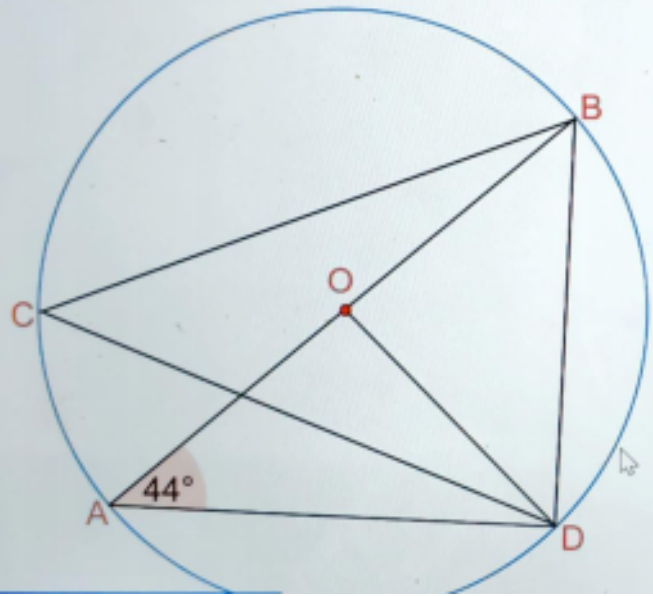
Question 1a (3 marks)

The following circle has centre O. The points A, B, C and D lie on the circumference such that O lies on AB.

Diagram not to scale

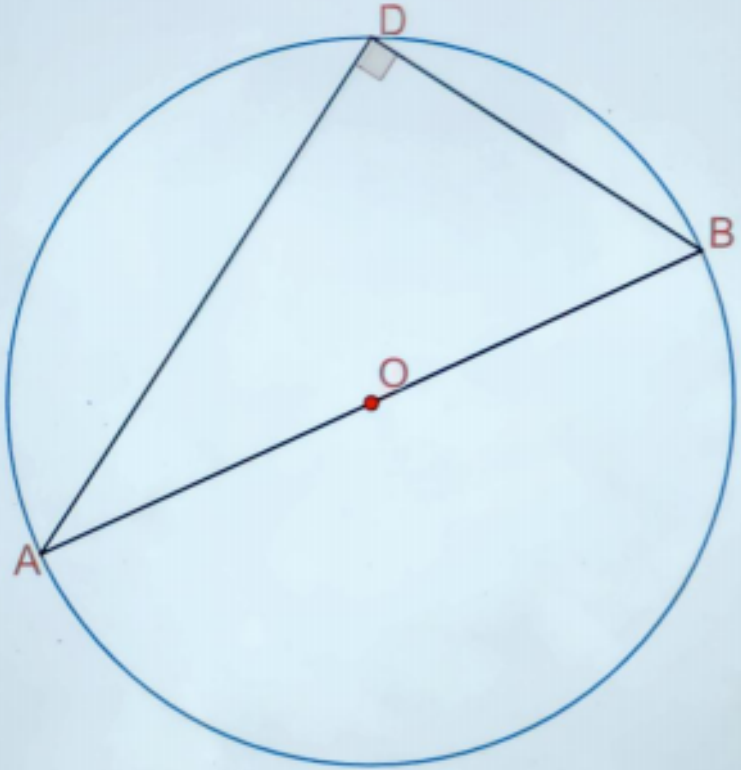


Given that angle DAB is 44°, **determine** the size of the following angles.

Angle AOD ☐ °

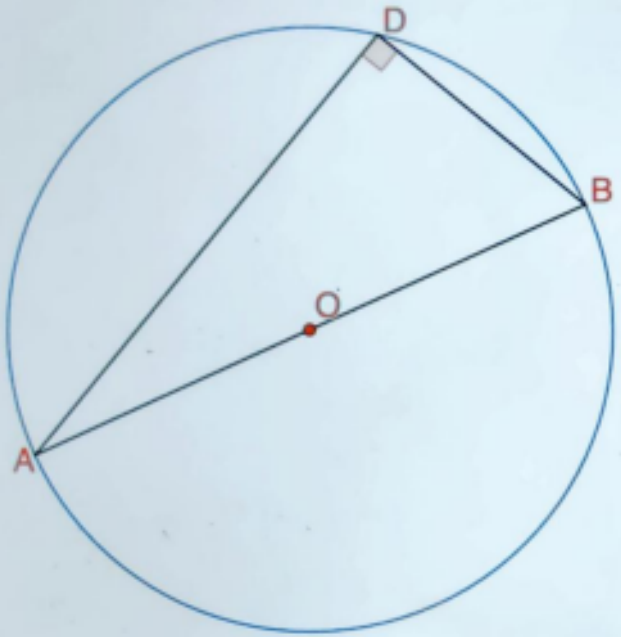
Angle DOB ☐ °

Angle DCB ☐ °



Using your knowledge of circle theorems, **write down** why angle ADB is 90°.

Diagram not to scale



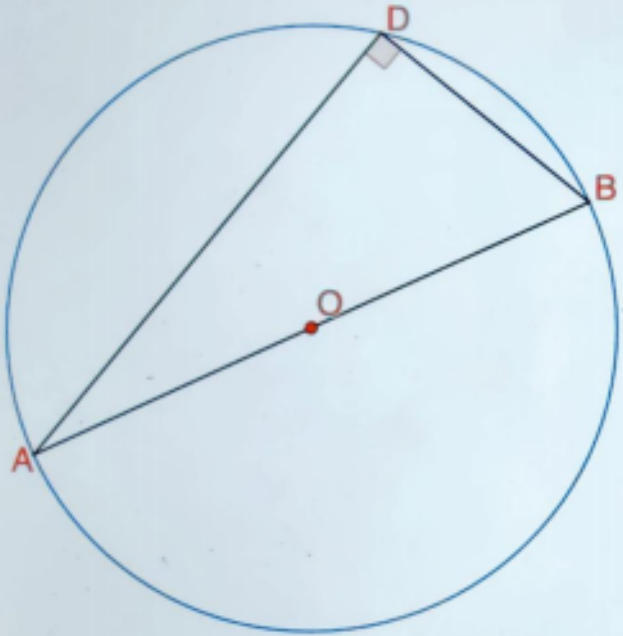
Question 1c (2 marks)

Given that, AD = 12 cm and BD = 6 cm, **find** the length of AB. Give your answer in simplified surd form $a\sqrt{b}$ where a and b are integers.

B I U x_2 x^2 Ω Σ

Styles

Diagram not to scale



Question 1d (2 marks)

Hence, **determine** the area of the circle.
Give you answer in terms of π.

B I U x_2 x^2 Ω Σ

Styles

Question 2 (5 marks)

MYP Academy is presenting a talent show for their community.

Some students from the Academy and some members of the community are performing in the show.

A total of 175 people will be at the show.

In the following Venn diagram:

Set A represents the number of Academy students at the show.

Set B represents the number of performers in the show.

Question 2a (1 mark)

One person at the show is selected at random. Given that they are a performer, **write down** the probability they are an Academy student.

B I U x_a x^a Ω Σ

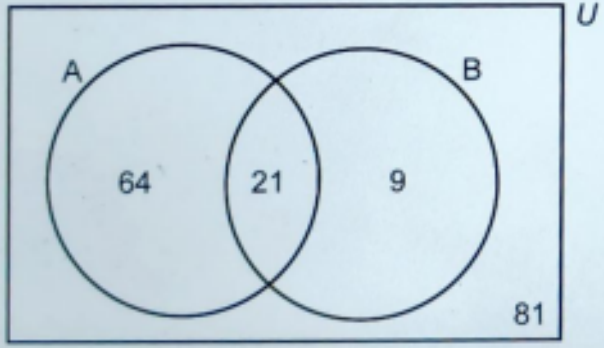
Styles

A total of 175 people will be at the show.

In the following Venn diagram:

Set A represents the number of Academy students at the show.

Set B represents the number of performers in the show.



Question 2a (1 mark)

One person at the show is selected at random. Given that they are a performer, **write down** the probability they are an Academy student.

