



NSW Education Standards Authority

This document shows the layout of the examination paper and provides some sample questions for each of the sections.

**Sample  
Questions**

HIGHER SCHOOL CERTIFICATE EXAMINATION

# Mathematics Standard 1

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## General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

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## Total marks: 80

### Section I – 10 marks (pages 3–9)

- Attempt Questions 1–10
- Allow about 15 minutes for this section

### Section II – 70 marks (pages 11–19)

- Attempt Questions 11–XX
- Allow about 1 hour and 45 minutes for this section

The first HSC examination for the new Mathematics Standard 1 Stage 6 syllabus will be held in 2019.

The first HSC examination for the new Mathematics Standard Stage 6 syllabus will be held in 2019.

Students studying Mathematics Standard 1 may elect to undertake an optional HSC examination. The examination mark may contribute to the calculation of the student's Australian Tertiary Admission Rank (ATAR).

The Mathematics Standard 1 examination specifications can be found in the *Assessment and Reporting in Mathematics Standard Stage 6* document.

The examination will focus on the Mathematics Standard 1 Year 12 course, objectives and outcomes. Questions may require candidates to integrate knowledge, understanding and skills developed through studying the course. The Mathematics Standard Year 11 course content notated by  $\diamond$  in the syllabus will be assumed knowledge for this examination and may be used to examine Year 12 outcomes.

There is no expectation that all the Year 12 content will be examined each year. In any given year, the examination will test a representative sample of the Year 12 content.

The following sample questions provide examples of some questions that may be found in HSC examinations for Mathematics Standard 1. Each question has been mapped to show how the sample question relates to syllabus outcomes and content. Answers for the objective-response questions (Section I) and marking guidelines for the short-answer questions (Section II) are provided. The marking guidelines indicate the criteria associated with each mark or mark range.

In the examination, students will record their answers to Section I on a multiple-choice answer sheet and their answers to Section II in the spaces provided on the examination paper.

The sample questions, annotations and marking guidelines provide teachers and students with guidance as to the types of questions to expect and how they may be marked. They are not meant to be prescriptive. Each year the structure of the examination may differ in the number and type of questions, or focus on different syllabus outcomes and content.

Note:

- Comments in coloured boxes are annotations for the purpose of providing guidance for future examinations.
- In this set of sample questions, some stimuli are used in both Section I and Section II. This is to illustrate how the same content area can be examined differently.
- Teachers and students should still refer to past HSC examination papers for examples of other questions that may be included.

## Section I

10 marks

Attempt Questions 1–10

Allow about 15 minutes for this section

Past examination papers provide guidance for other types of multiple-choice questions that could be included in the examination.

This is NOT a complete sample examination paper. Seven sample questions are included in this section.

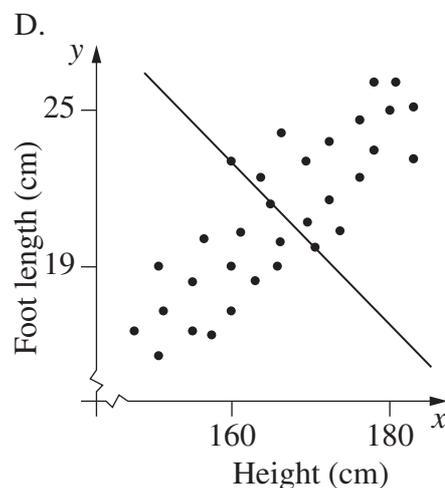
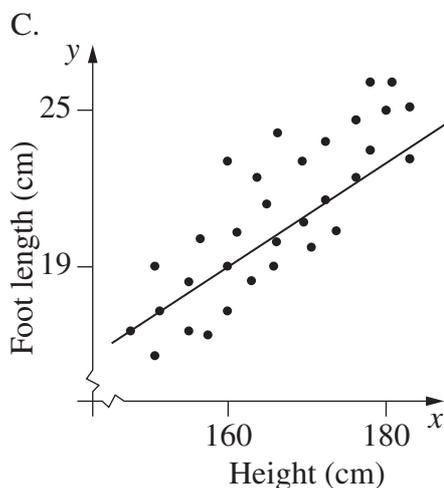
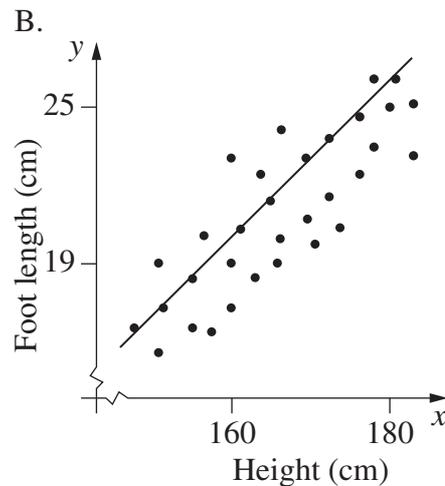
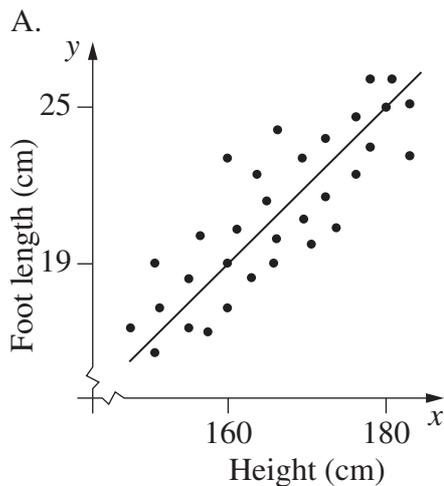
Use the multiple-choice answer sheet for Questions 1–10.

