EXTENDED MATHS
E-ASSESSMENT
NOVEMBER 2018

Question 1 (4 marks)

Below is an example of a mathematical wall clock.

©

In the process of designing a new mathematical wall clock, four values have been inserted in the correct place on Diagram 1 below and there are four more values that need to be placed on

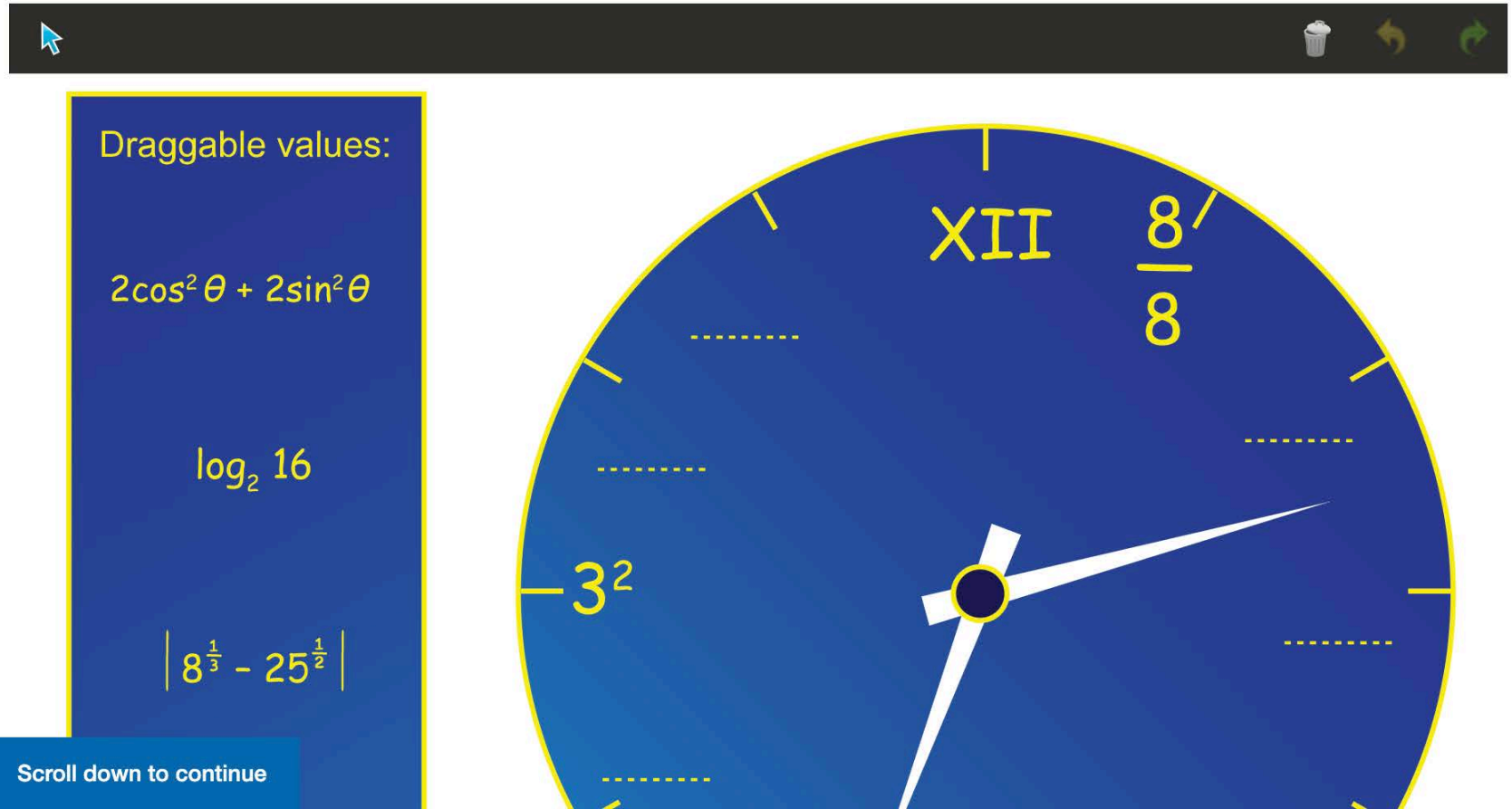
Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

In the process of designing a new mathematical wall clock, four values have been inserted in the correct place on Diagram 1 below and there are four more values that need to be placed on the diagram.

Label the mathematical clock by placing the values in the correct places.

Diagram 1



Scroll down to continue

1 (4 marks)
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4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Draggable values:

$2\cos^2\theta + 2\sin^2\theta$

$\log_2 16$

$\left|8^{\frac{1}{3}} - 25^{\frac{1}{2}}\right|$

$\frac{14x^2 + 7x}{2x^2 + x}$

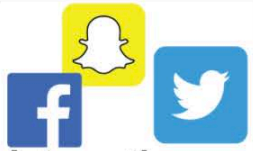
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Scroll down to continue

Question 2 (5 marks)

A group consisting of 120 students from MYP year 1 and MYP year 5 chose their favourite free-time activity from the following list: playing sport, gaming, and interacting on social media.

Their choices have been organized in the table below.

Year group \ Favourite activity	Playing sport	Gaming	 Interacting on social media	Total
MYP year 1	46	16	10	72
MYP year 5	8	16	24	48
Total	54	32	34	120

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Question 2a (1 mark)

Scroll down to continue

ted at random from MYP year 5. **Write down** the probability that this student

1 (4 marks)
2 (5 marks)
Question 2a
Question 2b
Question 2c
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Question 2a (1 mark)

A student is selected at random from MYP year 5. **Write down** the probability that this student chose gaming as their favourite activity.

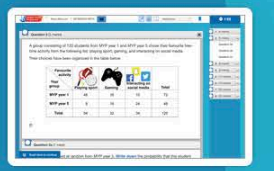
B I U x_2 x^2 Ω Σ Styles

Question 2b (2 marks)

Examine the following statement:

"MYP year 1 and MYP year 5 students are equally likely to choose gaming as their favourite

1 (4 marks)
2 (5 marks)
Question 2a
Question 2b
Question 2c
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)



Question 2b (2 marks)

Examine the following statement:

"MYP year 1 and MYP year 5 students are equally likely to choose gaming as their favourite activity."

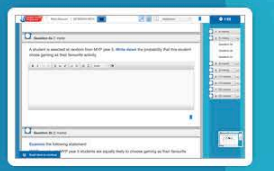
B I U x_2 x^2 Ω Σ Styles

Question 2c (2 marks)

Two students are selected at random from the whole group. Given that the first student is in [illegible]hose playing sport as their favourite activity, **determine** the probability that [illegible]t also chose playing sport

Scroll down to continue

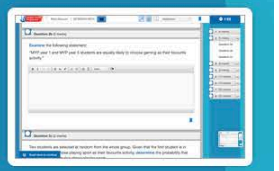
1 (4 marks)
2 (5 marks)
Question 2a
Question 2b
Question 2c
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)



Question 2c (2 marks)

Two students are selected at random from the whole group. Given that the first student is in MYP year 5 and chose playing sport as their favourite activity, **determine** the probability that the second student also chose playing sport.

