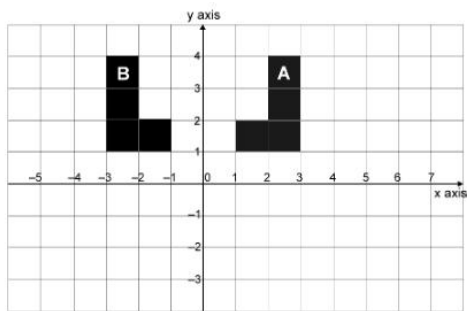




Question 1 (6 marks)



Question 1a (1 mark)



Write down the equation of the line that reflects shape A on to shape B.

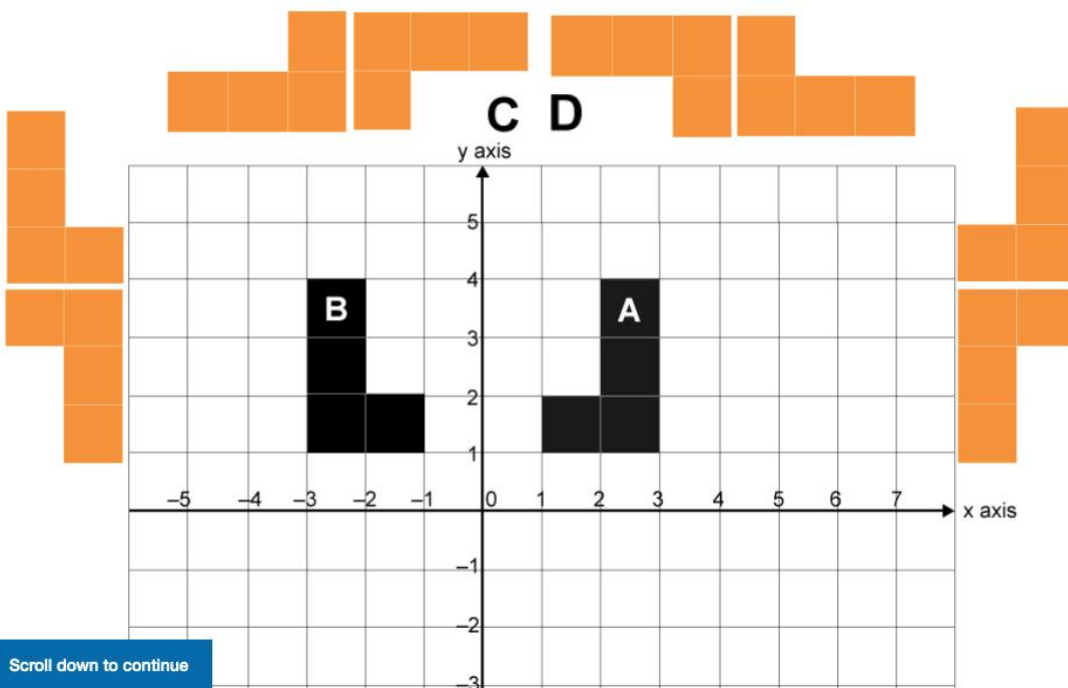
Rich text editor interface with a toolbar containing icons for bold (B), italic (I), underline (U), subscript (x₂), superscript (x²), bulleted list, numbered list, link (Ω), and insert (Σ). Below the toolbar is a text input area.



Question 1b (3 marks)

Translate shape B by vector $\begin{pmatrix} 8 \\ 2 \end{pmatrix}$, draw and label the new shape C; next reflect shape C in the line $y = 1$ and label the new shape D.

Ensure both shape C and shape D are on your final grid.



Scroll down to continue



Question 1c (2 marks)

Describe fully the rotation that maps shape D to shape A.

B *I* ← → U x_2 x^2 $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{8}$ $\frac{7}{8}$ Ω Σ Styles \downarrow



Question 2 (8 marks)



A manufacturer makes shoes to sell internationally. The manufacturer is contracted to make shoes for Egypt and Brazil.

