

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

Mathematics Standard 2

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours and 30 minutes
- 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

Total marks: 100

Section I – 15 marks (pages 3–7)

- Attempt Questions 1–15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 8–15)

- Attempt Questions 16–XX
- Allow about 2 hours and 5 minutes for this section

The first HSC examination for the new Mathematics Standard 2 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.

The Mathematics Standard 2 examination specifications can be found in the *Assessment and Reporting in Mathematics Standard Stage 6* document.

The examination will focus on the Mathematics Standard 2 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 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 2. 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

15 marks

Attempt Questions 1–15

Allow about 25 minutes for this section

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

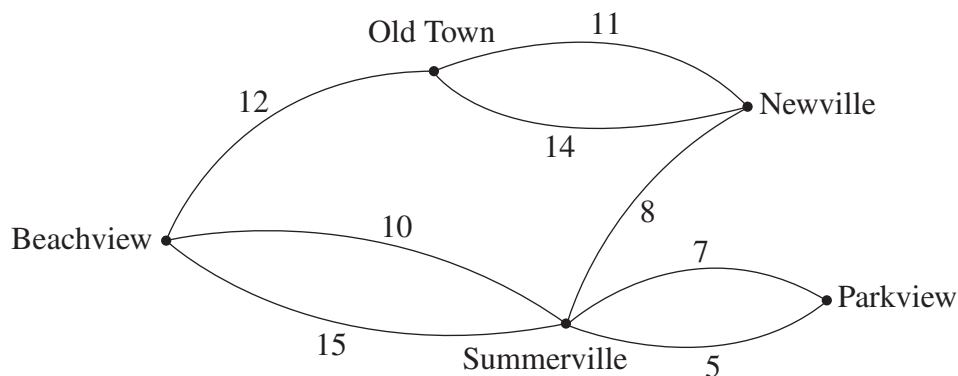
This is NOT a complete sample examination paper. Six sample questions are included in this section.

Use the multiple-choice answer sheet for Questions 1–15.

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 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

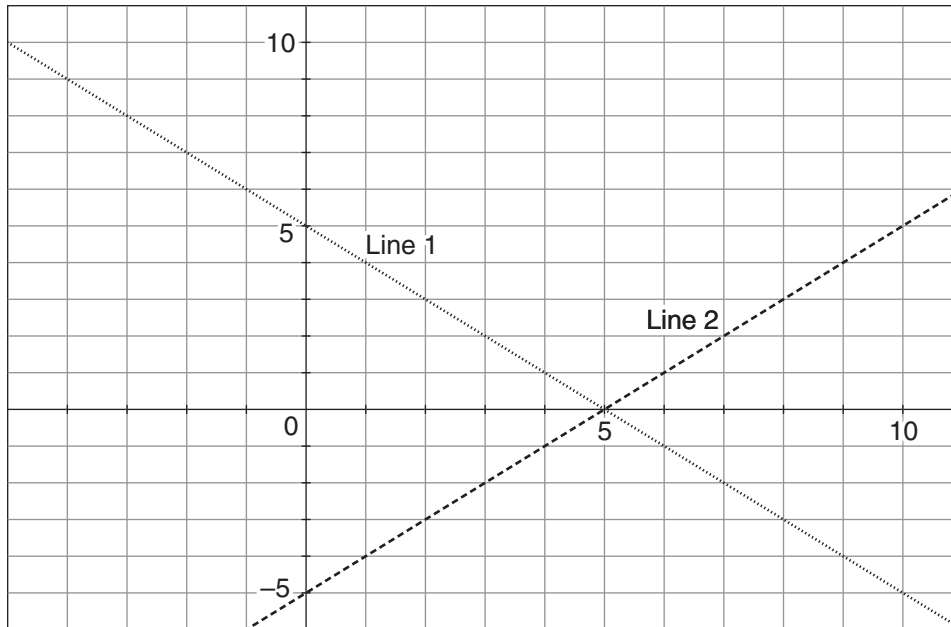
This question is common to Mathematics Standard 1 and Mathematics Standard 2.

This question is based on new content.

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.