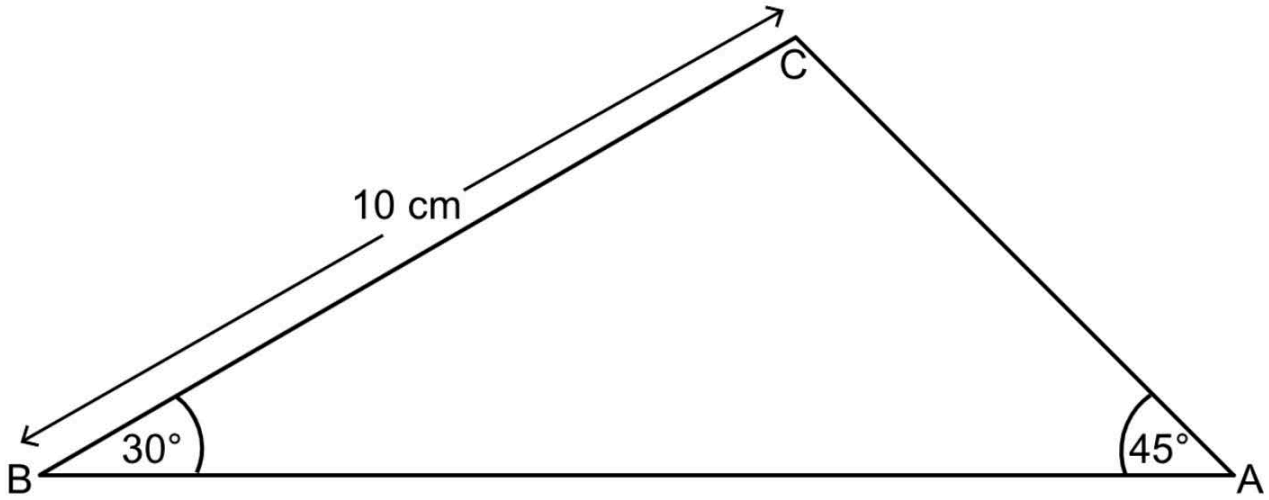
1 (4 marks)
2 (5 marks)
Question 2a
Question 2b
Question 2c
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)



Question 3 (8 marks)

Question 3a (3 marks)

In the diagram below, angle ABC = 30°, angle BAC = 45°, and the length BC is 10 cm.



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1 (4 marks)
2 (5 marks)
3 (8 marks)
Question 3a
Question 3b
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

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Show that the length of AC is $5\sqrt{2}$ cm.

1 (4 marks)
2 (5 marks)
3 (8 marks)
Question 3a
Question 3b
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

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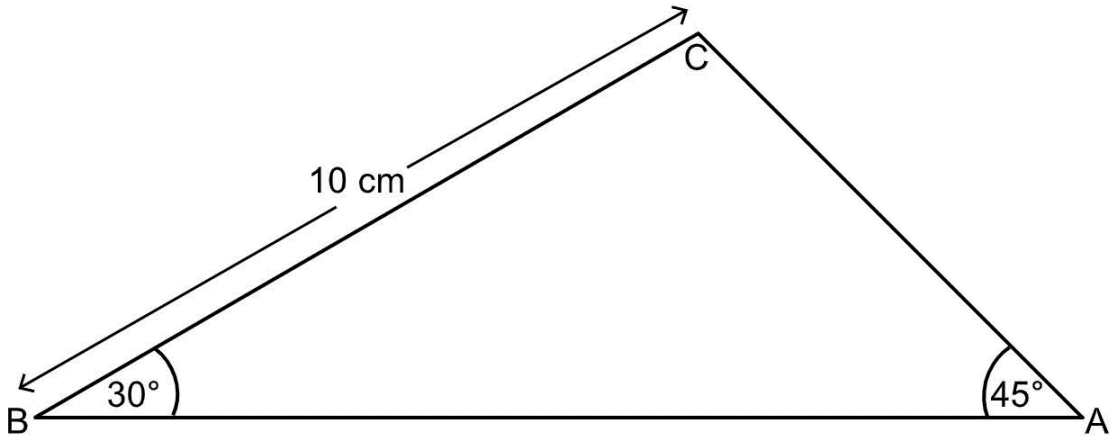
Question 3b (5 marks)

The side BC is extended by 5 cm which is demonstrated by the animation below.

Start



Hence, **find** the length of AD to the nearest cm.

Scroll down to continue

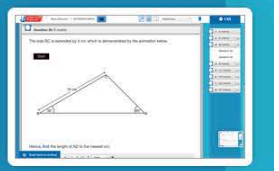
Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
Question 3a
Question 3b
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Hence, **find** the length of AD to the nearest cm.

B I U x_2 x^2 Ω Σ Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
Question 3a
Question 3b
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)



Question 4 (8 marks)

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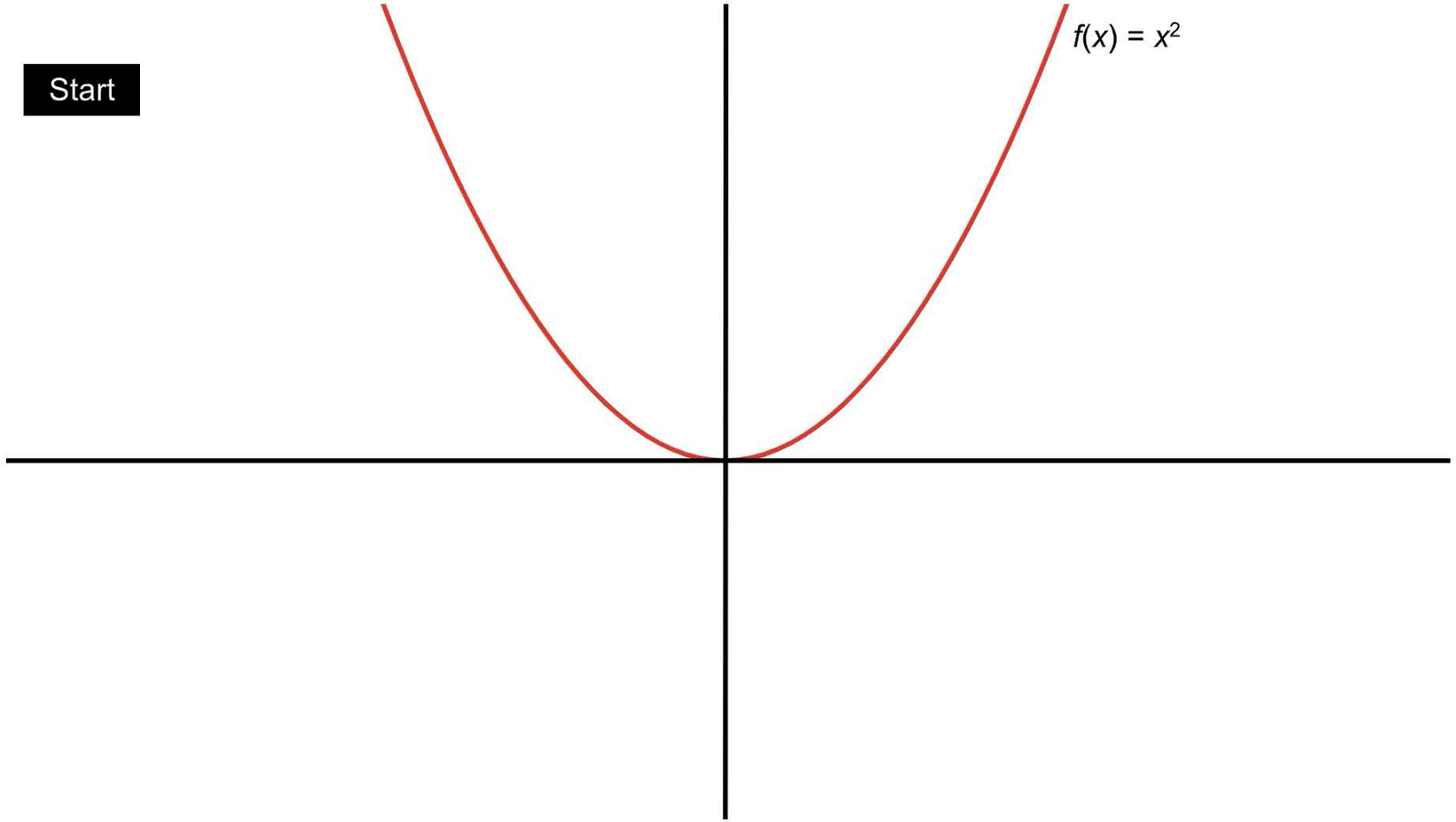