Image Formulas





Question 2 (8 marks)



A manufacturer makes shoes to sell internationally. The manufacturer is contracted to make shoes for Egypt and Brazil.

Image

Formulas

Interquartile range

$$\text{IQR} = Q_3 - Q_1$$

Independent events

$$P(A \cap B) = P(A)P(B)$$

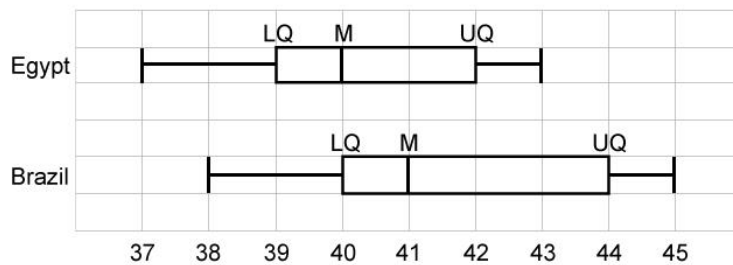
Complementary events

$$P(A) + P(A') = 1$$

Combined events

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

The box plots show the sizes of shoes sold in Egypt and Brazil. The distributions shown in the box plots are based on the medians and quartiles of the shoe sizes sold.



LQ Lower quartile
 UQ Upper quartile
 M Median



Question 2a (2 marks)

Compare the sizes of shoes sold in the two countries.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text color, Background color, Bulleted list, Numbered list, Link, and Unlink. Below the toolbar is a 'Styles' dropdown menu and a 'Copy' icon.



Question 2b (2 marks)

Determine the range of shoe sizes required for manufacture.

Range



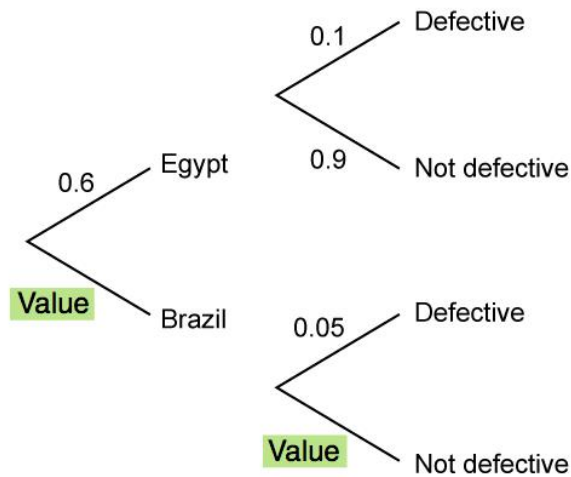
The manufacturer makes shoes in two factories; one in Egypt and one in Brazil. The factory in Egypt makes 60 % of the shoes and 10 % are defective. The factory in Brazil makes the rest of the shoes and 5 % are defective.

This information is illustrated in the tree diagram.



Question 2c (1 mark)

Write down the two missing values in the tree diagram.



Scroll down to continue



Question 2d (3 marks)

Find the probability that a shoe, chosen at random from either factory, is defective.

B *I* ← → U x_2 x^a \int \sum Ω Σ Styles



Question 3 (8 marks)

Question 3a (3 marks)

Given that a straight line L_1 has the equation $\frac{2y - 1}{2} = x$, **show** y as the subject, by rearranging the equation for L_1 .

B *I* ← → U x_2 x^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ

Styles ▾



Question 3b (5 marks)

Another straight line L_2 has the equation $y = \frac{x + 5}{2}$.
Find the coordinates of point of intersection between L_1 and L_2 .

B *I* ← → U x_2 x^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ

Styles ▾



Not Started **Question 4** (10 marks)

The diagram shows a circle with diameter 10 cm. Inside the circle is a square, the vertices of the square touch the circumference of the circle.

Click the next button to insert a square.