Which row of the table correctly matches the equations with the lines drawn and identifies the solution when the equations are solved simultaneously?

	$x + y = 5$	$x - y = 5$	<i>Solution</i>
A.	Line 1	Line 2	$x = 5, y = 0$
B.	Line 1	Line 2	$x = 5, y = 5$
C.	Line 2	Line 1	$x = 5, y = 0$
D.	Line 2	Line 1	$x = 5, y = 5$

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

The Mathematics Standard Year 11 course content will be assumed knowledge for this examination and may be used to examine Year 12 outcomes.

This question uses stimulus material common to Mathematics Standard 1 Question 2.

- 3 A survey was conducted into the number of hours worked by casual staff in the hospitality industry. It was found that the weekly average was 18 hours with a standard deviation of 2.5 hours, and that the number of hours worked was normally distributed.

Based on the survey, what is the percentage of casual staff working fewer than 23 hours in a week?

- A. 47.5%
 - B. 84%
 - C. 95%
 - D. 97.5%
- 4 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.

- 5 The table shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 30 minutes at different speeds.

<i>Walking speed</i>	<i>Energy used in 30 minutes</i>
3 km/h	5.53 kJ/kg
5 km/h	7.37 kJ/kg

Sam, who weighs 65 kg, drinks a regular cappuccino made with full cream milk. It contains 73 kilocalories.

For approximately how long must Sam walk at 3 km/h to burn off the energy contained in the cappuccino? (1 kilocalorie = 4.184 kJ)

- A. 20 minutes
- B. 25 minutes
- C. 90 minutes
- D. 120 minutes

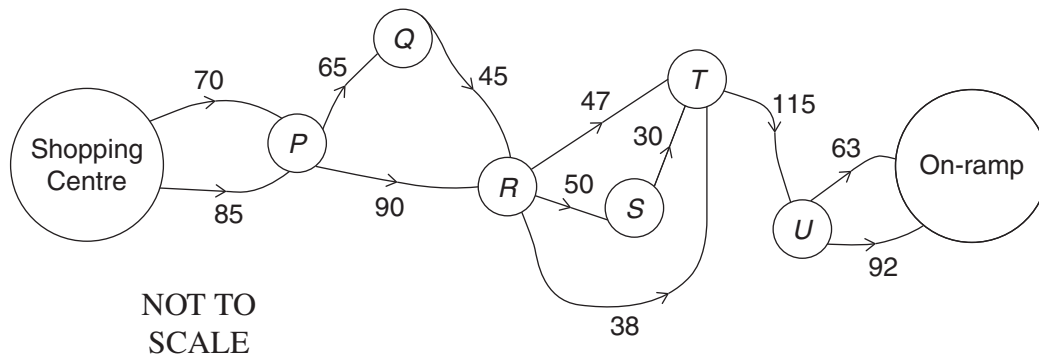
If information required to answer a question is not available on the Reference Sheet, it may be provided with the question.

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

The Mathematics Standard Year 11 course content will be assumed knowledge for this examination and may be used to examine Year 12 outcomes.

This question is based on new content.

- 6 The network diagram represents a system of roads connecting a shopping centre to the on-ramp of a freeway. Traffic flows via several routes. For example, there are two routes from the shopping centre to *P* and one route from *T* to *U*. The number on the edge of each road indicates the number of vehicles that can travel on it per hour.



At present, the flow capacity of the network from the shopping centre to the on-ramp is not maximised.

Which additional road(s) would increase the network flow capacity to its maximum?

- A. A road from *P* to *U* with a flow capacity of 20 vehicles per hour
- B. A road from *Q* to *T* with a flow capacity of 20 vehicles per hour
- C. A road from *R* to *T* with a flow capacity of 20 vehicles per hour and a road from *T* to *U* with a flow capacity of 40 vehicles per hour
- D. A road from *Q* to *U* with a flow capacity of 20 vehicles per hour and a road from *S* to *U* with a flow capacity of 20 vehicles per hour

Question 17 is a short-answer question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

This question is based on new content.

Mathematics Standard 2

Section II Answer Booklet

Questions in Section II may contain parts. There will be 35 to 40 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.