A variety of stimulus material, such as text, diagrams, pictures, graphs, photographs and illustrations, may be included in the questions in Section I. However, stimulus material will only be included when it is essential for answering the question.

Multiple-choice options (A–D) may be presented in different formats, for example, text, graphs, photographs, diagrams.

- 1 Some students had their height and foot length measured and recorded. The results were graphed and a line of best fit was drawn by four different students.

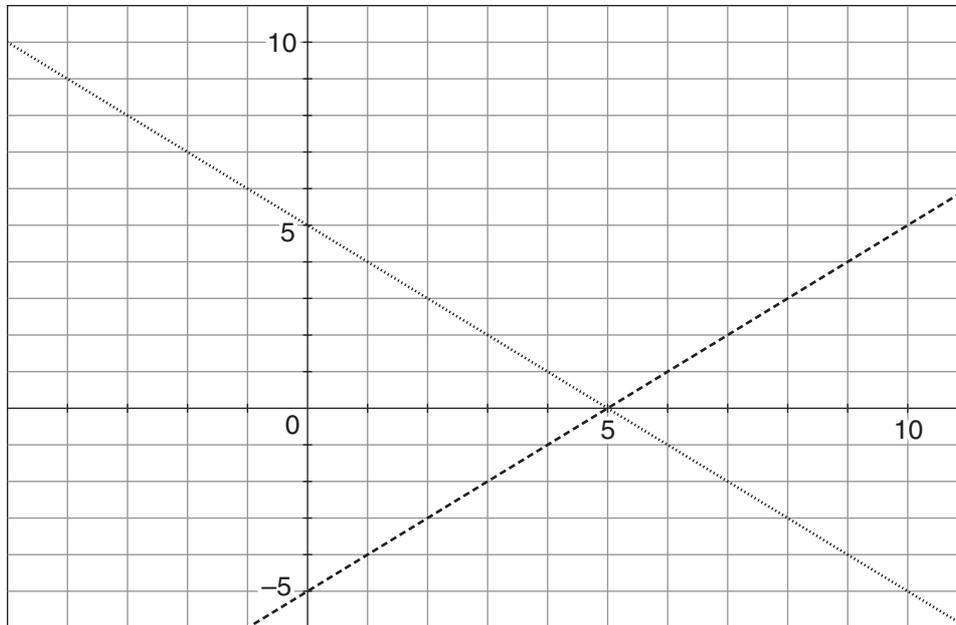
Which of the following shows the most suitable line of best fit?



2 A computer application was used to draw the graphs of the equations

$$x + y = 5 \text{ and } x - y = 5.$$

Part of the screen is shown.

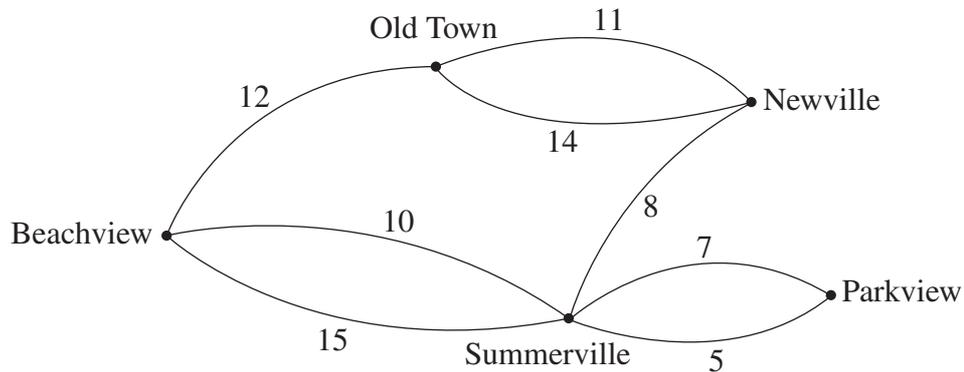


What is the solution when the equations are solved simultaneously?