B I U x_2 x^2 Ω Σ

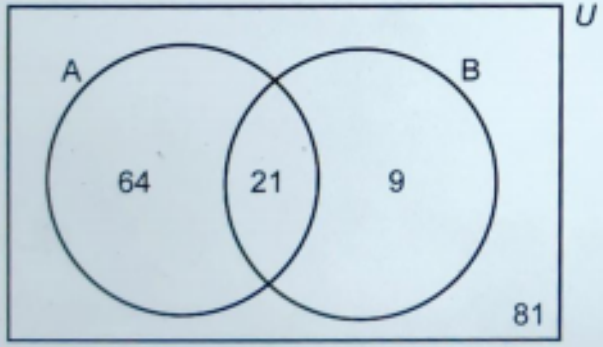
Styles

A total of 175 people will be at the show.

In the following Venn diagram:

Set A represents the number of Academy students at the show.

Set B represents the number of performers in the show.



Question 2b (2 marks)

Two of the performers will be selected at random to introduce the show.
Determine the probability that they are both Academy students.

B I U x_2 x^2 Ω Σ

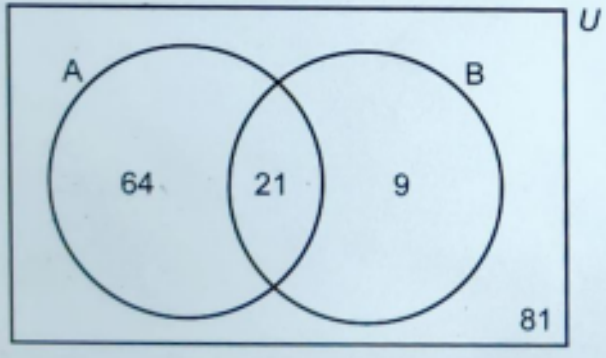
Styles

A total of 175 people will be at the show.

In the following Venn diagram:

Set A represents the number of Academy students at the show.

Set B represents the number of performers in the show.



Question 2c (2 marks)

Show that A and B are not independent.

B I U x_2 x^2 Ω Σ

Styles

Question 3 (5 marks)

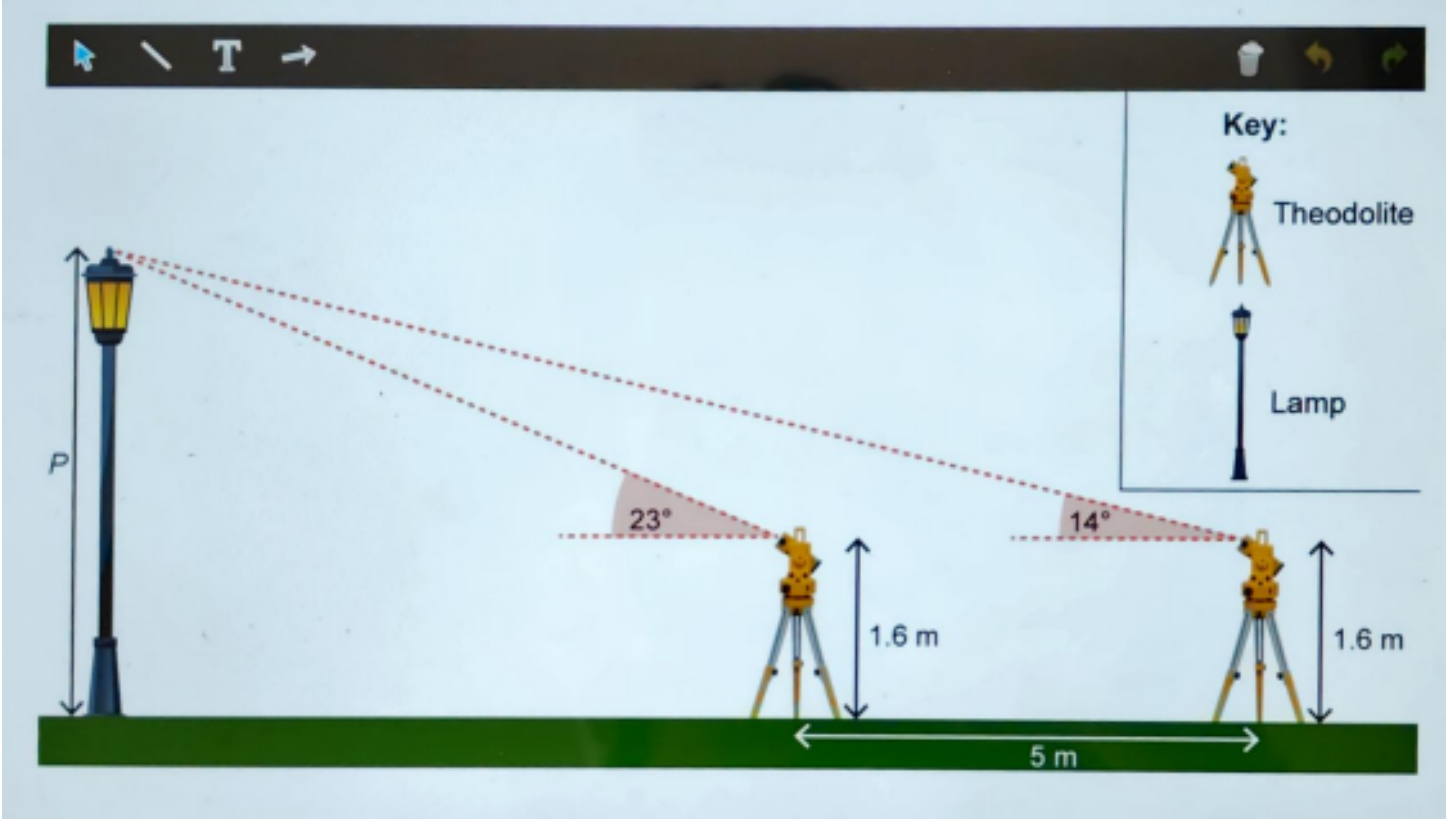
The height of a lamp is calculated using a measuring instrument called a theodolite. The theodolite measures angles. The theodolite has a height of 1.6 metres.

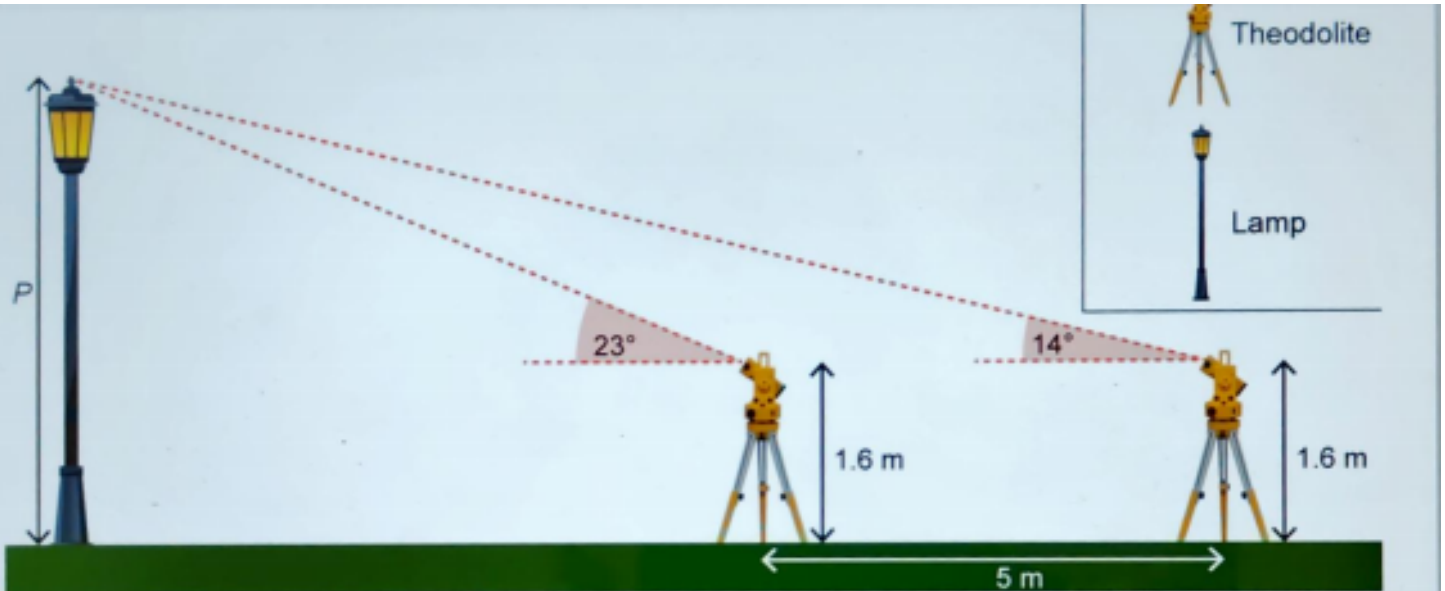
The theodolite measures the angle of elevation of the top of the lamp at 14° to the nearest degree.