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Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
Question 4a
Question 4b
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Question 4a (4 marks)

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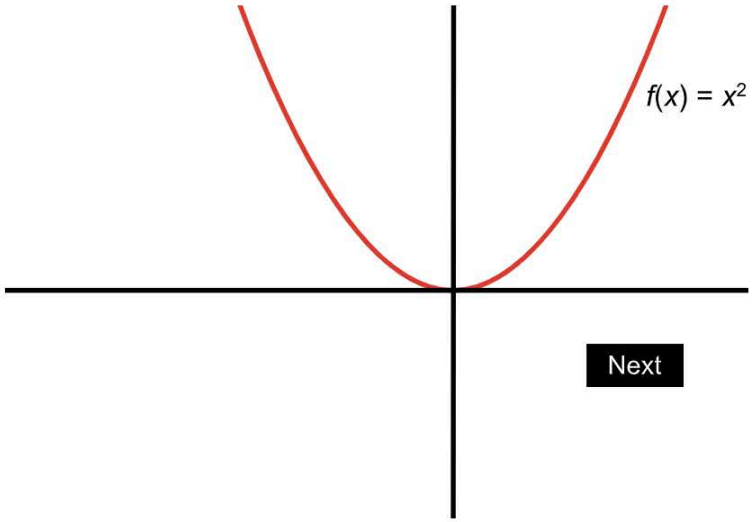


Given that $f(x) = x^2$ and $g(x) = -4(x + 2)^2 + 1$, **identify** the stages that transform $f(x)$ onto $g(x)$.

B I U x_2 x^2 Ω Σ Styles

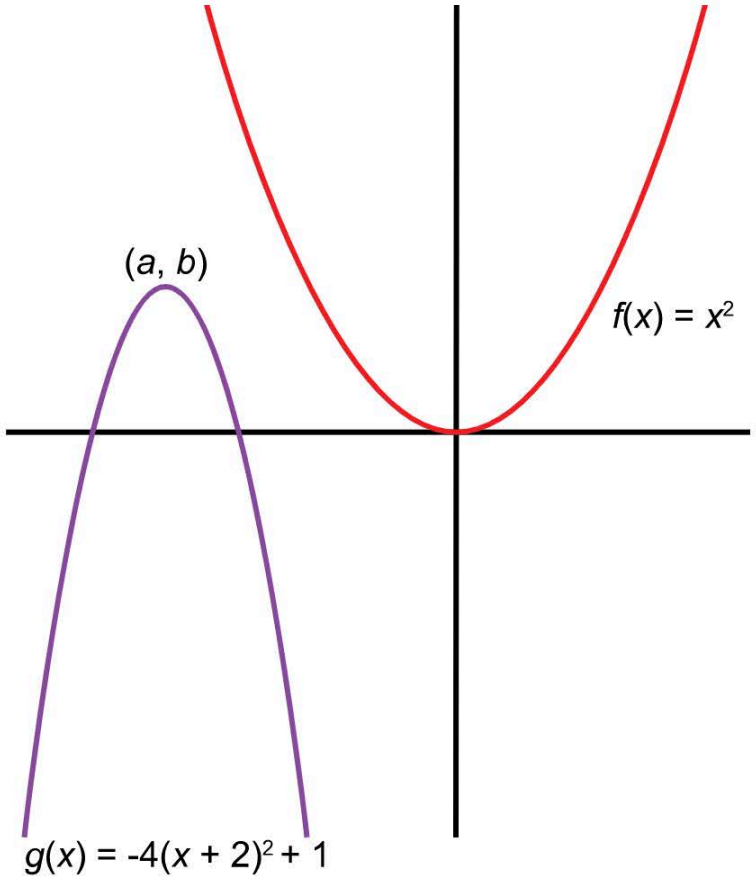
Question 4b (4 marks)

Given that $x = \frac{-3}{2}$ is one solution for

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
Question 4a
Question 4b
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)

Question 4b (4 marks)



©

Given that $x = \frac{-3}{2}$ is one solution for $g(x) = 0$, **find** the value of the other solution.

B I U x_2 x^2 Ω Σ Styles

1 (4 marks)
2 (5 marks)
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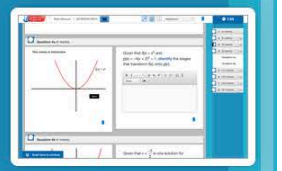
4 (8 marks)
Question 4a
Question 4b
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)



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Question 5 (11 marks)

Question 5a (2 marks)

The diagram shows a circle of radius 4 cm. The angle ACB is $\frac{\pi}{2}$ radians.

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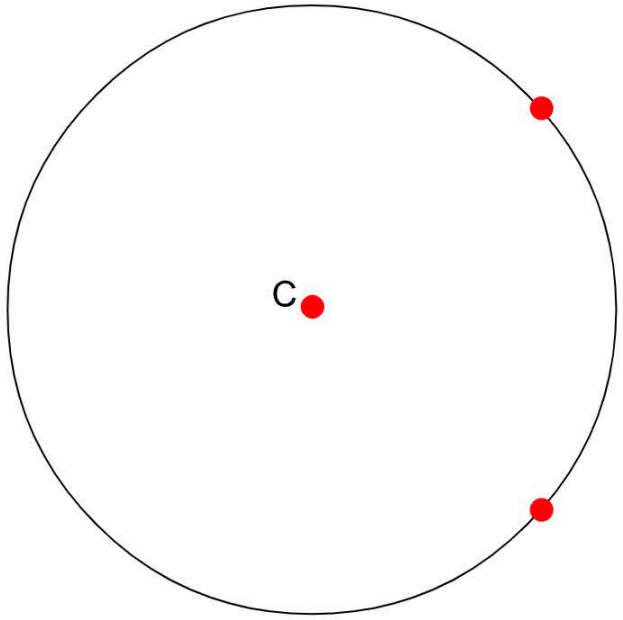

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1 (4 marks)
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3 (8 marks)
4 (8 marks)
5 (11 marks)
Question 5a
Question 5b
Question 5c
6 (10 marks)
7 (23 marks)
8 (31 marks)

Question 5a (2 marks)

The diagram shows a circle of radius 4 cm. The angle ACB is $\frac{\pi}{2}$ radians.