- A.  $x = 0, y = -5$
- B.  $x = 0, y = 5$
- C.  $x = 5, y = 0$
- D.  $x = 5, y = 5$

This question tests some of the knowledge and skills examined in Mathematics Standard 2 Question 2.

- 3 This diagram shows the possible paths (in km) for laying gas pipes between various locations.



NOT TO  
SCALE

Students should note that not all diagrams are drawn to scale.

Gas is to be supplied from one location. Any one of the locations can be the source of the supply.

What is the minimum total length of the pipes required to provide gas to all the locations?

- A. 32 km
- B. 34 km
- C. 36 km
- D. 38 km

This question is common to Mathematics Standard 1 and Mathematics Standard 2.

This question is based on new content.

4 Part of a train timetable is shown.

<i>Amesham</i>	13.37	13.47	...	13.55
<i>Bickford</i>	13.43	...	14.00	14.02
<i>Clipsbury</i>	...	14.02	...	14.11
<i>Doppleton</i>	14.05	14.12	14.20	14.24
<i>Evesbury</i>	14.17	14.29	...	14.43
<i>Frampton</i>	14.38	...	14.47	14.55

Kris arrives at Amesham station at 1.45 pm and needs to get to Frampton as quickly as possible.

Assuming all trains run to schedule, what is the EARLIEST time that Kris can arrive at Frampton station?

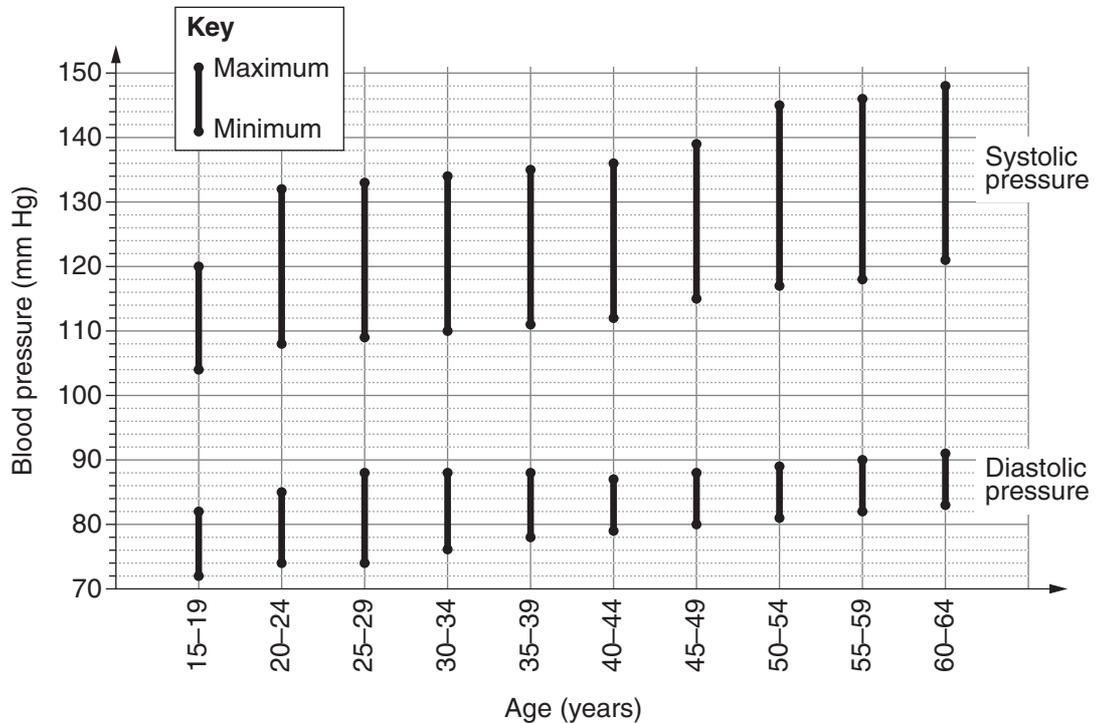
- A. 2.29 pm
- B. 2.38 pm
- C. 2.47 pm
- D. 2.55 pm

This question uses Year 11 content to examine a Year 12 outcome.

The Mathematics Standard Year 11 course content notated by  $\diamond$  in the syllabus will be assumed knowledge for this examination and may be used to examine Year 12 outcomes.

- 5 Blood pressure is measured using two numbers: systolic pressure and diastolic pressure. If the measurement shows 120 systolic and 80 diastolic, it is written as '120 over 80'.

The bars on the graph show the normal ranges of blood pressure for people of various ages.