The theodolite is moved 5 metres towards the lamp and measures the angle of elevation of the top of the lamp at 23° to the nearest degree.

The measurements are shown on the following diagram.

Diagram not to scale


Key:
Theodolite
Lamp
P
23°
14°
1.6 m
1.6 m
5 m



Calculate the height of the lamp *P*.

Question 4 (7 marks)

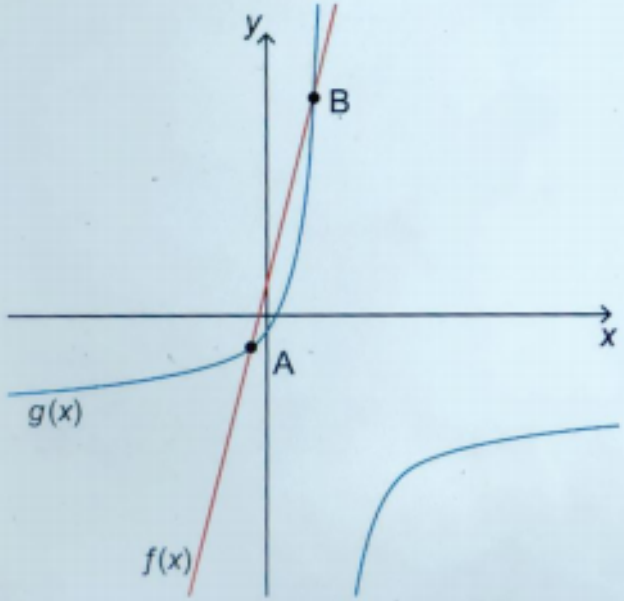
Question 4a (4 marks)

Given that $f(x) = 4x + 1$ and $g(x) = \dfrac{1 - 3x}{x - 2}$

Solve $f(x) = g(x)$

Question 4b (3 marks)

The solutions of the equation $f(x) = g(x)$ are the x coordinates of the points A and B shown on the following graph.



Using your answers from (a), find the values of the y coordinates of points A and B.

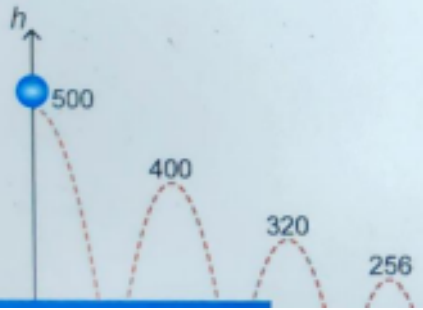
B I U x_2 x^2 Ω Σ

Styles

Question 5 (10 marks)

A ball is dropped from a height of 500 cm and bounces on the ground. In between each bounce, the ball follows a parabolic path. The height (h) that the ball reaches decreases after each bounce. The heights are indicated on the diagram in centimetres (cm).

This media is interactive



Question 5a (1 mark)

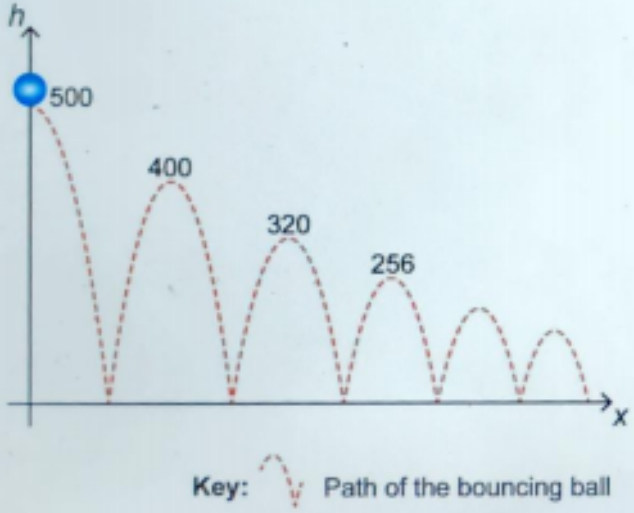
The heights form a sequence with first term 500. **Show that** the sequence is geometric with common ratio (r) where $r = 0.8$.

B I U x_2 x^2 Ω Σ

Styles

cm and bounces on the ground. In between each bounce, the ball follows a parabolic path. The height (h) that the ball reaches decreases after each bounce. The heights are indicated on the diagram in centimetres (cm).

This media is interactive



geometric with common ratio (r) where $r = 0.8$.

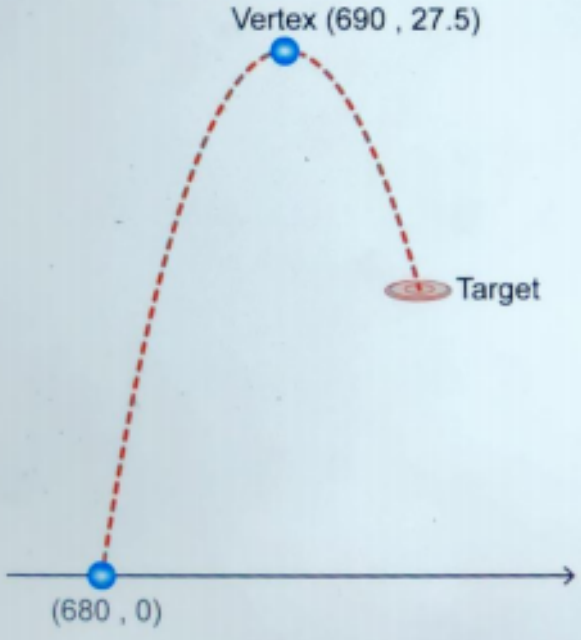
B I U x_2 x^2 Ω Σ Styles

Question 5b (2 marks)

Determine the value of the **tenth** term.

B I U x_2 x^2 Ω Σ Styles

The ball keeps bouncing towards a target. The diagram below illustrates the final parabola.



Question 5c (3 marks)

Find the equation of the parabola in the form $h(x) = a(x - b)^2 + c$.

B I U x_2 x^2 Ω Σ

Styles

Question 5d (4 marks)

The ball hits the target at the

Question 5d (4 marks)

The ball hits the target at the coordinates (L, 17.6). Find the value of L.

Video Script

Around the time of the French revolution, in 1790, French scientists created the metric system to measure weights and distances.

For a few years, the French abandoned the Gregorian 24 hour measure of time and adopted a metric measure of time.

This metric time was called 'The French Revolutionary time' and began officially on the 24 of November 1793.

Humans have evolved to live within the routine of a day.

Metric time uses 10 hours for one day instead of 24 hours for one day. Each metric hour has 100 minutes and each metric minute has 100 seconds.