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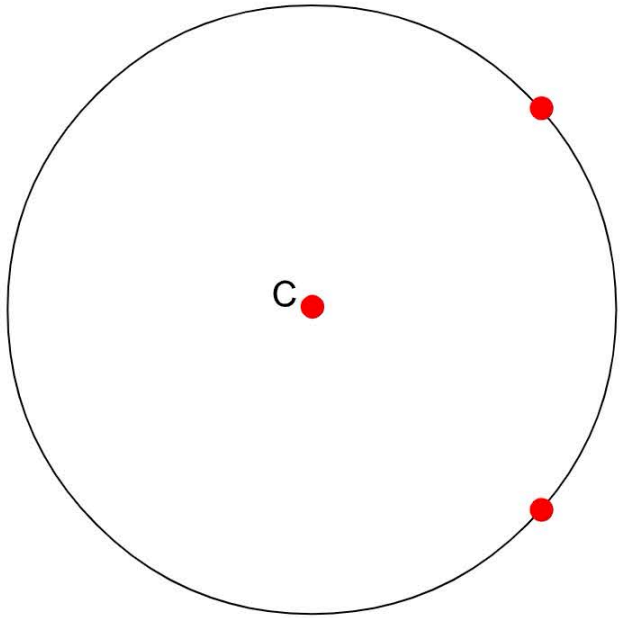

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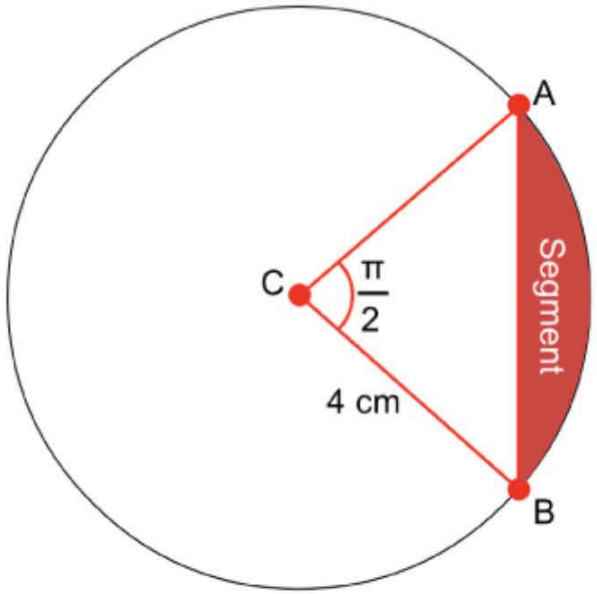
3 (8 marks)
4 (8 marks)
5 (11 marks)
Question 5a
Question 5b
Question 5c
6 (10 marks)
7 (23 marks)
8 (31 marks)

Determine the area of triangle ACB.



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4 (8 marks)
5 (11 marks)
Question 5a
Question 5b
Question 5c
6 (10 marks)
7 (23 marks)
8 (31 marks)

Scroll down to continue

Question 5b (3 marks)

Show that the area of the shaded segment is $4(\pi - 2)$.

B I U x_2 x^2 Ω Σ Styles

Question 5c (6 marks)

Scroll down to continue

1 (4 marks)
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5 (11 marks)
Question 5a
Question 5b
Question 5c
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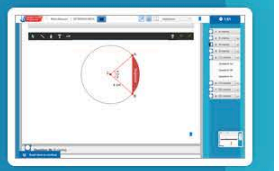
7 (23 marks)
8 (31 marks)



Question 5c (6 marks)

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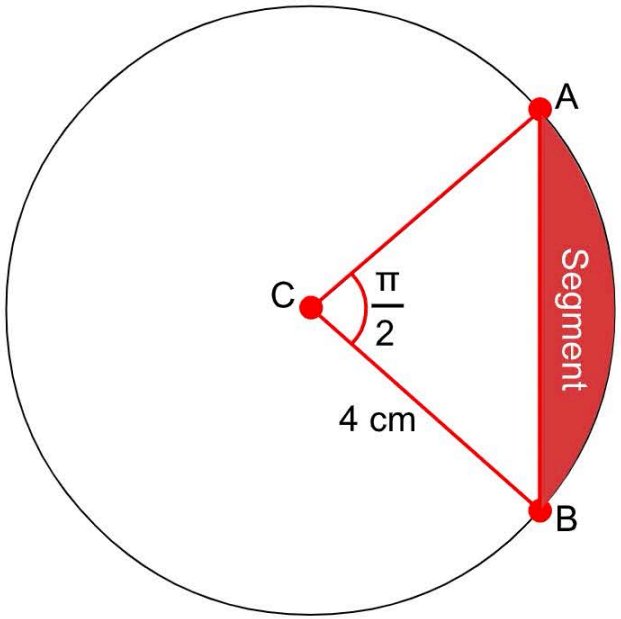
Start



Scroll down to continue

1 (4 marks)
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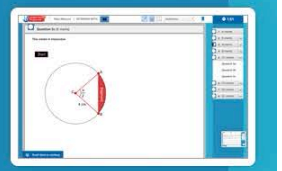
5 (11 marks)
Question 5a
Question 5b
Question 5c
6 (10 marks)
7 (23 marks)
8 (31 marks)



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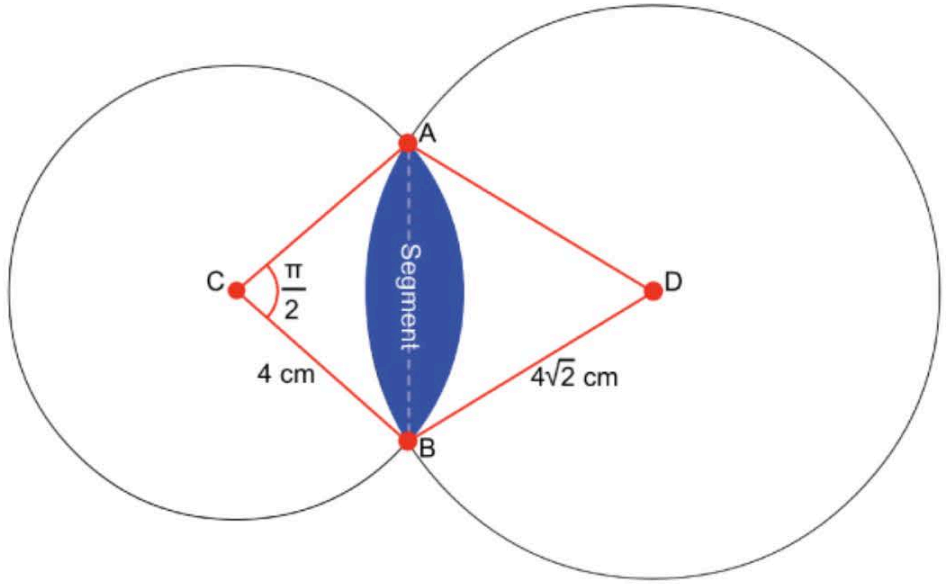
Hence, **find** the area of the shaded region. Give your answer to one decimal place.