Jamie, aged 42, had a blood pressure reading of 180 over 130. A doctor prescribed Jamie a medication to reduce his blood pressure. To check that the medication was being effective, the doctor measured Jamie's blood pressure for 10 weeks and recorded the following results.

Week	1	2	3	4	5	6	7	8	9	10
Systolic pressure	180	160	152	134	140	130	130	128	131	132
Diastolic pressure	130	115	106	85	83	90	85	84	81	80

Based on these results, from which week onwards was Jamie's blood pressure consistently in the normal range?

- A. Week 4
- B. Week 5
- C. Week 6
- D. Week 7

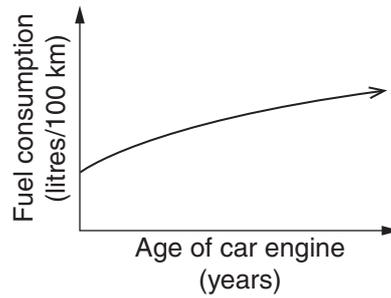
Question 11 is a short-answer question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

- 6 What amount must be invested now at 4% per annum, compounded quarterly, so that in five years it will have grown to \$60 000?
- A. \$8919
  - B. \$11 156
  - C. \$49 173
  - D. \$49 316

This question is common to Mathematics Standard 1 and Mathematics Standard 2.

If information required to answer a question is not available on the Reference Sheet, it may be provided with the question.

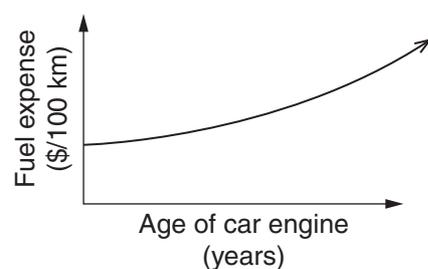
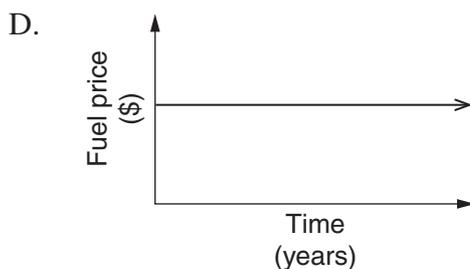
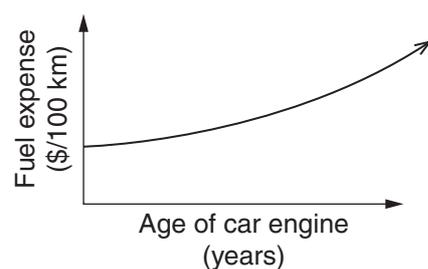
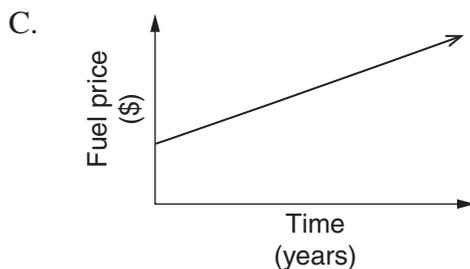
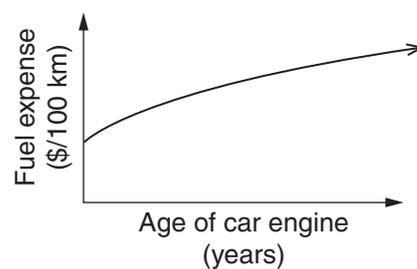
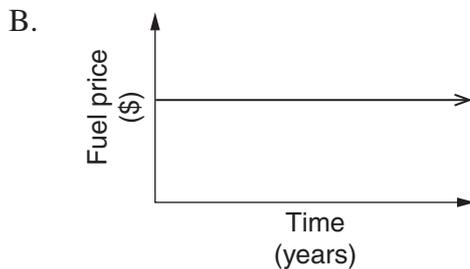
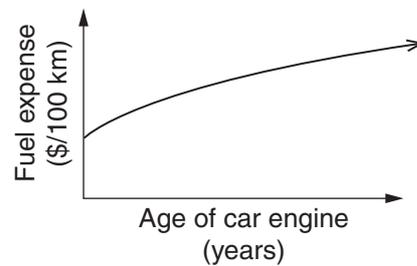
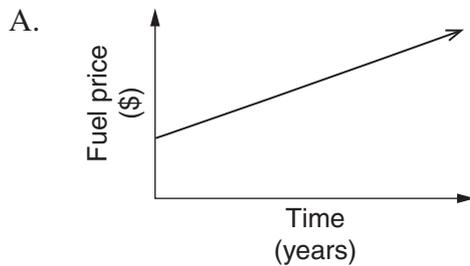
- 7 The graph shows the relationship between the age of a car's engine and the car's expected fuel consumption.