85 marks

Attempt Questions 16–XX

Allow about 2 hours and 5 minutes for this section

Instructions

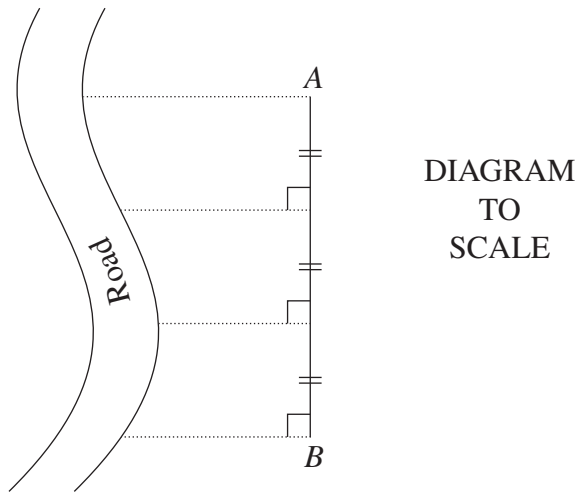
- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
 - Your responses should include relevant mathematical reasoning and/or calculations.
 - Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate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

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 16 (3 marks)

The scale diagram shows the aerial view of a block of land bounded on one side by a road. The length of the block, AB , is known to be 45 metres. **3**



Calculate the approximate area of the block of land, using three applications of the Trapezoidal rule.

.....

.....

.....

.....

.....

.....

.....

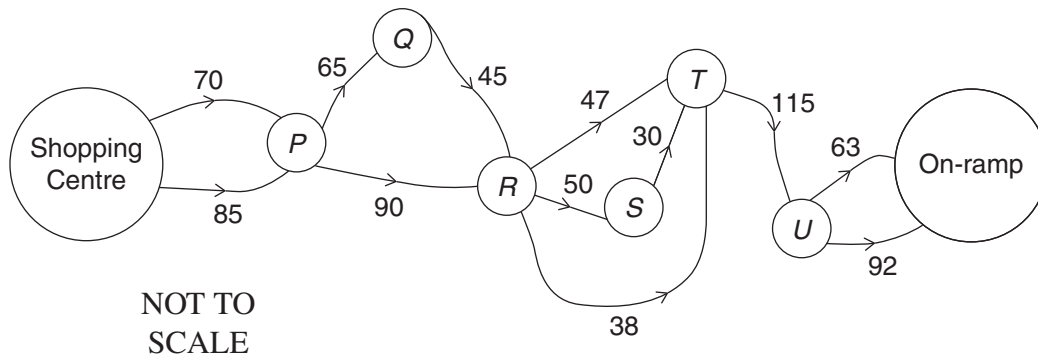
.....

.....

Question 17 (3 marks)

3

The network diagram represents a system of roads connecting a shopping centre to the on-ramp of a freeway. Traffic flows via several routes. For example, there are two routes from the shopping centre to *P* and one route from *T* to *U*. The number on the edge of each road indicates the number of vehicles that can travel on it per hour.



At present, the flow capacity of the network from the shopping centre to the on-ramp is not maximised. It is not possible to construct a road directly between the shopping centre and the on-ramp.

Suggest ONE way that the network flow capacity can be maximised with additional road(s). Justify your answer.

.....

..... An alternative question that examines similar knowledge and skills may be:

 Draw additional road(s) on the diagram to maximise the network flow capacity. Include the number of vehicles that can travel on each road.

..... 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.

..... Question 6 is a multiple-choice question based on the same stimulus and demonstrates another method of examining similar knowledge and skills.