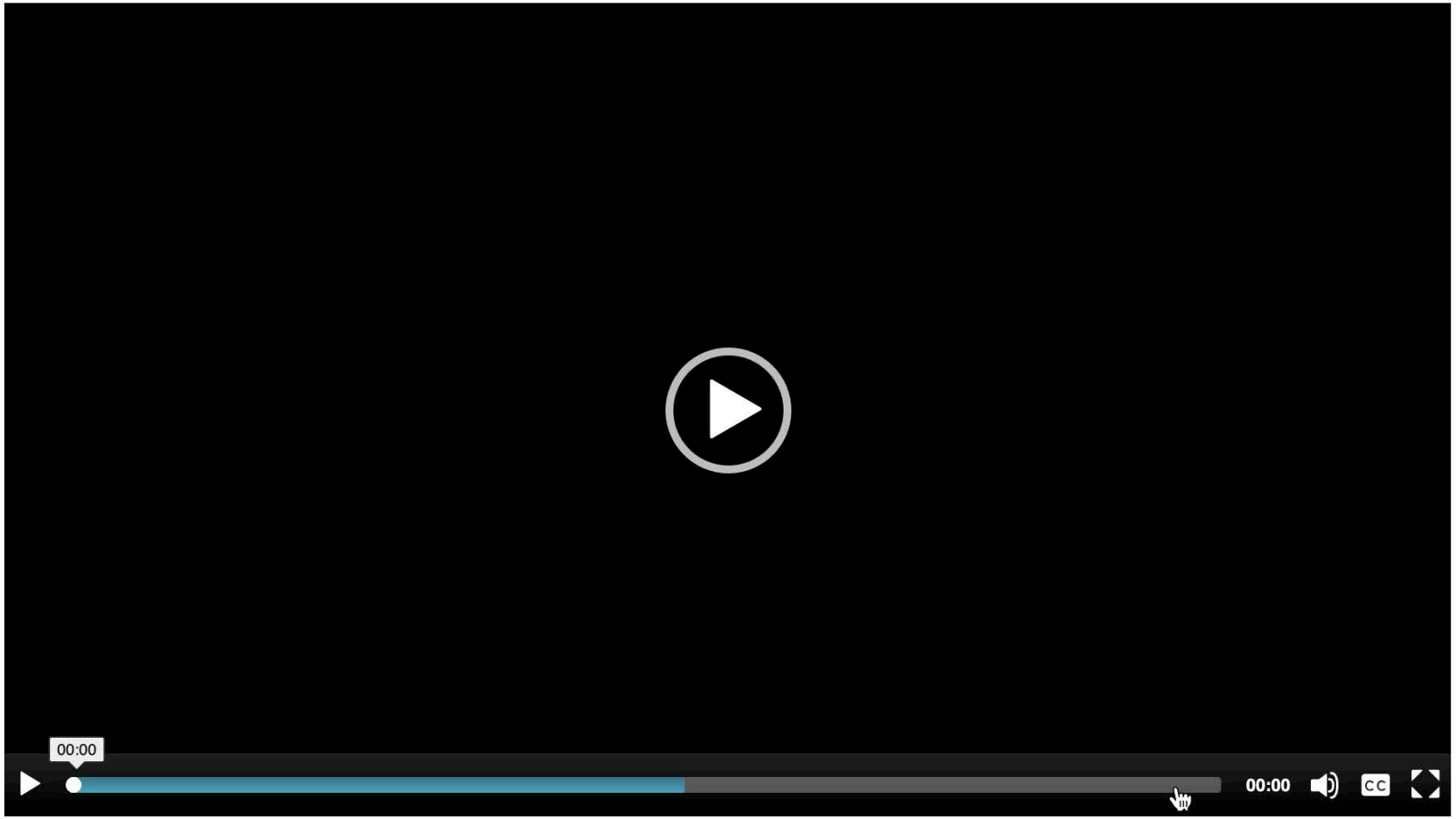
Styles

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
Question 5a
Question 5b
Question 5c
6 (10 marks)
7 (23 marks)
8 (31 marks)

Video | Script

The following video provides information on heart rate for a healthy lifestyle.



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Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

Video | Script

There are many health benefits of exercise, whether it is getting active through fun activities or doing more serious structured workouts, exercise helps you stay fit and healthy.

Exercise has many other benefits. Exercise is not just good for the body, but it is also good for your mind and general feeling of well-being.

Studies have shown that exercising is a great self-esteem booster that can help you feel good about yourself all day long. You may feel more relaxed and less stressed.

In this question, you will review an exercise programme for a sixteen-year-old student. You will be provided with information about maximum heart rate. Heart rate is measured in beats per minute, otherwise called bpm. An effective exercise programme is reached when the heart rate is at least eighty percent of the maximum heart rate and a safe exercise programme is achieved when the heart rate is below the maximum heart rate.

The information provided in the question will help you review an exercise programme.

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

Scroll down to continue

The maximum heart rate (H) in beats per minute (bpm) is calculated in terms of age, (a) in years, using the formula $H = 208 - 0.7a$

A safe exercise is one that stays below the maximum heart rate.

Question 6a (1 mark)

Show that the maximum heart rate of a 16-year-old is 197 bpm to the nearest beat.

B I U x_2 x^2 Ω Σ Styles

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

Question 6b (2 marks)

Research has shown that physical exercise is most effective when the heart rate reaches 80 % of the maximum heart rate and this should be maintained for 15 minutes.

Determine the heart rate of a 16-year-old for the most effective physical exercise. Give your answer in bpm to the nearest beat.

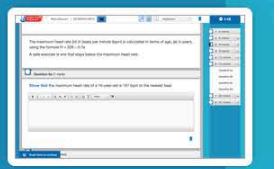
B I U x_2 x^2 Ω Σ Styles

The heart rate of a 16-year-old student was monitored whilst doing 30 minutes of exercise.

art rate during the exercise are modelled by the function shown below.

Scroll down to continue

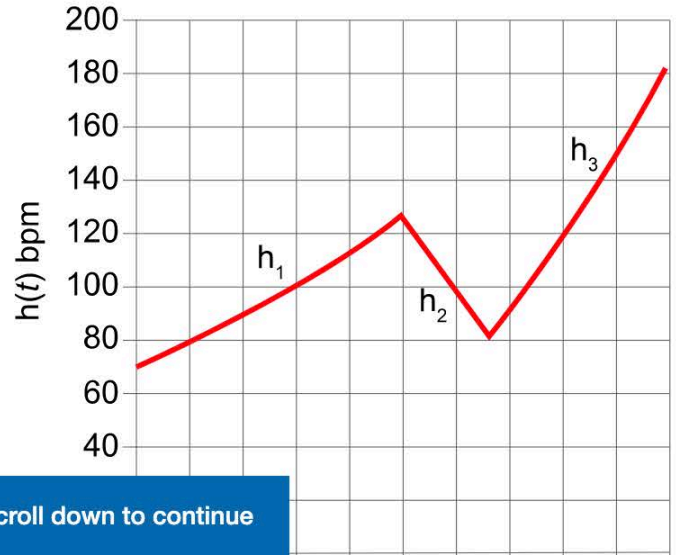
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)



The heart rate of a 16-year-old student was monitored whilst doing 30 minutes of exercise.