Simulator **Formulas**

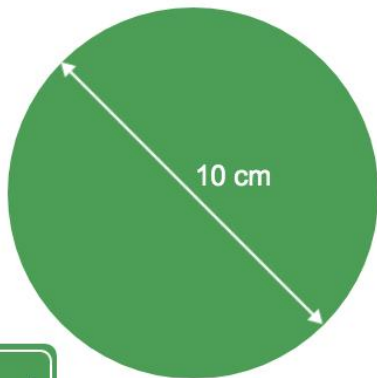


Diagram not to scale

Question 4a (1 mark)

Show that the total area enclosed by the circle is 25π .

B *I* ← → U x_2 x^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ

Styles ▾



Question 4b (3 marks)

Find the length of one side of the square and write your answer as an exact value.



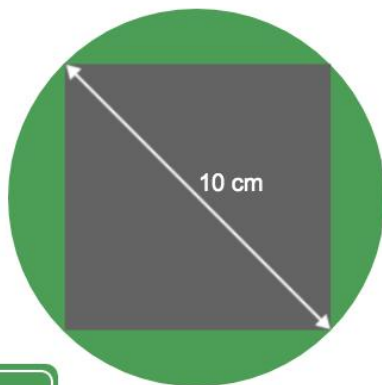
Question 4c (3 marks)

Calculate the total area of the green shaded segments that do not include the square. Write your answer to one decimal place.



Question 4d (3 marks)

Click the next button to insert the outer circle.



Next

Diagram not to scale

Find the circumference of the outer circle.

Rich text editor toolbar with buttons for Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x₂), Superscript (x²), Bulleted List, Numbered List, Omega (Ω), and Sigma (Σ). Below the toolbar is a text input area with a "Styles" dropdown and a "Copy" icon.



Question 5a (2 marks)

Find the maximum height achieved by the ball.



Question 5 (10 marks)



A ball is kicked from $(0,0)$ towards the posts and describes the path of a parabola as shown in Tab 2.

Tab 1 Tab 2 Formulas



A ball is kicked at the posts shown, the ball describes the path of a parabola.

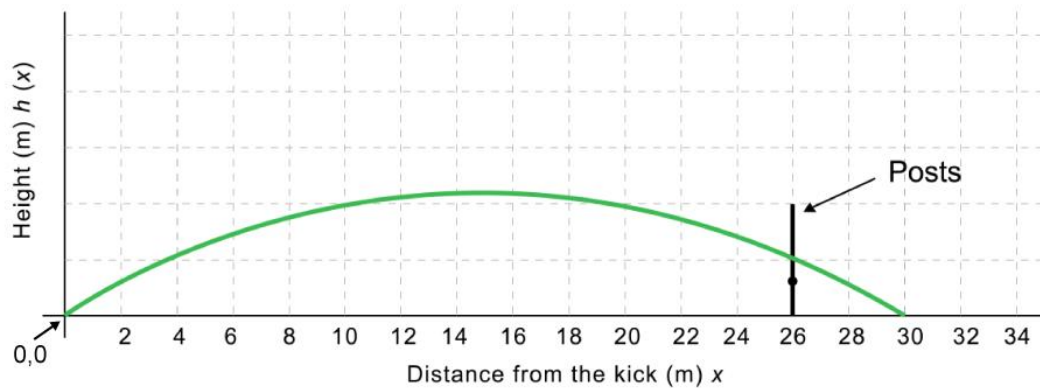


Question 5 (10 marks)



A ball is kicked from $(0,0)$ towards the posts and describes the path of a parabola as shown in Tab 2.

Tab 1 Tab 2 Formulas



**Question 5** (10 marks)

A ball is kicked from (0,0) towards the posts and describes the path of a parabola as shown in Tab 2.

Tab 1

Tab 2

Formulas

**Axis of symmetry of graph
of a quadratic function**

$$f(x) = ax^2 + bx + c \Rightarrow \text{axis of symmetry } x = -\frac{b}{2a}$$

Solutions of a quadratic equation

$$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \quad a \neq 0$$

Discriminant

$$\Delta = b^2 - 4ac$$

The height in metres (m) of the ball above the ground is given by the function $h(x) = \frac{x(30-x)}{25}$.