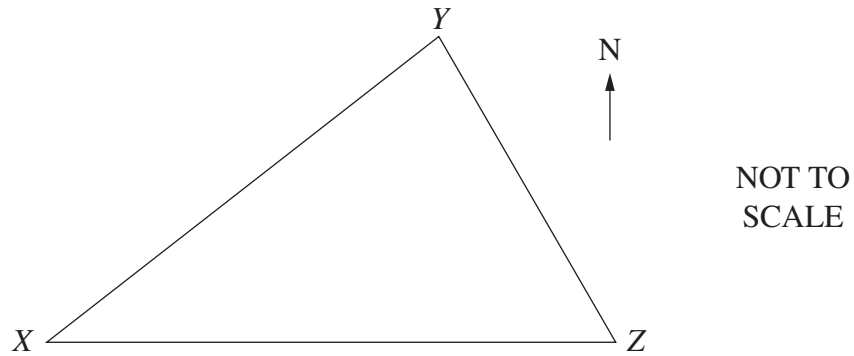
..... This question is based on new content.

.....

Question 18 (9 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° . **2**

.....

.....

.....

.....

- (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**

.....

.....

.....

.....

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

.....

..... 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.

.....

Question 18 continues on page 12

Question 18 (continued)

- (d) The plane is going to fly from Town *Y* to Town *X*, stopping at Town *Z* on the way. Leaving Town *Y*, the pilot incorrectly sets the bearing of Town *Z* to S50°E. The pilot flies for 1650 km before realising the mistake, then changes course and flies directly to Town *X*, without going to Town *Z*. 3

From where the pilot changes course, is it a shorter or longer distance to Town *X* than if the plane had flown from Town *Z* to Town *X*?

.....

.....

.....

.....

.....

.....

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 18 parts (a)–(c) are common to Mathematics Standard 1 Question 12 parts (a)–(c).

End of Question 18

Question 19 (5 marks)

A project requires activities *A* to *G* to be completed, as shown in the table.

5

<i>Activity</i>	<i>Immediate prerequisite(s)</i>	<i>Duration in days</i>
<i>A</i>	–	?
<i>B</i>	–	15
<i>C</i>	<i>A</i>	?
<i>D</i>	<i>A, B</i>	20
<i>E</i>	<i>D</i>	8
<i>F</i>	<i>C, E</i>	?
<i>G</i>	<i>D</i>	?

The minimum completion time for the project is 50 days and the critical path includes activities *B, D, E* and *F*. The float for *G* is three days and the float for *C* is 8 days.

This question is based on new content.

Question 19 continues on page 14

Question 19 (continued)

Find a possible duration for each of the activities *A*, *C*, *F* and *G*. Include a network diagram in your answer.



.....

.....

.....

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.

.....

.....

.....

.....

.....

End of sample questions

Section II extra writing space

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

Reference sheet
to be published
at a later date

HSC Mathematics Standard 2 Sample Questions Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16

Criteria	Marks
• Provides correct solution	3
• Demonstrates some understanding of a scale drawing • Applies the Trapezoidal rule	2
• Provides some relevant information	1

Sample answer:

4.5 cm represents 45 m

∴ 1 cm represents 10 m

$$h = 15 \text{ m}$$

$$A = \frac{15}{2}(25 + 20) + \frac{15}{2}(20 + 25) + \frac{15}{2}(25 + 30)$$

∴ Area = 1087.5 m²

Question 17

Criteria	Marks
<ul style="list-style-type: none"> • Identifies additional road(s) that can maximise the network flow capacity • Relates the additional road(s) to maximising the flow capacity 	3
<ul style="list-style-type: none"> • Demonstrates some understanding of maximising network flow capacity and/or identifies areas where flow capacities are not maximised 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

A road from Q to U and a road from S to U , each with a flow capacity of 20 vehicles per hour, can be added to maximise the flow capacity.

Q can handle 65 vehicles per hour travelling into it but only has 45 vehicles per hour travelling out of it. Building a road directly from Q to U with a flow capacity of 20 vehicles per hour will rectify this shortfall and maximise the flow.