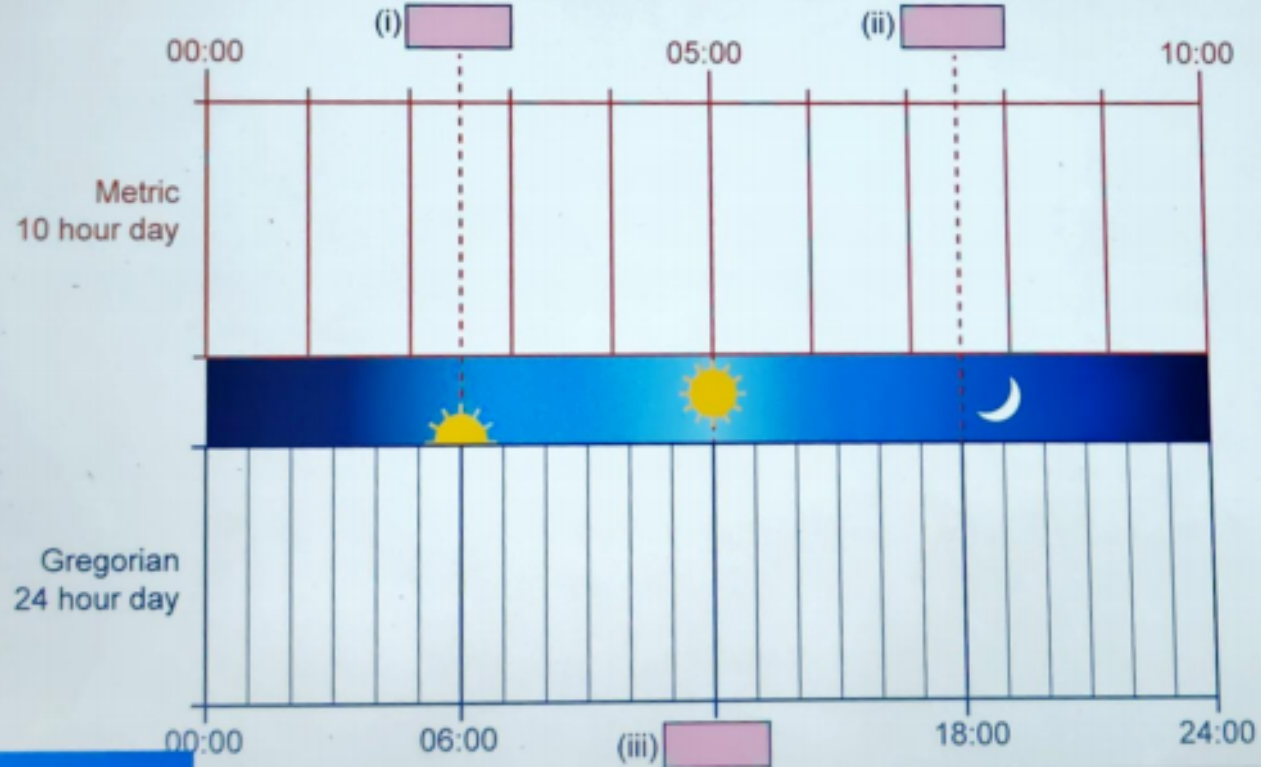
Despite its simplicity, the new system was not at all popular. Replacing all clocks was expensive and it became increasingly difficult to trade with other countries which did not adopt the metric time.

In this question you will make comparisons between Gregorian and metric time and observe how simple calculations are in terms of metric time.

Question 6a (2 marks)

The following diagram shows one day in two systems of time, metric and Gregorian.

Write down the missing times on the diagram.



Question 6b (2 marks)

Determine the number of Gregorian hours and minutes in one metric hour.

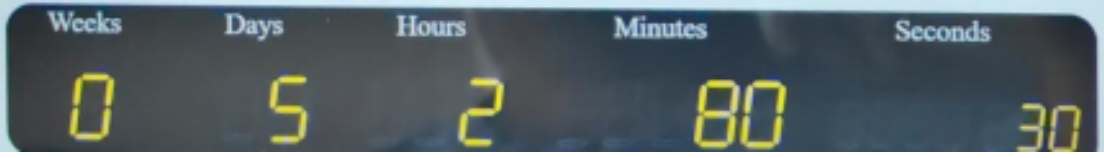
Metric system	Gregorian system
1 hour(s) 0 minute(s)	____ hour(s) ____ minute(s)

Question 6c (4 marks)

Metric time conversions are shown in the following infographic.

This media is interactive

For example: 528 030 metric seconds is equivalent to:



For example: 528 030 metric seconds is equivalent to:

Write down the missing times in the following table.

School event	Metric time	Metric seconds in standard form
Examination	90 minutes	$\square \times \square^{\square}$
School day	2 hours and 40 minutes	$\square \times \square^{\square}$
Time to run 10 kilometres		5.3×10^{3}
Climbing mount Kilimanjaro	4 days, 2 hours and 5 minutes	$\square \times \square^{\square}$

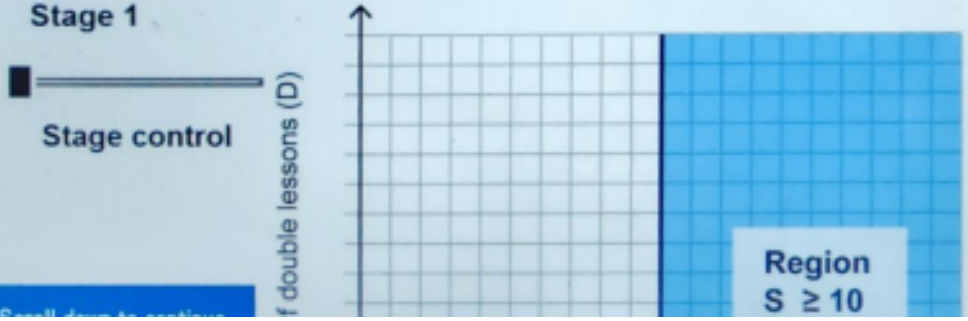
Question 6d (3 marks)

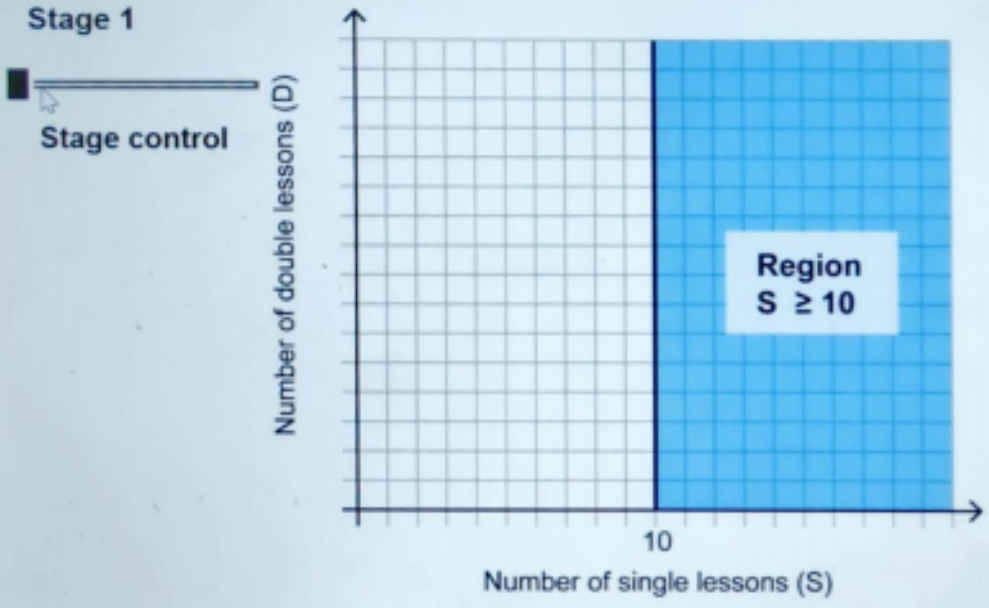
All the following questions are in the context of metric time.

The information below provides guidance for the allocation of mathematics lessons per month:

- S represents the number of single lessons
- D represents the number of double lessons
- At least one single lesson and at least one double
- Single lessons are 20 metric minutes
- Double lessons are 40 metric minutes

Interact with the slider to reveal four graphs.

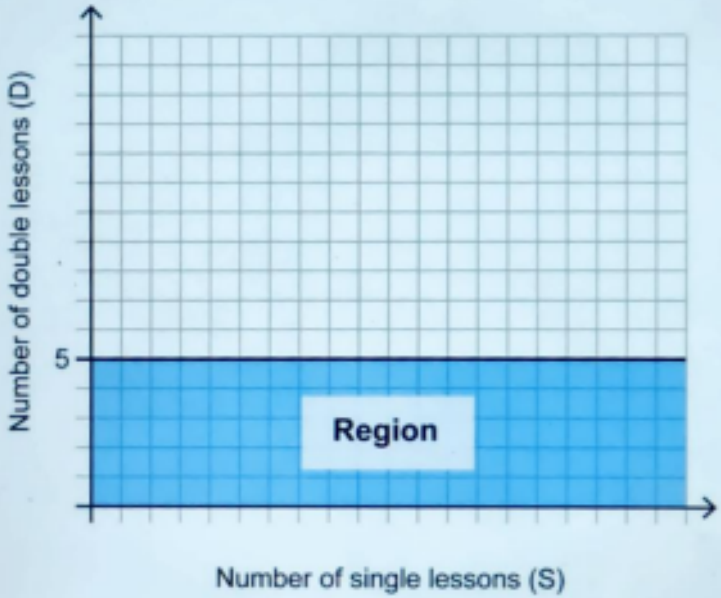




Determine the missing elements in the following table.