To score points the ball is kicked from the point (0,0) and must go over a bar on the posts that is

3 m above the ground and 26 m away from the point the ball was kicked. This is illustrated in the diagram in Tab 2 above.

Remember the function for the height of the ball is $h(x) = \frac{x(30-x)}{25}$.

**Question 5b** (3 marks)

Using the equation, **show that** the team scored points.

Later in the game another kick is taken from the point $(x,0)$ towards the posts.

This time the height of the ball above ground is represented by the function

$$g(x) = \frac{-x^2 + 30x - 125}{25}.$$

Note that the posts cannot be moved.



Question 5c (3 marks)

Solve $g(x) = 0$.



Question 5d (2 marks)

Did the team score points? **Explain** your answer.



Question 6 (21 marks)



Music is a widely accepted form of artistic expression and creativity. In this question you will be presented with the instrument design of a piano.

Video [Hearing range](#)

Note	Frequency (Hz)	
A	440	
B	493	
C	523	
D	587	
E	659	
F	698	
G	783	
A	880	

We measure the frequency
of the note in hertz.



Not Started
Question 6 (21 marks)



Music is a widely accepted form of artistic expression and creativity. In this question you will be presented with the instrument design of a piano.

Video

Hearing range



Humans can only hear
between 20 and 20 000 Hertz.

Here is a table with some information on the first four octaves and frequencies of the note A on the piano.

Octave (n)	0	1	2	3
Note (A)	A_0	A_1	A_2	A_3
Frequency (F) Hertz (Hz)	27.5	55	110	220



Question 6a (1 mark)

Write down what happens to the frequency F as the octaves increase.



Question 6b (1 mark)

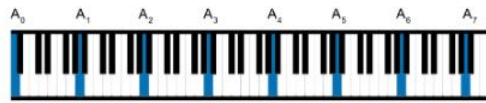
Write down the frequencies for A_4 and A_5 .

A_4

A_5



Question 6c (2 marks)



Deduce that all the A notes on the piano are within human hearing.

B *I* ← → U ×₂ ×² ∑ ∏ Ω Σ

Styles -



Question 6d (3 marks)

The frequency F_3 can be written as $F_0 \times 2^k$. **Calculate** the value of k , where k is an integer.



Question 6e (2 marks)

Find a formula for F in terms of n .



Question 6f (2 marks)

A note has frequency 28 160 Hz. Is it an A note? **Justify** your answer.



Question 6g (10 marks)



Piano **Keys** Hearing range Arm span



Grotrian-Steinweg Friedrich
Width A: 148 cm
Depth B: 52 cm
Height C: 111 cm

A new design for a piano will contain all of the A notes within human hearing.

Use the information provided in the tabs on the left to **discuss** the practicality of the new design for the piano. In your discussion you should:

- identify the relevant information for the new design
- calculate relevant measurements for the new design
- justify your degree of accuracy
- justify the practicality of the new design.

Question 7 (18 marks)

Ancient civilizations built pyramids to express cultural identity. In this question you will make calculations for a model of Chichén Iztá pyramid.

Video Formulas



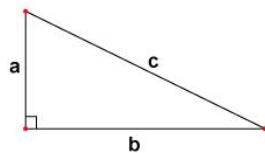
Question 7 (18 marks)

Ancient civilizations built pyramids to express cultural identity. In this question you will make calculations for a model of Chichén Iztá pyramid.