Assume that the fuel price is constant over time. Which pair of graphs best represents the fuel price over time and the amount expected to be spent on fuel as this car's engine ages?

**The price of fuel**

**Expected fuel expense**



This question uses Year 11 content to examine a Year 12 outcome.

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# Mathematics Standard 1

## Section II Answer Booklet

Questions in Section II may contain parts. There will be 30 to 35 items and at least two items will be worth 4 or 5 marks.

This is NOT a complete sample examination paper. Four sample questions (seven items) have been included in this section.

**70 marks**

**Attempt Questions 11–XX**

**Allow about 1 hour and 45 minutes for this section**

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**Instructions**

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

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**Please turn over**

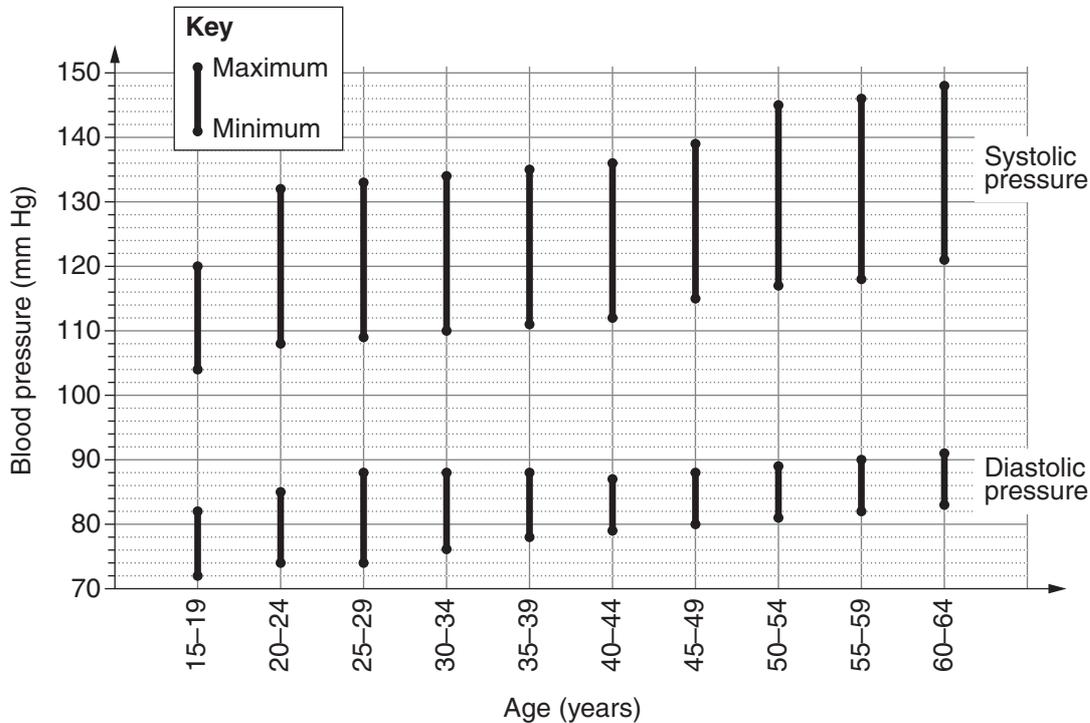
A variety of stimulus material, such as text, diagrams, pictures, graphs, photographs and illustrations, may be included in the questions in Section II.

Equipment such as a ruler, a protractor and a pair of compasses may be required to answer questions in this examination.

**Question 11** (5 marks)

Blood pressure is measured using two numbers: systolic pressure and diastolic pressure. If the measurement shows 120 systolic and 80 diastolic, it is written as '120 over 80' or 120/80.

The bars on the graph show the normal range of blood pressure for people of various ages.



(a) What is the normal range of blood pressure for a 42-year-old?

2

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**Question 11 continues on page 13**

Question 11 (continued)

- (b) Jamie, aged 42, had a blood pressure reading of 180 over 130. A doctor prescribed Jamie a medication to reduce his blood pressure to be within the normal range. To check that the medication was being effective, the doctor measured Jamie’s blood pressure for 10 weeks and recorded the following results. 3

<i>Week</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
<i>Blood pressure</i>	180/130	160/115	152/106	134/85	140/83	130/90	130/85	128/84	131/81	132/80

With reference to the data provided, comment on the effectiveness of the medication during the 10-week period in returning Jamie’s blood pressure to the normal range.

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Some questions in this section may specify that the response must be supported with a diagram or other material such as a graph.

In some cases, students may find it useful to support their answer with a diagram or other material although no specific requirement is made in the question.