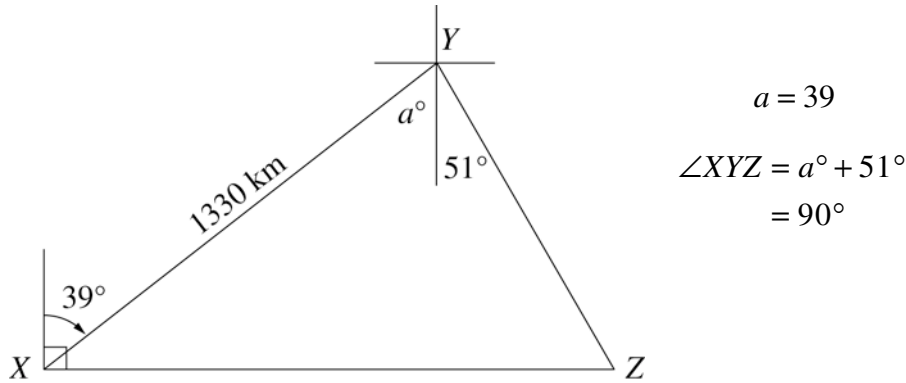
Similarly, S can handle 50 vehicles per hour travelling into it but only 30 vehicles per hour travelling out of it. Building a road directly from S to U with a flow capacity of 20 vehicles per hour will rectify the shortfall and maximise the flow.

U is capable of taking on 40 extra vehicles per hour since it can handle 155 vehicles per hour ($63 + 92$) into the on-ramp but there are only 115 vehicles entering it. The two additional roads, each with a flow capacity of 20 vehicles per hour, will maximise the flow capacity at U .

Question 18 (a)

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

Sample answer:



Question 18 (b)

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

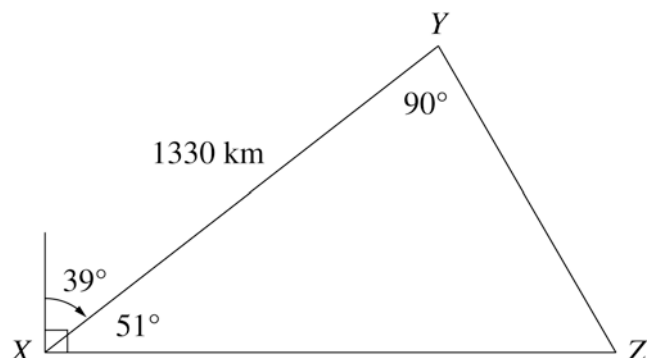
Sample answer:

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

Question 18 (c)

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

Sample answer:



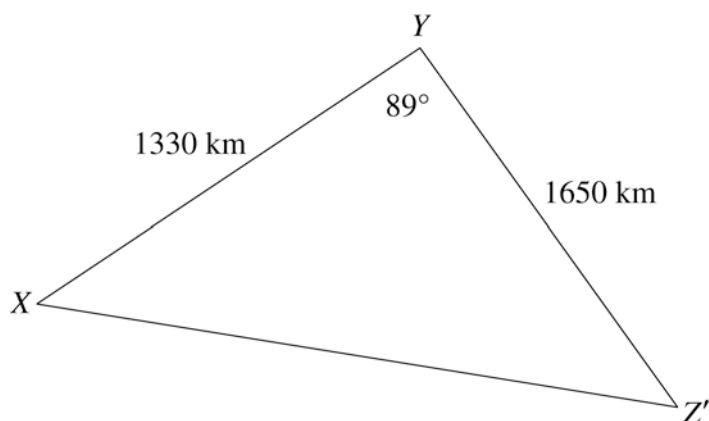
$$\cos 51^\circ = \frac{1330}{XZ}$$

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

Question 18 (d)

Criteria	Marks
• Concludes that the plane flies a shorter distance	3
• Supports conclusion with relevant calculations	2
• Substitutes correct values into the cosine rule	1
• Provides some relevant information	1

Sample answer:



Since the bearing is S50°E instead of S51°E, $\angle XYZ' = 89^\circ$.

