question 4c (i) using the table on page 24 of your response book.

Using the information in the column headed “Customer served”, complete the table.

ii. Respond to Question 4c (ii) using the graph paper on page 25 of your response book.

Display the data in the above table in a graph to show the waiting and service times for each customer. (KP)
Question 5

a. Sally and Mark have 15000 $5 preference shares in Chingsu International at $5.25 each and 10000 $4 ordinary shares in Icon Holdings at $6.20 each. There is a guaranteed annual dividend of $4800 for the Chingsu International preference shares and $4600 for the Icon Holdings ordinary shares. Mark and Sally sell the shares which produce the lowest yield. For the sold shares, how much did Sally and Mark receive if the fees and charges below were applied?

Show full working to justify your response.

<table>
<thead>
<tr>
<th>STAMP DUTY</th>
<th>60 cents per $100 or part thereof</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROKERAGE</td>
<td>Minimum charges: $50 on buying and $20 on selling</td>
</tr>
</tbody>
</table>

Ignore GST in all calculations

b. Alexandra and Bart want to purchase their first home. The local bank manager has provided them with a monthly mortgage repayment table so they can consider repayment options.

<table>
<thead>
<tr>
<th>Monthly mortgage repayment table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal and interest per $1000 borrowed</td>
</tr>
<tr>
<td>Interest rate per annum</td>
</tr>
<tr>
<td>6.0%</td>
</tr>
<tr>
<td>6.5%</td>
</tr>
<tr>
<td>7.0%</td>
</tr>
<tr>
<td>7.5%</td>
</tr>
<tr>
<td>8.0%</td>
</tr>
</tbody>
</table>

Alexandra and Bart have savings of $125000 to put towards the purchase price of their $430000 dream home. They have enough spare cash to cover the cost of fees and charges.

i. Alexandra and Bart decide to purchase the home using $50000 of their savings as a deposit and to borrow the balance over 20 years at a rate of 6.5% per annum. Calculate their monthly loan repayment.

ii. After reviewing their financial position with the bank manager, Alexandra and Bart realise they can’t afford to pay any more than $1800 per month. The bank will lend at 6.0% per annum over 30 years provided Alexandra and Bart use all of their savings as a deposit. The owner of the property is prepared to drop the sale price of the property by $10000. Can Alexandra and Bart afford this house?

(KP)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and procedures</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</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 generally 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.</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 demonstrates 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>
</tr>
</tbody>
</table>
### Communication and justification

- **Criterion**

<table>
<thead>
<tr>
<th>Standard A</th>
<th>Standard B</th>
<th>Standard C</th>
<th>Standard D</th>
<th>Standard E</th>
</tr>
</thead>
</table>
| 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 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 and mathematics. |