The changes in heart rate during the exercise are modelled by the function shown below, where t is the elapsed time from the beginning of the exercise, in minutes and h(t) is the heart rate, in bpm.

t	h(t)	
$0 \le t \le 15$	$h(t) = 70 \times (1.04)^t$	h_1
$15 \le t \le 20$	h(t) Heart rate decreases every minute by 9 beats per minute.	h_2
$20 \le t \le 30$	$h(t) = 0.2025t^2$	h_3



Scroll down to continue

Question 6c (4 marks)

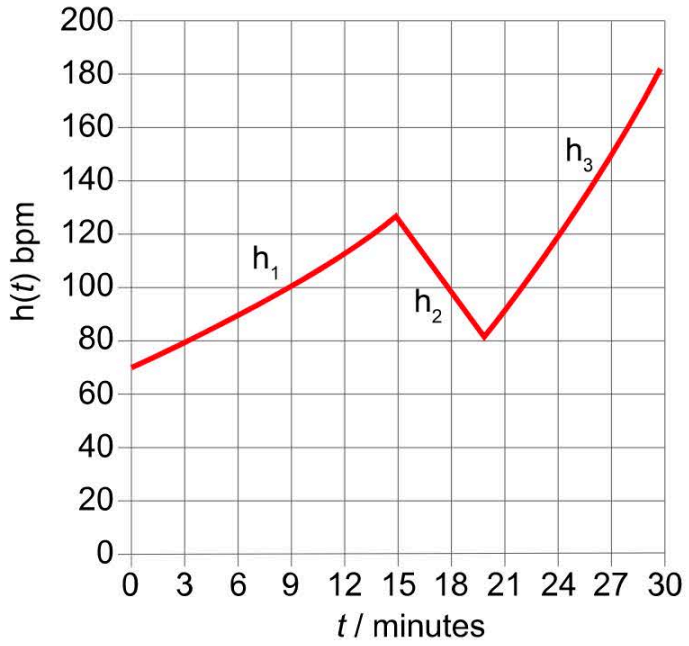
The heart rate reached 108 bpm for the first time when $108 = 70 \times (1.04)^t$.

Calculate the time t .

B I U x_2 x^2 Ω Σ Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

t	h(t)	
$0 \le t \le 15$	$h(t) = 70 \times (1.04)^t$	h_1
$15 \le t \le 20$	h(t) Heart rate decreases every minute by 9 beats per minute.	h_2
$20 \le t \le 30$	$h(t) = 0.2025t^2$	h_3



Question 6c (4 marks)

The heart rate reached 108 bpm for the first time when $108 = 70 \times (1.04)^t$.

Calculate the time t .

B I U x_2 x^2 Ω Σ Styles

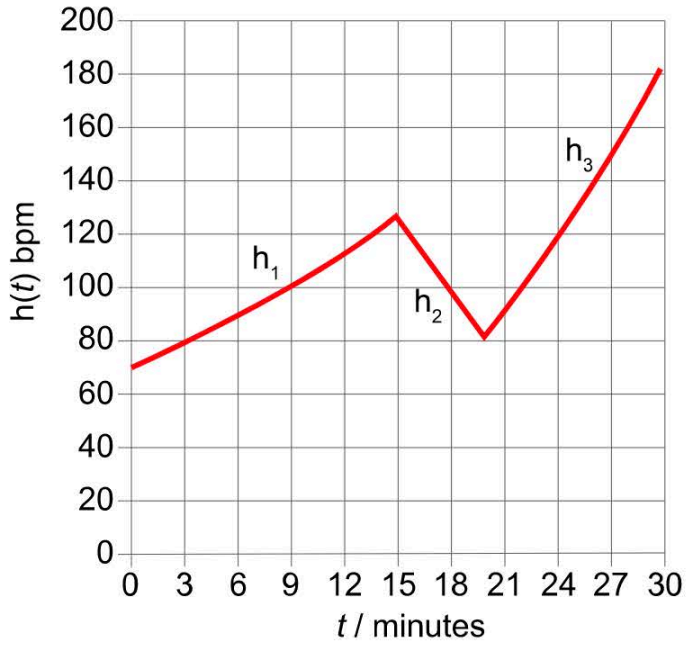
Question 6d (3 marks)

Based on the behaviour of the graph, **discuss** the effectiveness and safety of this 30-minute exercise.

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

Scroll down to continue

t	h(t)	
$0 \le t \le 15$	$h(t) = 70 \times (1.04)^t$	h_1
$15 \le t \le 20$	h(t) Heart rate decreases every minute by 9 beats per minute.	h_2
$20 \le t \le 30$	$h(t) = 0.2025t^2$	h_3



Question 6d (3 marks)

Based on the behaviour of the graph, **discuss** the effectiveness and safety of this 30-minute exercise.

Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
Question 6a
Question 6b
Question 6c
Question 6d
7 (23 marks)
8 (31 marks)

Scroll down to continue

Question 7 (23 marks)

Video | Script

The following video discusses the factors that contribute to a healthy lifestyle.

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Question 7 (23 marks)

Video | Script

A balanced diet and regular exercise contribute to a healthy lifestyle. The intake of nutrients and energy comes from the food and drink consumed. The output of energy is achieved by every day activities and the amount of exercise we take. A healthy lifestyle has the appropriate balance of nutrients and energy.

Human beings need a certain amount of nutrients and energy for their bodies to function well.

The nutrients can be divided into three main categories: proteins, fats and carbohydrates. This pie chart shows an example of a recommended division of nutrients.

When nutrients and energy are balanced our bodies perform at their best and an imbalance of nutrients and energy can lead to poor performance.

In this question, you will examine how to balance different factors to help lead a healthy lifestyle.