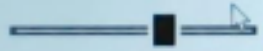
Stage 2

Stage control

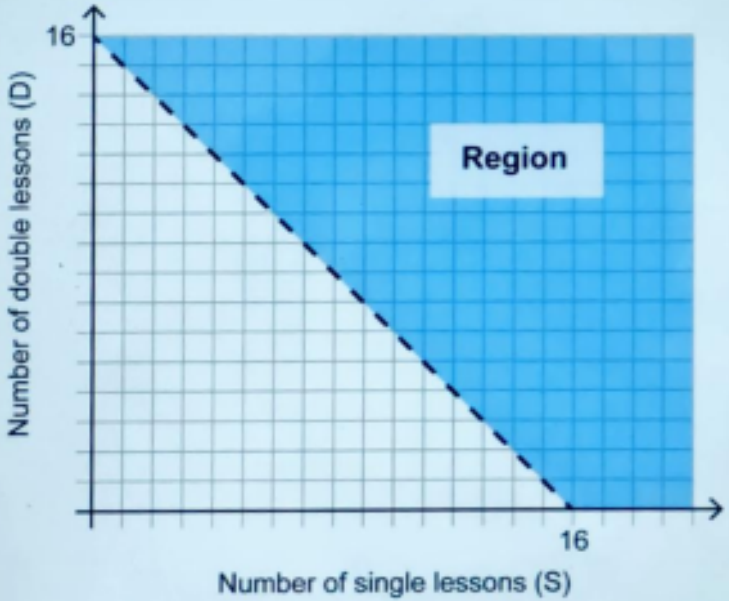


Determine the missing elements in the following table.

Stage 3



Stage control



Determine the missing elements in the following table.

Stage 4

Stage control

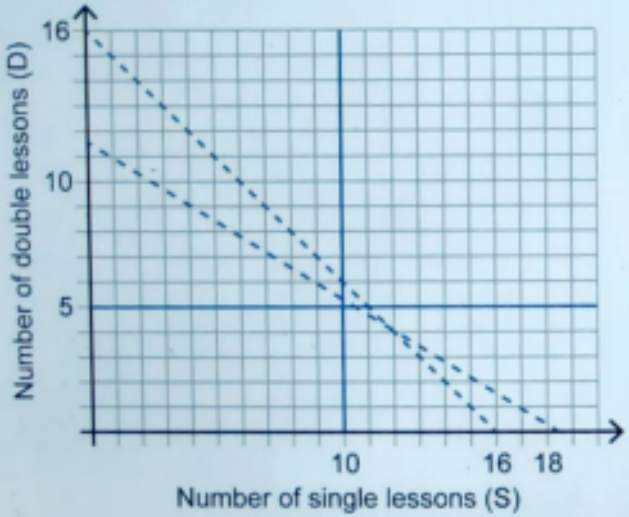
Determine the missing elements in the following table.

Determine the missing elements in the following table.

Draggable inequalities	Inequalities	Description of region in words
<	$S \geq 10$	The number of single lessons is
≥	D ☐ 5	The number of double lessons is
>	$S + D$ ☐ 16	The total number of single and double lessons is
≤	$5S + 8D$ ☐ 92	

Question 6e (3 marks)

The diagram below shows all constraints in one graph.



The mathematics department wants to allocate lessons within the constraints given above. Find the values of S and D that will give the maximum number of minutes.

B I U x_2 x^2 Ω Σ

Styles

The MYP 5 chemistry class is creating copper sulphate crystals from a solution.

It takes **one** metric day for the solution to form 2.987 grams of copper sulphate crystal.

Question 6f (1 mark)

Show that the rate of production is 2.987 milligrams per minute.

B I U x_2 x^2 Ω Σ

Styles

Question 6g (3 marks)

Calculate the maximum number of grams that can be produced from 04:00 on Day 1 to 04:90 on Day 2. Give your answer to the nearest gram.

B I U x_2 x^2 Ω Σ

Styles

Question 7 (17 marks)

The Tropics of Cancer and Capricorn are lines of latitude that are parallel to the equator of the Earth.

There are eleven countries on the Tropic of Capricorn and seventeen countries in the Tropic of Cancer.

In this question, you will analyse the data on the life expectancies of countries on the two Tropics.

Click on the tab titles to switch between the Tropics.


Countries that fall on Tropic of Cancer
Countries that fall on Tropic of Capricorn
Arctic Circle
Arctic Circle
Tropic of Cancer
Tropic of Cancer
Equator
Equator
Tropic of Capricorn
Tropic of Capricorn
Antarctic Circle
Antarctic Circle
Mexico
Bahamas
Western Sahara
Mauritania
Mali
Niger
Algeria
Libya
Egypt
Saudi Arabia
UAE
Oman
China
Bangladesh
India
Myanmar
Taiwan


Countries that fall on Tropic of Cancer
Countries that fall on Tropic of Capricorn
Arctic Circle
Arctic Circle
Tropic of Cancer
Tropic of Cancer
Equator
Equator
Brazil
Botswana
Mozambique
Paraguay
French Polynesia
Tropic of Capricorn
Tropic of Capricorn
Namibia
Madagascar
Australia
South Africa
Chile
Argentina
Antarctic Circle
Antarctic Circle

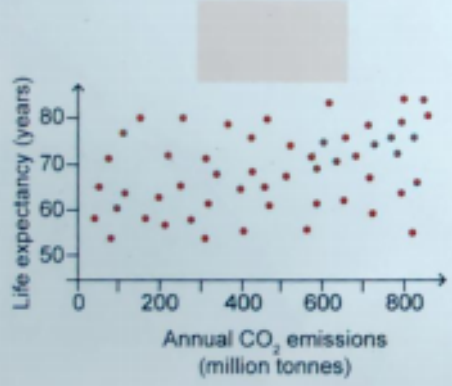
Question 7a (2 marks)

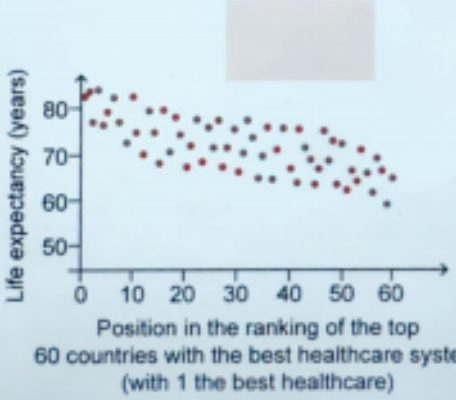
The relationship between life expectancy and other factors is represented on the following scatter graphs.

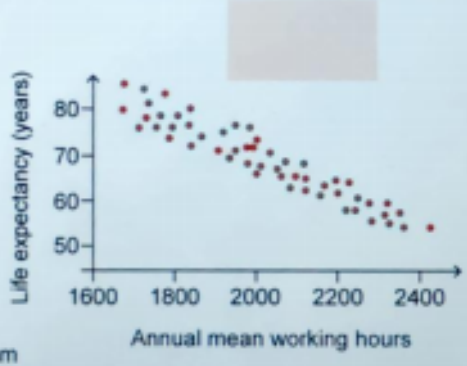
Identify the correlation for each of the scatter graphs.