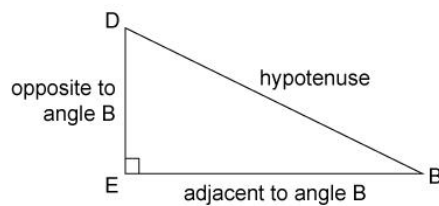
Video Formulas

Pythagoras' Theorem

$$c^2 = a^2 + b^2$$



Trigonometric ratios

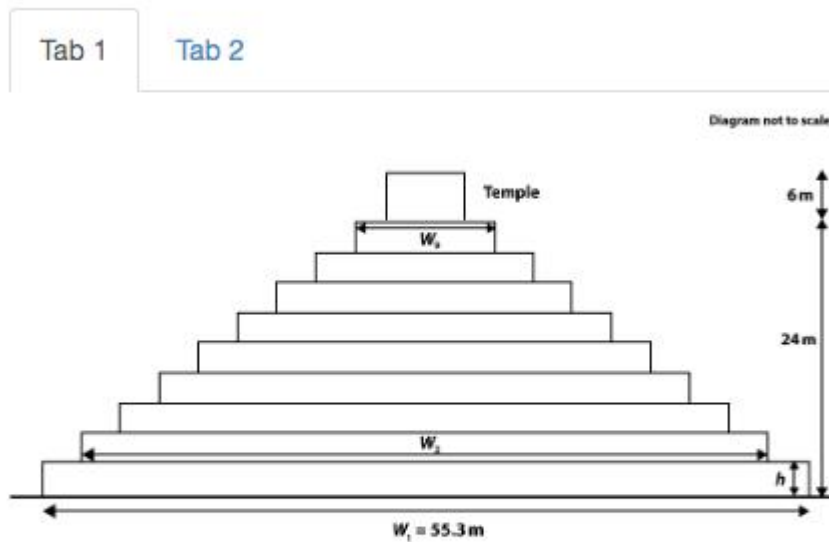


$$\sin B = \frac{\text{opposite to angle } B}{\text{hypotenuse}}$$
$$\cos B = \frac{\text{adjacent to angle } B}{\text{hypotenuse}}$$
$$\tan B = \frac{\text{opposite to angle } B}{\text{adjacent to angle } B}$$

Chichén Iztá pyramid is composed of nine platforms. The width of the first platform is 55.3 m and on the ninth platform there is a temple that is 6 m high.

All lengths provided are given to the nearest centimetre (cm) and angles are to the nearest whole degree.

You are planning to construct a scale model of the Chichén Iztá Pyramid and will use 1:100 as scale for your model. In this question you will work out values of lengths. The validity of the accuracy of your model will be required in part (e).



a platform



Tab 1

Tab 2

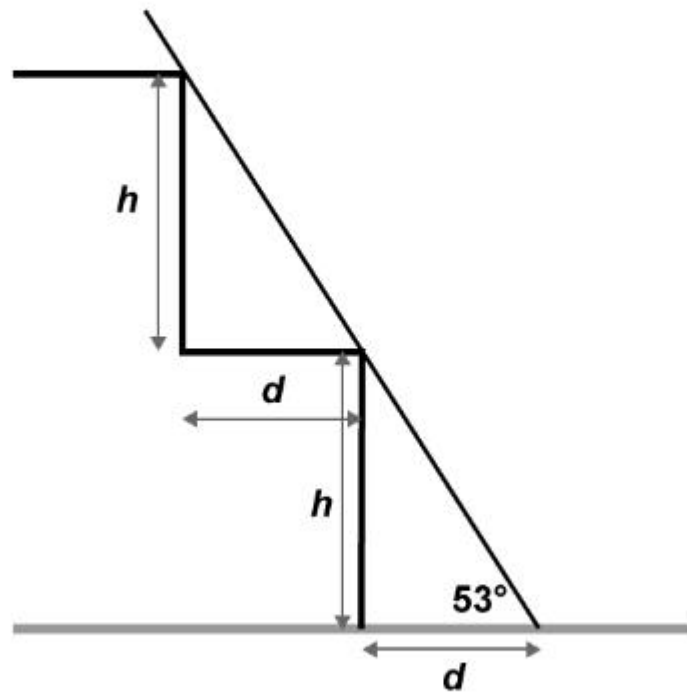


Diagram not to scale



Question 7a (2 marks)

Using the diagram in Tab 1,
determine the total height of your model pyramid including the nine platforms and the temple. Write your answer in cm.