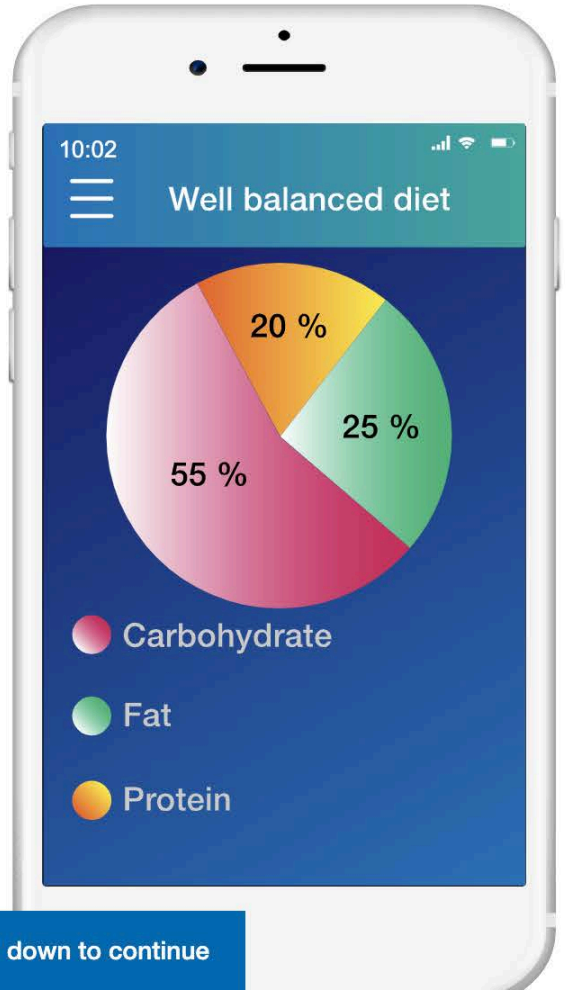
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Scroll down to continue

Question 7a (2 marks)

This media is interactive

Hover over the pie chart sectors for details



Scroll down to continue

A 180 gram (g) steak provides the correct amount of protein and fat. **Determine**, in grams, the amount of carbohydrates to be included with the steak for a balanced meal.

B I U x_2 x^2 Ω Σ

Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Question 7b (3 marks)

Daily average energy intake for children aged 13–18 years		
Age in years	Energy intake in kiloJoules (KJ)	
	Boys	Girls
13	10 100	9 300
14	11 000	9 800
15	11 800	10 000
16	12 400	10 100
17	12 900	10 300
18	13 200	10 300

Gerry is a 16-year-old boy. He wants to divide his daily intake of energy over three meals in the following ratio:

Breakfast		Mid-day meal		Evening meal
2	:	3	:	4

Find the total amount of energy, in kJ, Gerry should have for his mid-day meal and evening meal to the nearest kJ.

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

16	12 400	10 100
17	12 900	10 300
18	13 200	10 300

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2	:	3	:	4

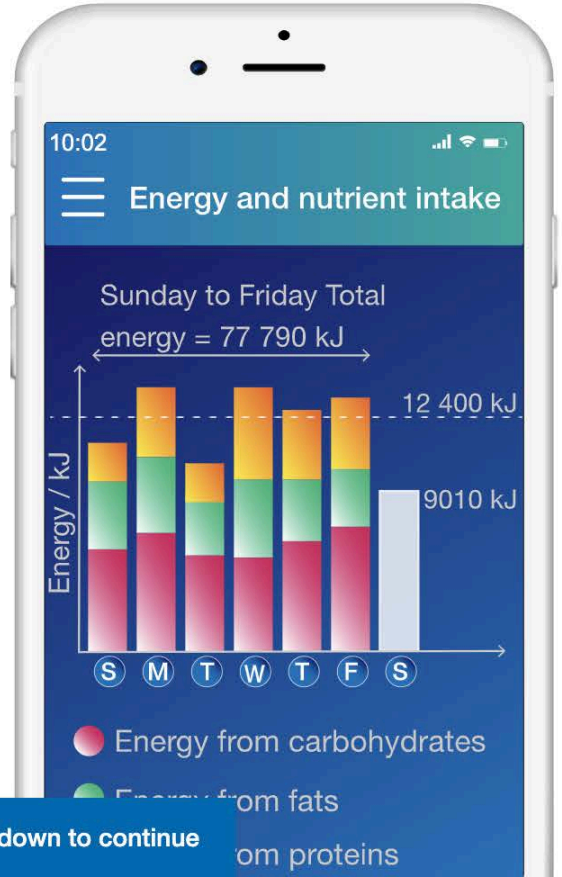
Find the total amount of energy, in kJ, Gerry should have for his mid-day meal and evening meal to the nearest kJ.

B I U x_2 x^2 Ω Σ Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Question 7c (2 marks)

The bar chart shows Gerry's energy and nutrient intake over six days, Sunday to Friday. The total intake of energy is 77 790 kJ. He knows that the average intake per day should be 12 400 kJ.



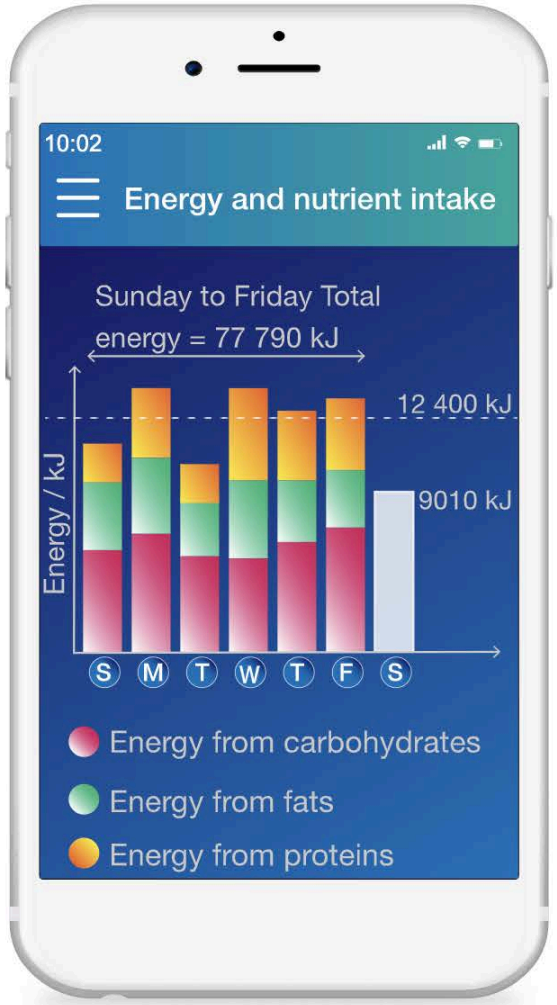
Show that he should intake only 9010 kJ on Saturday the last day of the week.

Styles

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

77 790 kJ. He knows that the average intake per day should be 12 400 kJ.



Show that he should intake only 9010 kJ on Saturday the last day of the week.

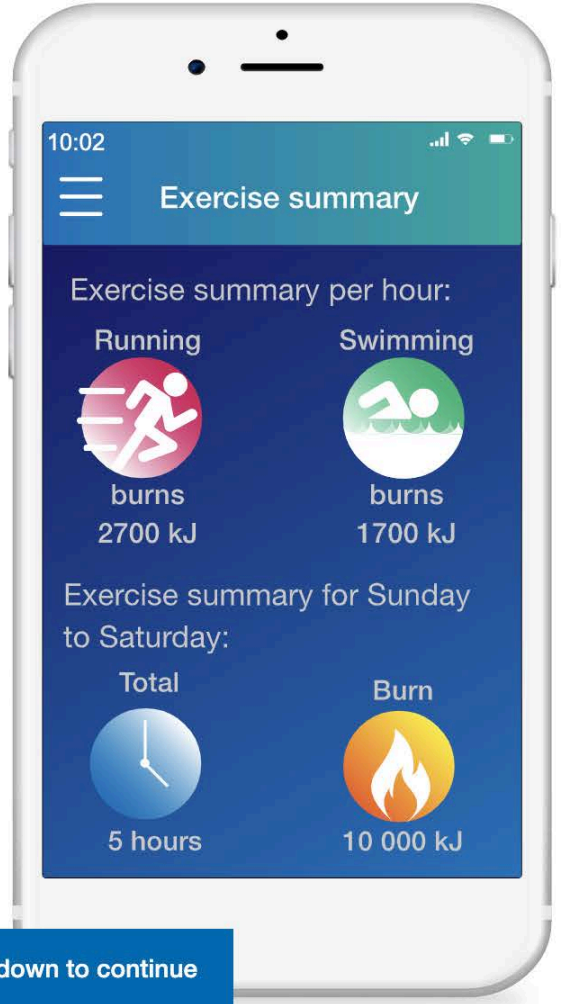
Styles

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Scroll down to continue

Question 7d (6 marks)

Gerry wants to make healthy lifestyle choices. In the infographic below you can see his exercise summary.