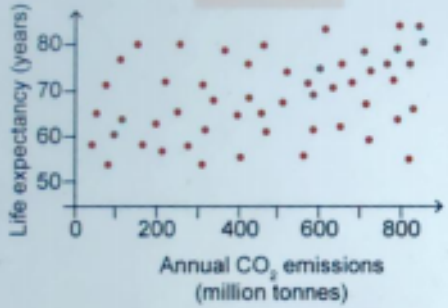
Draggable correlation description:

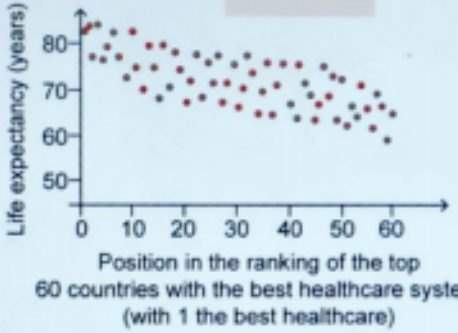
Strong negative	None	Strong positive	Positive	Negative

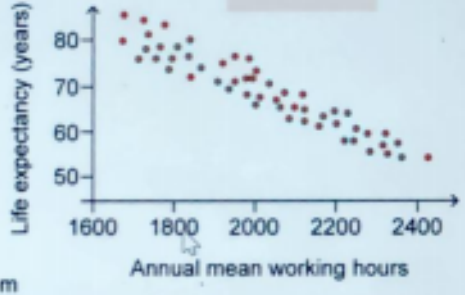


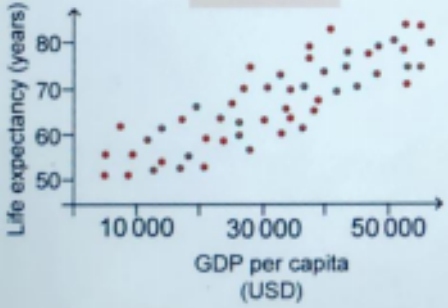


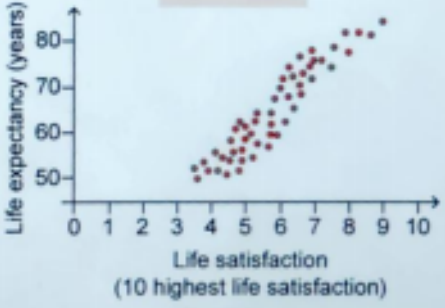



Life expectancy (years)
80
70
60
50
0
200
400
600
800
Annual CO_2 emissions
(million tonnes)


Life expectancy (years)
80
70
60
50
0
10
20
30
40
50
60
Position in the ranking of the top
60 countries with the best healthcare system
(with 1 the best healthcare)


Life expectancy (years)
80
70
60
50
1600
1800
2000
2200
2400
Annual mean working hours


Life expectancy (years)
80
70
60
50
10 000
30 000
50 000
GDP per capita
(USD)


Life expectancy (years)
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Life satisfaction
(10 highest life satisfaction)

There are **eleven** countries positioned on the **Tropic of Capricorn**. The life expectancies in 2021 for these (11) countries are as follows.

Life expectancy (Age in years)										
59	59	61	62	65	71	73	75	79	80	85

Question 7b (3 marks)

Write down the missing values in the box and whisker plot.

Box-and-whisker plot for life expectancy in 2021

Tropic of Capricorn

Question 7c (2 marks)

Hence, **determine** the following measures of dispersion.

Range:

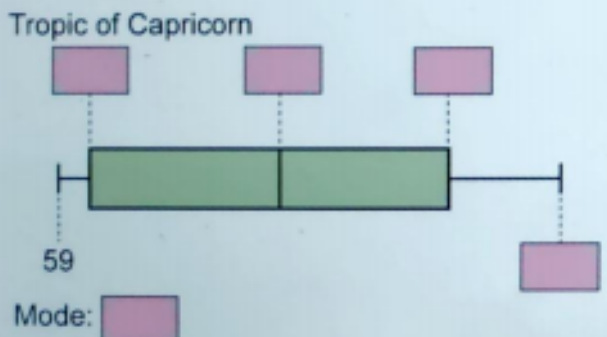
B I U x_2 x^2 Ω Σ

Styles

Question 7b (3 marks)

Write down the missing values in the box and whisker plot.

Box-and-whisker plot for life expectancy in 2021



Question 7c (2 marks)

Hence, **determine** the following measures of dispersion.

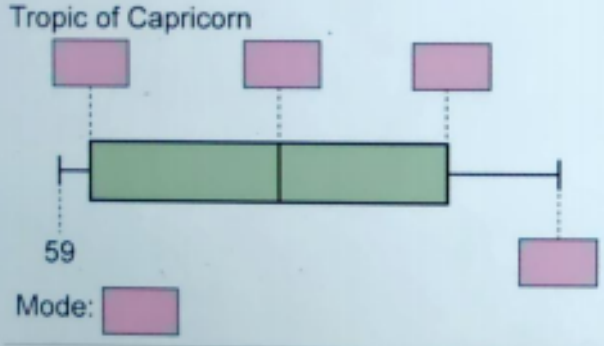
Range:

Interquartile range (IQR):

Question 7b (3 marks)

Write down the missing values in the box and whisker plot.

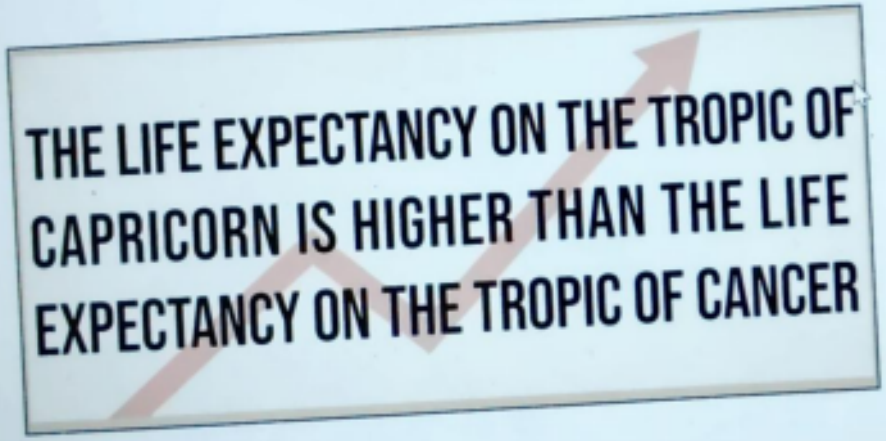
Box-and-whisker plot for life expectancy in 2021



Interquartile range (IQR):

Question 7d (10 marks)

News Headline:

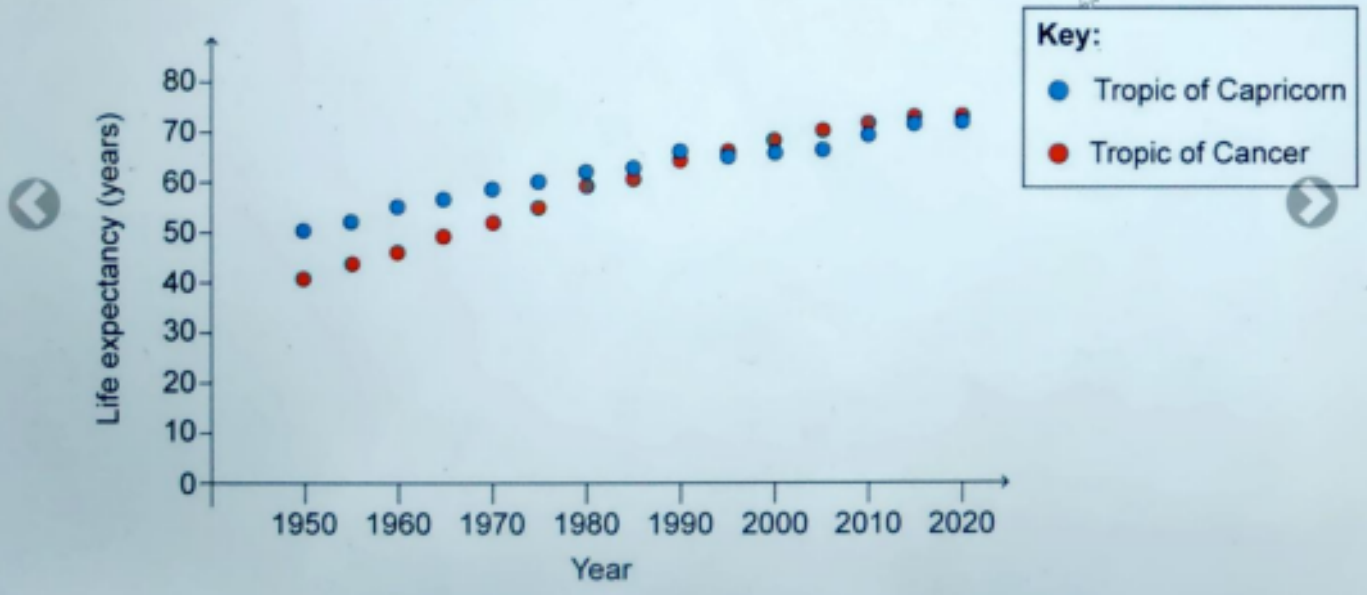


Scroll through the image gallery to see life expectancy data for the Tropic of Cancer and the Tropic of Capricorn.