Total height = cm

**Question 7b** (3 marks)

Using the diagram in Tab 1, **find** the height h of each platform in your model. Write your answer in cm correct to one decimal place.

Model height $h =$ cm

**Question 7c** (4 marks)

The average inclination of the slant is 53° to the nearest degree.

Using the diagram in Tab 2, **find** the depth d of each pyramid step. Write your answer in cm correct to the nearest whole number.

Model $d =$ cm

**Question 7d** (3 marks)

Using the diagram in Tab 1, **find** the width W_9 in cm of the top platform in your model.

Model width $W_9 =$ cm



Question 7e (6 marks)

Discuss the validity of your model for Chichén Iztá pyramid. In your discussion you should:

- identify relevant information required to discuss the validity
- consider the implications of the chosen degree of accuracy
- comment on the validity of the model to Chichén Iztá.



Question 8 (20 marks)

A recursive sequence is one where the next term is a specific combination of the previous terms.

In this question the recursive sequence is created where the next term is the mean of the previous two terms. This is called a mean sequence.

Note: This video contains **no** audio

The mean sequence terms approach the value 7

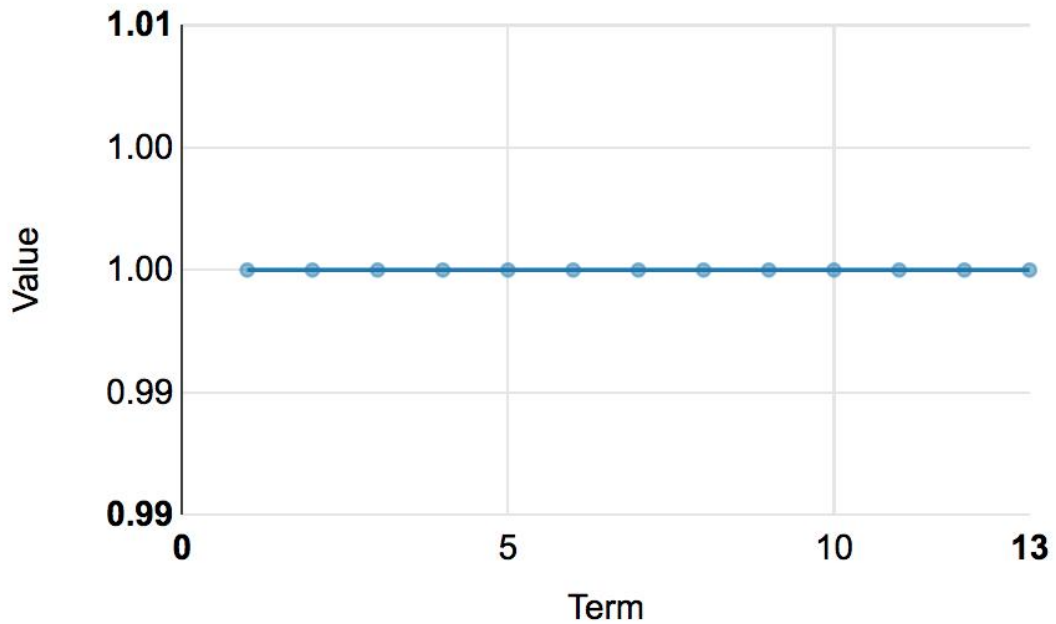
The mean sequence has a limit L , of 7



9, 6, 7.5, 6.75, 7.125, 6.938, 7.031, 6.984, 7.008, 6.996, ...

You can use the simulator to find the limit of a mean sequence. Input the first two terms of the sequence into the simulator and click 'Calculate mean sequence'.

Term 1	<input type="text"/>	Term 2	<input type="text"/>
Calculate mean sequence			



Question 8a (2 marks)

Here is a mean sequence with starting terms 6 and 9.

6, 9, 7.5, 8.25, ...

Show that the next term in the sequence is 7.875 and **write down** the limit of the sequence.