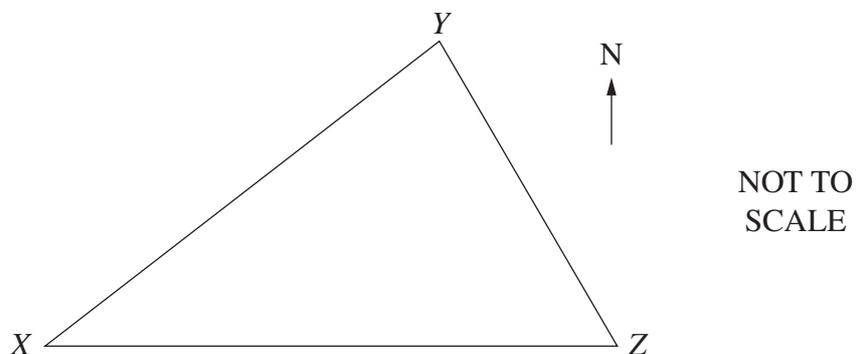
Question 5 is a multiple-choice question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

**End of Question 11**

**Question 12** (6 marks)

The diagram shows three towns  $X$ ,  $Y$  and  $Z$ . Town  $Z$  is due east of Town  $X$ . The bearing of Town  $Y$  from Town  $X$  is  $N39^\circ E$  and the bearing of Town  $Z$  from Town  $Y$  is  $S51^\circ E$ . The distance between Town  $X$  and Town  $Y$  is 1330 km.

A plane flies between the three towns.



- (a) Mark the given information on the diagram and explain why  $\angle XYZ$  is  $90^\circ$ . **2**

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- (b) If the speed of the plane is 570 km/h, how long does the flight take from Town  $X$  to Town  $Y$ , in hours and minutes? **2**

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Students should show all relevant working in responses involving calculations. This ensures that marks can be allocated for working even if the student's final answer is incorrect.

Whenever possible, question parts are sequenced in order of difficulty.

An incorrect answer in a previous part will not necessarily preclude students from achieving full marks in a later part.

**Question 12 continues on page 15**

Question 12 (continued)

- (c) Find the distance between Town X and Town Z to the nearest kilometre. **2**

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This question is common to Mathematics Standard 2, Question 18 parts (a)–(c).

**Question 13** (2 marks)

A restaurant owner wants to find out what the customers like best about the restaurant. Each customer is asked to complete this questionnaire at the end of their meal.

**2**

**What did you like best about this restaurant?**

Number the boxes 1, 2, 3 and 4, where 1 is your first choice.

Great-tasting food	<input type="checkbox"/>
Friendly staff and fast service	<input type="checkbox"/>
Relaxed atmosphere	<input type="checkbox"/>
Food has great flavour	<input type="checkbox"/>

Outline TWO reasons showing why this questionnaire can be considered to be poorly designed for its purpose.

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This question is based on new content.

**Question 14** (5 marks)

Two friends, Anka and Budi, sold their cupcakes at the school cake stall.

5

Anka sold her cupcakes for \$2 each while Budi sold his for \$3 each. Their combined sales for the first hour were \$18.

If Anka sold  $x$  cupcakes and Budi sold  $y$  cupcakes, then the following equation can be formed:  $2x + 3y = 18$ .

In the first hour, the friends sold a total of 7 cupcakes between them.

Find the number of cupcakes each of the friends sold during this time, by forming a second equation and solving the simultaneous equations graphically.

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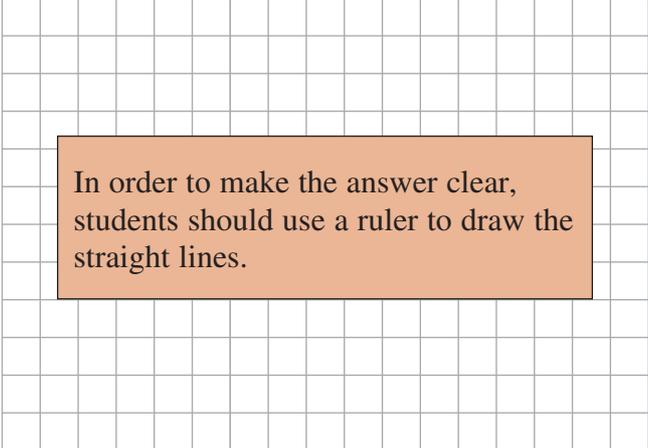
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In order to make the answer clear, students should use a ruler to draw the straight lines.

A response in this section may need to be expressed in a particular format such as text, graphs, tables, diagrams, calculations. A combination of these formats may also be required.

This question is based on new content for the Mathematics Standard 1 course. The content is currently in the Mathematics General 2 course.