Scroll through the image gallery to see life expectancy data for the Tropic of Cancer and the Tropic of Capricorn.

Image 1

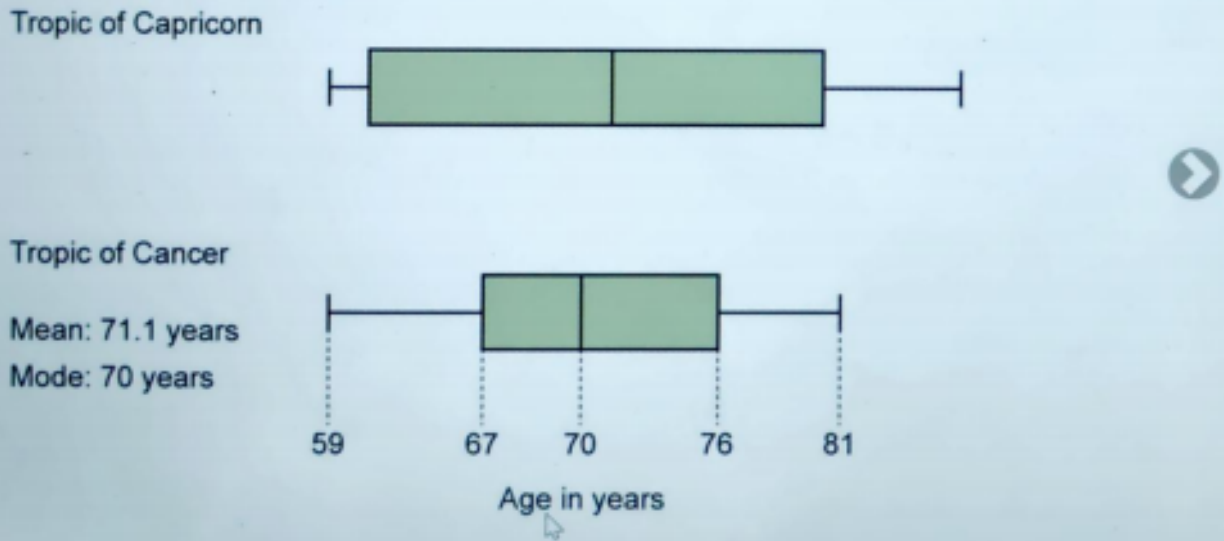
Life expectancy from 1950 to 2020 for Tropic of Capricon and Tropic of Cancer



Scroll through the image gallery to see life expectancy data for the Tropic of Cancer and the Tropic of Capricorn.

Image 2

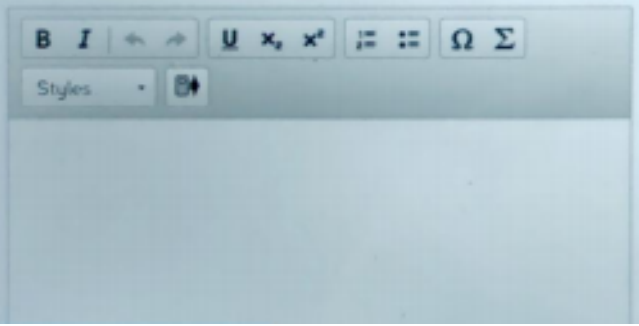
Box-and-whisker plot for life expectancy in 2021



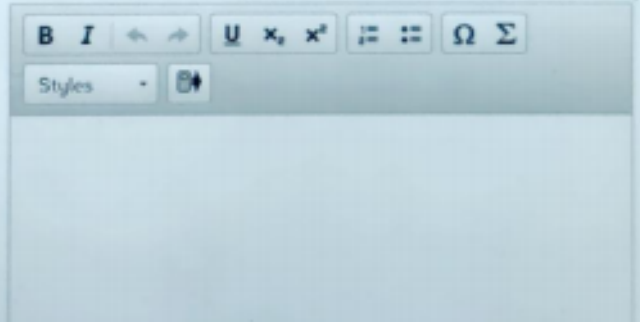
Analyse the data on life expectancy and comment on the headline. In your answer you should:

- identify the elements relevant to your comparison
- compare measures of central tendency, measures of dispersion, and any other relevant information
- comment on the headline
- justify the degree of accuracy of your results.

Elements relevant to your comparison.



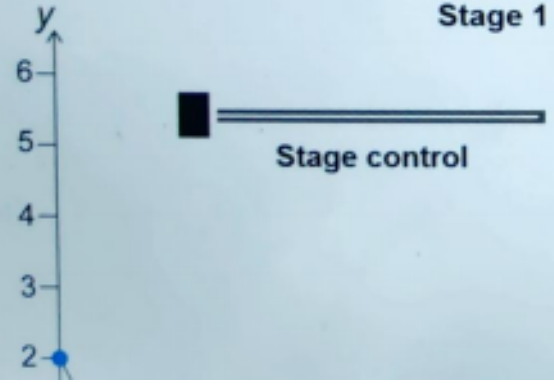
Comparison, comment and justification.



Question 8 (30 marks)

Diagonal lines are formed on coordinate plane to form right angle triangles.

Drag the stage slider to see how the triangles are formed.



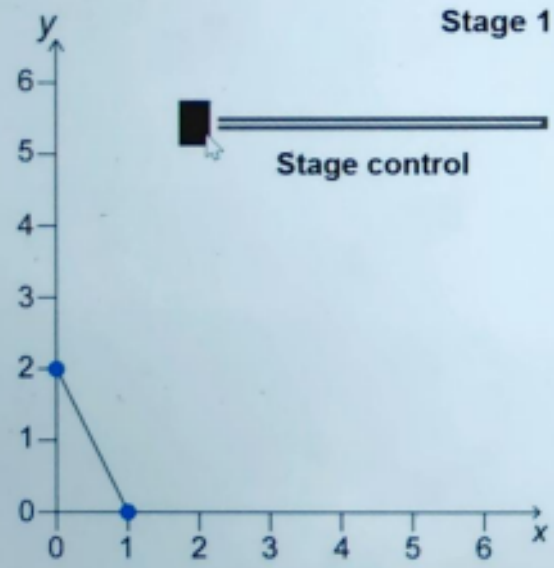
Question 8a (1 mark)

Show that gradient of the diagonal line in stage 4 is $\frac{-5}{4}$

B I U x_2 x^2 Ω Σ

Styles

Drag the stage slider to see how the triangles are formed.



Question 8a (1 mark)

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B I U Ω Σ

Styles

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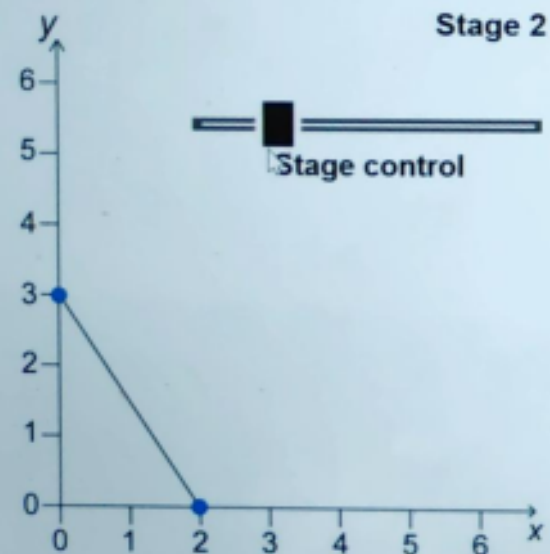

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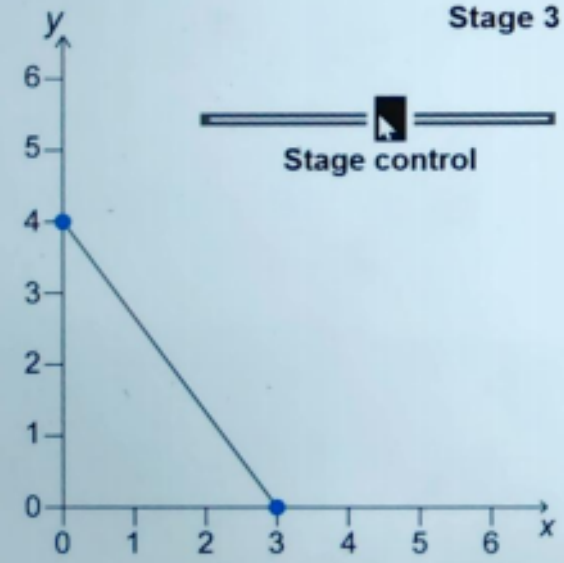