All mean sequences have limits and there is a connection between the first two terms a and b and the limit L of each sequence.

Question 8b (2 marks)

The table below shows the first two terms and the limit L , for some mean sequences. The different starting terms a are provided and b is fixed at 3.

Write down in the table the limit values L , for row 2, 3 and 4 for the mean sequences provided. Use the simulator to help you.

Row	First term (a)	Second term (b)	Limit (L)
1	6	3	4
2	9	3	
3	12	3	
4	15	3	

Question 8c (2 marks)

Describe in words **two** patterns you have found from the table.

Rich text editor toolbar with options: Bold (B), Italic (I), Undo, Redo, Underline (U), Subscript (x_2), Superscript (x^2), Bulleted list, Numbered list, Link, Unlink, Styles dropdown, and a mobile device icon.

Question 8d (2 marks)

Find a general rule connecting a and L .

Question 8e (12 marks)

Using your previous results, **investigate** and **find** a general rule connecting a , b and L . The simulator and a blank table are provided below to support your investigation. In your answer you should:

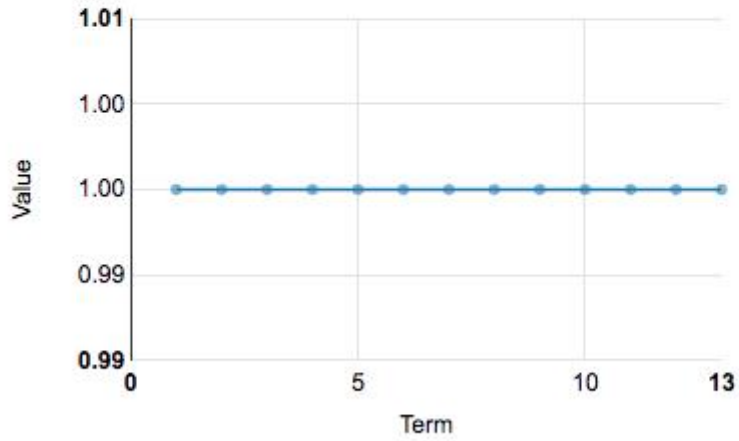
- describe patterns
- find a general rule
- test your general rule
- use correct mathematical notation
- prove or verify and justify your general rule.

↔

Term 1

Term 2

Calculate mean sequence



First term (a)	Second term (b)	Limit (L)

🔍 Question 9 (19 marks)
✕

We can also use an algebraic approach to investigate mean sequences.

If a and b are the first two terms, the mean sequence will start with the terms below.

$a, b, \frac{1}{2}a + \frac{1}{2}b, \dots$

🔍 Question 9a (1 mark)

Explain why the third term is $\frac{1}{2}a + \frac{1}{2}b$.



Question 9b (4 marks)

Predict the seventh and eighth terms from the table and write your answers in the relevant response box.

Term (T)	Sequence
1	a
2	b
3	$\frac{1}{2}a + \frac{1}{2}b$
4	$\frac{1}{4}a + \frac{3}{4}b$
5	$\frac{3}{8}a + \frac{5}{8}b$
6	$\frac{5}{16}a + \frac{11}{16}b$
7	$\frac{\square}{\square}a + \frac{\square}{\square}b$
8	$\frac{\square}{\square}a + \frac{\square}{\square}b$

Term 7:

Rich text editor interface for Term 7. The toolbar includes: Bold (B), Italic (I), Undo (←), Redo (→), Underline (U), Subscript (x₂), Superscript (x²), Bulleted list (≡), Numbered list (≡), Insert link (Ω), and Insert table (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'Paste' icon. The main text area is currently empty.

Term 8:

Rich text editor interface for Term 8. The toolbar includes: Bold (B), Italic (I), Undo (←), Redo (→), Underline (U), Subscript (x₂), Superscript (x²), Bulleted list (≡), Numbered list (≡), Insert link (Ω), and Insert table (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'Paste' icon. The main text area is currently empty.