$$(XZ')^2 = 1330^2 + 1650^2 - 2 \times 1330 \times 1650 \times \cos 89^\circ$$

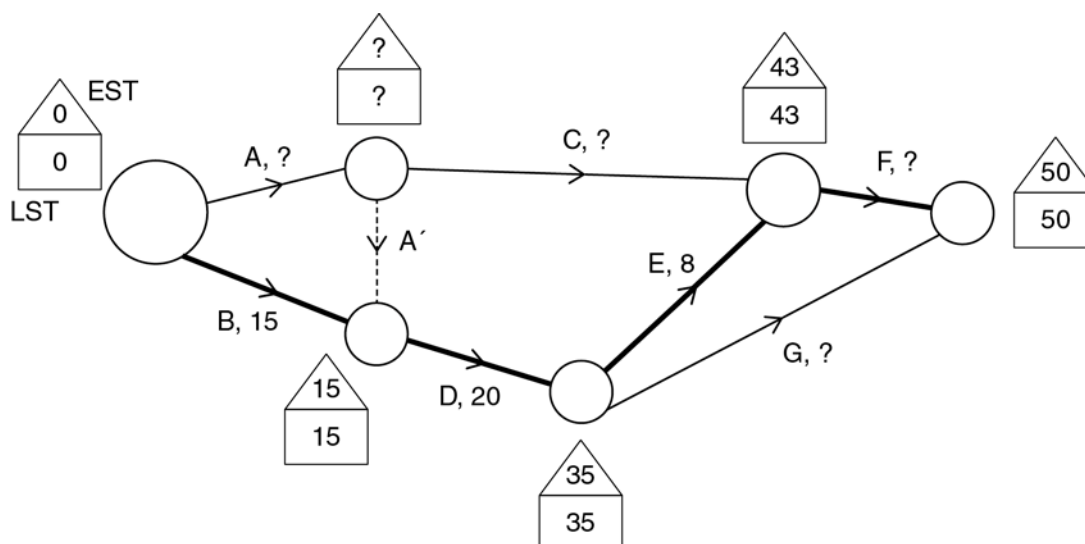
$$XZ' = 2101 \text{ km (to the nearest km)}$$

Since XZ' is shorter than XZ , the plane flies a shorter distance to Town X.

Question 19

Criteria	Marks
<ul style="list-style-type: none"> Finds possible values for the missing entries Supports the solution with a correct network diagram 	5
<ul style="list-style-type: none"> Finds possible values for some of the missing entries Supports the solution with a relevant network diagram 	4
<ul style="list-style-type: none"> Finds a value for a missing entry and supports the solution with a relevant network diagram <p>OR</p> <ul style="list-style-type: none"> Correctly represents all the given information on a network diagram and demonstrates some understanding of critical path / LST / EST / float 	3
<ul style="list-style-type: none"> Shows the relationship between some of the activities using a diagram and/or calculations 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:



F is on critical path and so has no float.
 \therefore duration of F is $50 - 43 - 0 = 7$ days

Float = LST of next activity – EST of this activity – duration of this activity
 \therefore duration = LST of next activity – EST of this activity – Float

The float of G is 3 days.
 \therefore duration of G = $50 - 35 - 3 = 12$ days

The float of C is 8 days.
 \therefore duration of C = $43 - \text{EST for C} - 8$

But EST for C is equal to the duration of A since A has no prerequisites.
 \therefore duration of C = $43 - \text{duration of A} - 8$

So, duration of A + duration of C = $43 - 8 = 35$ days
 \therefore possible durations for A and C may be A = 1 day and C = 34 days.

HSC Mathematics Standard 2 Sample Questions Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
1*	1	MS-N2 Network Concepts	MS2-12-8	2–3
2*	1	MS-A2 Linear Relationships MS-A4 Types of Relationships	MS2-12-6	3–4
3	1	MS-S5 The Normal Distribution	MS2-12-7	3–4
4*	1	MS-F4 Investments and Loans	MS2-12-5	3–4
5	1	MS-M1 Applications of Measurement	MS2-12-3	4–5
6	1	MS-N3 Critical Path Analysis	MS2-12-8	5–6

Section II

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
16	3	MS-M7 Rates and Ratio	MS2-12-4	2–5
17	3	MS-N3 Critical Path Analysis	MS2-12-8, MS2-12-10	3–6
18 (a)*	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4	2–4
18 (b)*	2	MS-M7 Rates and Ratios	MS2-12-3	2–4
18 (c)*	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4	3–5
18 (d)	3	MS-M6 Non-right-angled Trigonometry	MS2-12-4, MS2-12-10	4–6
19	5	MS-N3 Critical Path Analysis	MS2-12-8	2–6

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