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Styles

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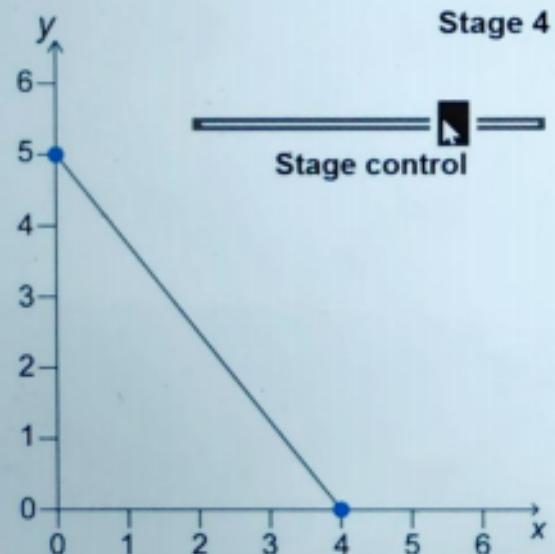

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Styles

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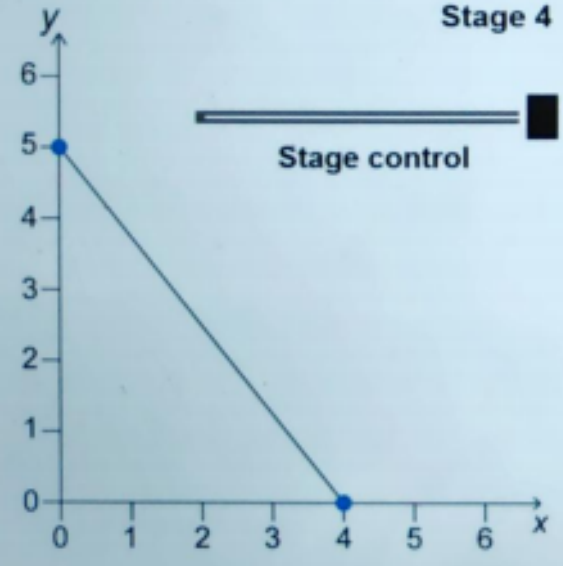


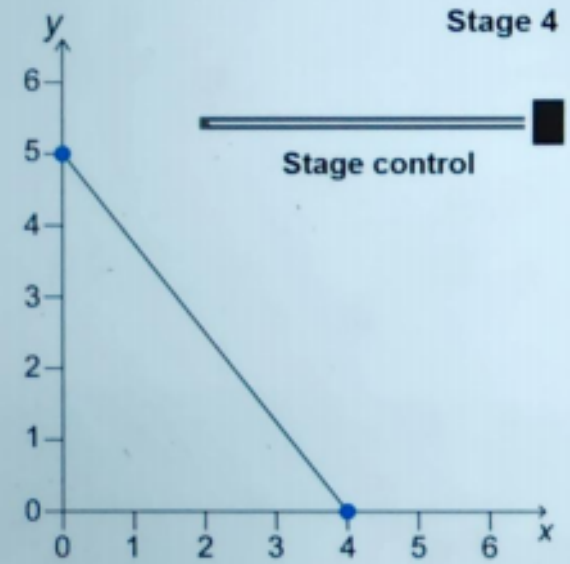
Question 8a (1 mark)

Show that gradient of the diagonal line in stage 4 is $\frac{-5}{4}$

B I U x_2 x^2 Ω Σ

Styles

Drag the stage slider to see how the triangles are formed.



Question 8b (2 marks)

Write down the missing values in the table up to row 6.

Stage (n)	Base (b)	Height (h)	Gradient (G)
1	1	2	$\frac{-2}{1}$
2	2	3	$\frac{-3}{2}$
3	3	4	$\frac{-4}{3}$
4	4	5	$\frac{-5}{4}$
5			
6			

Question 8c (2 marks)

Describe in words two patterns in the table for the gradient (G).

B I U x_2 x^2 Ω Σ

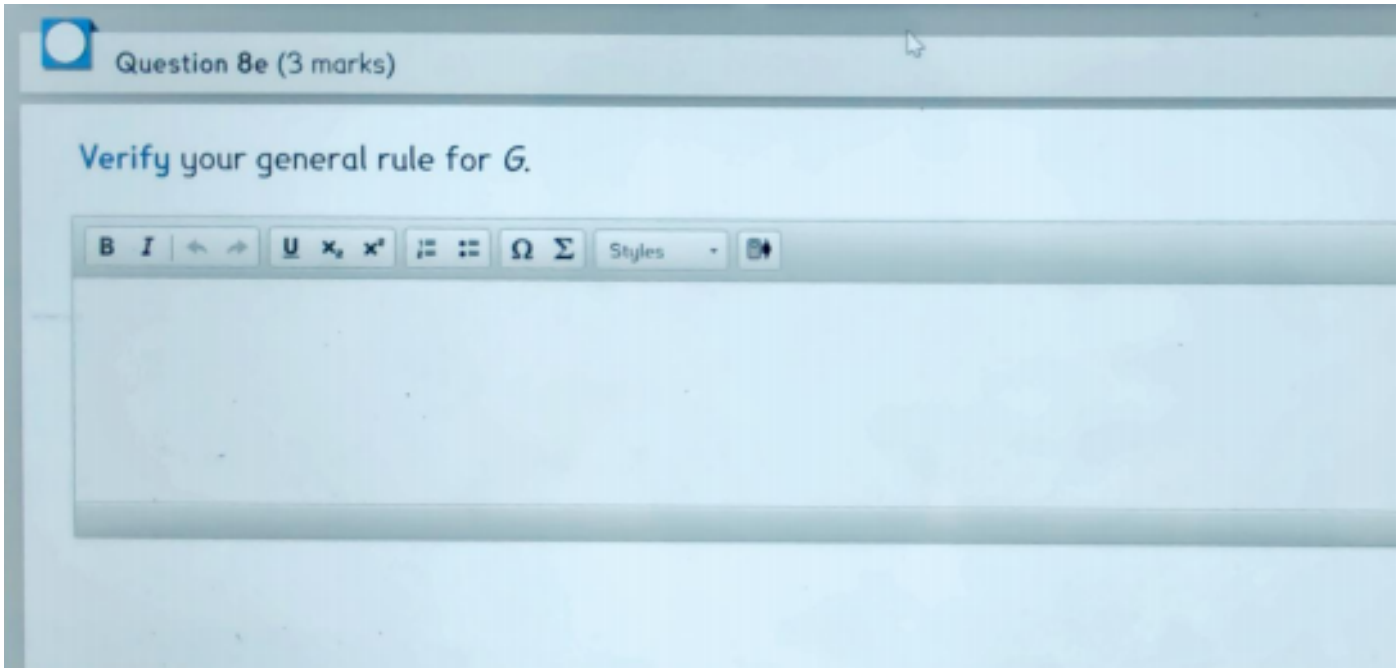
Styles

Question 8d (2 marks)

Write down a general rule for G in terms of n.

B I U x_2 x^2 Ω Σ

Styles


Question 8e (3 marks)
Verify your general rule for G.
Styles

Question 8f (20 marks)

You will now consider the length of the diagonal lines.

Stage (n)	Base (b)	Height (h)	Diagonal length (L)
1	1	2	$\sqrt{5}$
2	2	3	$\sqrt{13}$
3	3	4	$\sqrt{25}$
4	4	5	$\sqrt{41}$
5			
6			

Investigate the values in the table to find a relationship for the diagonal length L in terms of n.

In your answer, you should communicate the following in an organized and coherent manner:

- predict more values and record these in the table.
- describe in words a pattern in the table for the diagonal length (L).
- write down a general rule for L in terms of n.
- test and verify your general rule for L.
- justify your general rule for L.