**End of sample questions**



**Section II extra writing space**

**If you use this space, clearly indicate which question you are answering.**

Mathematics Standard 1  
Mathematics Standard 2

REFERENCE SHEET

**Measurement**

**Precision**

Absolute error =  $\frac{1}{2} \times$  precision

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

**Length, area, surface area and volume**

$$l = \frac{\theta}{360} \times 2\pi r$$

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(x + y)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

**Trigonometry**

$$A = \frac{1}{2}ab \sin C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

**Financial Mathematics**

$$FV = PV(1 + r)^n$$

**Straight-line method of depreciation**

$$S = V_0 - Dn$$

**Declining-balance method of depreciation**

$$S = V_0(1 - r)^n$$

**Statistical Analysis**

$$z = \frac{x - \bar{x}}{s}$$

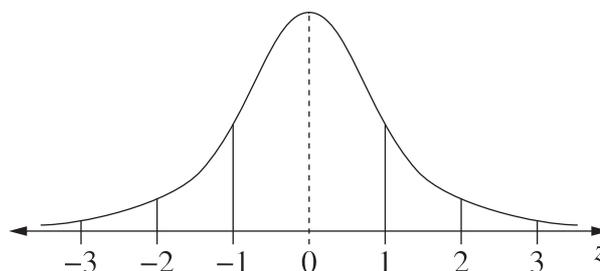
An outlier is a score

less than  $Q_1 - 1.5 \times IQR$

or

more than  $Q_3 + 1.5 \times IQR$

**Normal distribution**



- approximately 68% of scores have z-scores between -1 and 1
- approximately 95% of scores have z-scores between -2 and 2
- approximately 99.7% of scores have z-scores between -3 and 3

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## HSC Mathematics Standard 1 Sample Questions Marking Guidelines

### Section I

#### Multiple-choice Answer Key

Question	Answer
1	A
2	C
3	B
4	C
5	D
6	C
7	B

## Section II

### Question 11 (a)

Criteria	Marks
• Identifies the normal blood pressure range for a 42-year-old	2
• Provides some relevant information	1

**Sample answer:**

The systolic pressure should be between 112 mm Hg and 136 mm Hg.

The diastolic pressure should be between 79 mm Hg and 87 mm Hg.

### Question 11 (b)

Criteria	Marks
• Provides an appropriate judgement regarding the effectiveness of the medication • Supports judgement with reference to the relevant data during the 10-week period	3
• Identifies some effects of the medication • Provides some link to the expected normal blood pressure range	2
• Provides some relevant information	1

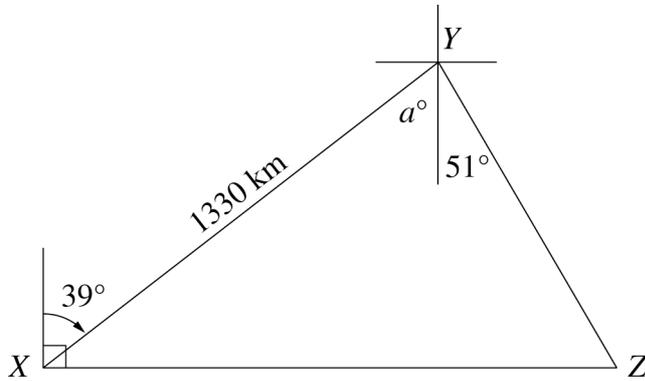
**Sample answer:**

The medication was effective in reducing Jamie's blood pressure. From Week 2 onwards, both the systolic and diastolic readings were under the Week 1 readings (of 180 and 130 respectively). While a normal range was achieved in Week 4, the systolic reading was above the normal in Week 5 and the diastolic reading was above the normal in Week 6. A normal range was only consistently achieved from Week 7 onwards.

**Question 12 (a)**

Criteria	Marks
<ul style="list-style-type: none"> <li>Marks the given information on the diagram</li> <li>Provides an explanation of why <math>\angle XYZ</math> is <math>90^\circ</math></li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

*Sample answer:*



$$a = 39$$

$$\angle XYZ = a^\circ + 51^\circ$$

$$= 90^\circ$$

**Question 12 (b)**

Criteria	Marks
<ul style="list-style-type: none"> <li>Correctly calculates the duration of the flight in hours and minutes</li> </ul>	2
<ul style="list-style-type: none"> <li>Applies an appropriate method</li> </ul>	1

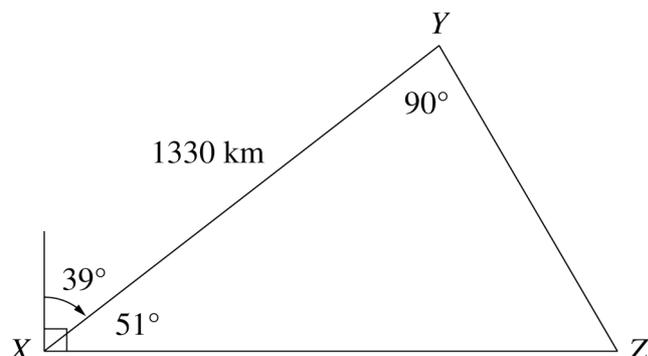
*Sample answer:*

$$\begin{aligned} \text{Duration of the flight} &= \frac{1330}{570} \\ &= 2.33\dots \text{ hours} \\ &= 2 \text{ hours } 20 \text{ minutes} \end{aligned}$$

**Question 12 (c)**

Criteria	Marks
• Correctly calculates the distance	2
• Applies an appropriate method	1

*Sample answer:*



$$\cos 51^\circ = \frac{1330}{XZ}$$

$$XZ = 2113 \text{ km (to the nearest km)}$$

**Question 13**

Criteria	Marks
• Outlines two reasons which show why the questionnaire is poorly designed	2
• Provides some relevant information	1

*Sample answer:*

The first and last options are really the same so it can be confusing or it may lead to contradictory results.

The second item contains two different options and there is no way for customers to indicate if they only like one of them best.

*Answers could include:*

- There is no opportunity for customers to:
  - list other options such as live music, location and value for money
  - rank two or more options equally.
- There is no need for customers to rank the items if the restaurant owner only wants to find out what people like best.

**Question 14**

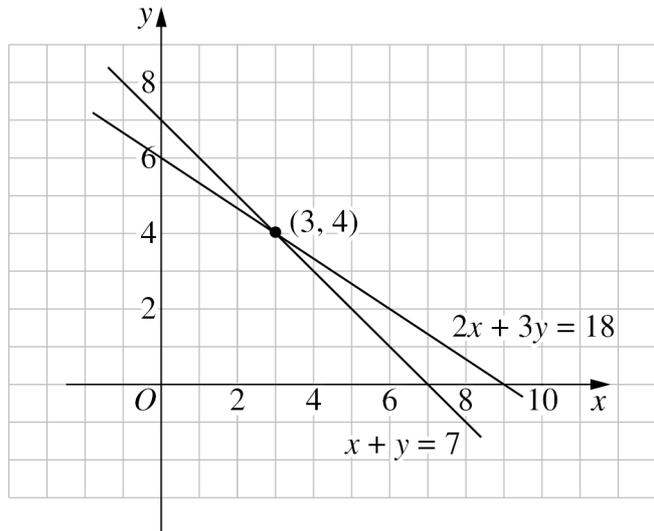
Criteria	Marks
<ul style="list-style-type: none"> <li>Correctly determines the number of cupcakes sold by each friend, meeting the specified requirements</li> </ul>	5
<ul style="list-style-type: none"> <li>Provides an answer based on an incorrect second equation</li> </ul> OR	4
<ul style="list-style-type: none"> <li>Provides an answer based on an incorrect graph of one of the equations</li> </ul>	
<ul style="list-style-type: none"> <li>Correctly graphs the given equation and a second equation</li> </ul>	3
<ul style="list-style-type: none"> <li>Provides a correct second equation and shows some understanding of graphing on a grid</li> </ul> OR	2
<ul style="list-style-type: none"> <li>Correctly graphs the given equation or a second equation</li> </ul>	
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

**Sample answer:**

Second equation:  
 $x + y = 7$

Lines intersect at (3, 4).

∴ Anka sold 3 cupcakes and Budi sold 4 cupcakes.



# HSC Mathematics Standard 1 Sample Questions Mapping Grid

## Section I

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
1	1	MS-S3 Further Statistical Analysis	MS1-12-2	2–3
2*	1	MS-A3 Types of Relationships	MS1-12-1	3–4
3*	1	MS-N1 Networks and Paths	MS1-12-8	3–4
4	1	MS-M2 Working with Time	MS1-12-2	3–4
5	1	MS-M4 Rates	MS1-12-3	4–5
6*	1	MS-F2 Investment	MS1-12-5	4–5
7	1	MS-A3 Types of Relationships	MS1-12-6	5–6

## Section II

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
11 (a)	2	MS-M4 Rates	MS1-12-3	2–3
11 (b)	3	MS-M4 Rates	MS1-12-3, MS1-12-10	2–5
12 (a)*	2	MS-M3 Right-angled Triangles	MS1-12-4, MS1-12-10	2–4
12 (b)*	2	MS-M4 Rates	MS1-12-3	3–5
12 (c)*	2	MS-M3 Right-angled Triangles	MS1-12-4	4–6
13	2	MS-S3 Further Statistical Analysis	MS1-12-10	2–4
14	5	MS-A3 Types of Relationships	MS1-12-6, MS1-12-10	2–6

\* These questions are common to Mathematics Standard 1 and Mathematics Standard 2.