Find the number of hours of running (r) and number of hours of swimming (s) that will allow Gerry to achieve his goal of burning exactly 10 000 kJ.

B I U x_2 x^2 Ω Σ Styles

Scroll down to continue

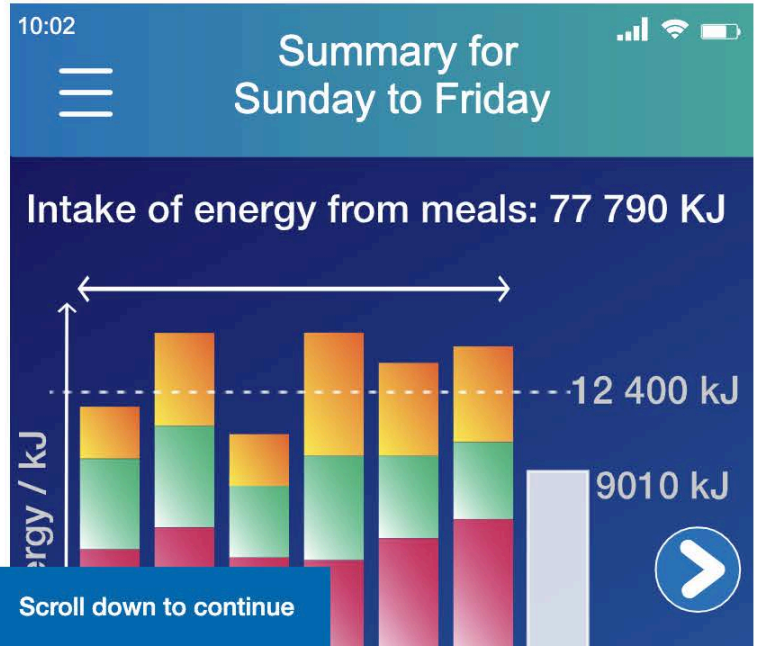
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Question 7e (10 marks)

Gerry has decided to use a mobile application (app) to record his activities on a weekly basis. He is on the final day, Saturday, of his first week. He has already had his breakfast and mid-day meal and has taken no exercise today. He hopes to complete the week having achieved his healthy lifestyle goal.

This media is interactive

To toggle between pages in the App, use the buttons.

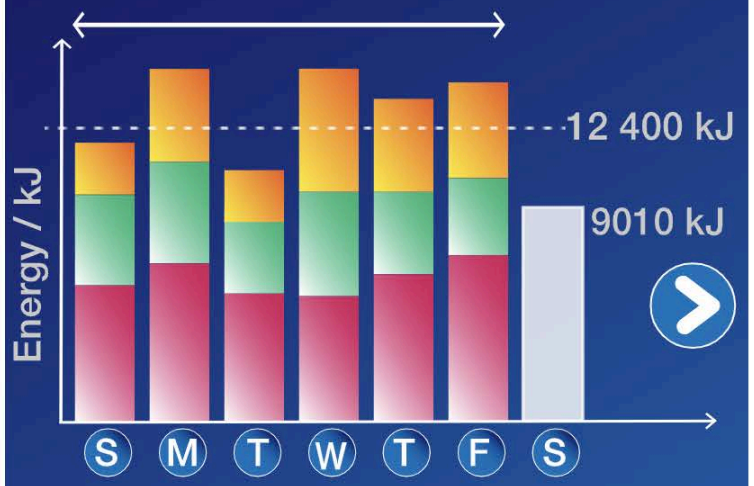


1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

10:02

Summary for Sunday to Friday

Intake of energy from meals: 77 790 KJ



Output of energy from exercise: 8300 kJ

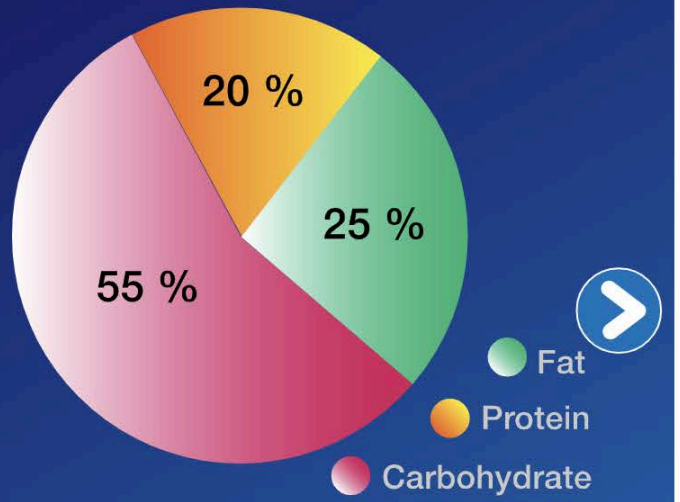
Time	Swimming	Running
4 hours	2.5 hours	1.5 hours

Scroll down to continue

10:02

Nutrient intake guidance

Well balanced diet



Ratio for daily intake of energy over three meals

Breakfast		Mid-day meal		Evening meal
2	:	3	:	4

Total intake of energy from meals Sunday to Saturday: 86 800 kJ

©

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Evaluate Gerry's progress towards a healthy lifestyle. Use the information provided in the mobile app. In your answer, you should:

- identify four factors to be considered for a healthy lifestyle
- calculate the remaining nutrition and energy for Saturday
- justify the degree of accuracy of your results
- suggest advice for Gerry on his approach to a healthy lifestyle
- explain how the advice makes sense for a healthy lifestyle.

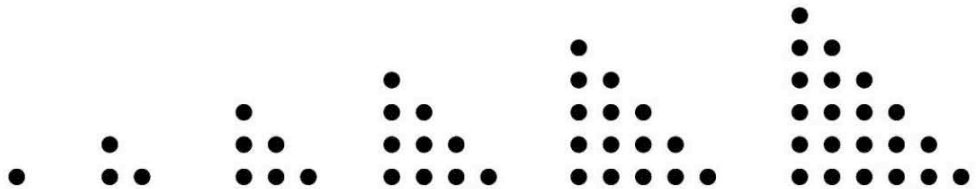
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
Question 7a
Question 7b
Question 7c
Question 7d
Question 7e
8 (31 marks)

Scroll down to continue

Question 8 (31 marks)

The animation below shows how square numbers can be formed from triangular numbers.

This media contains no audio



00:00

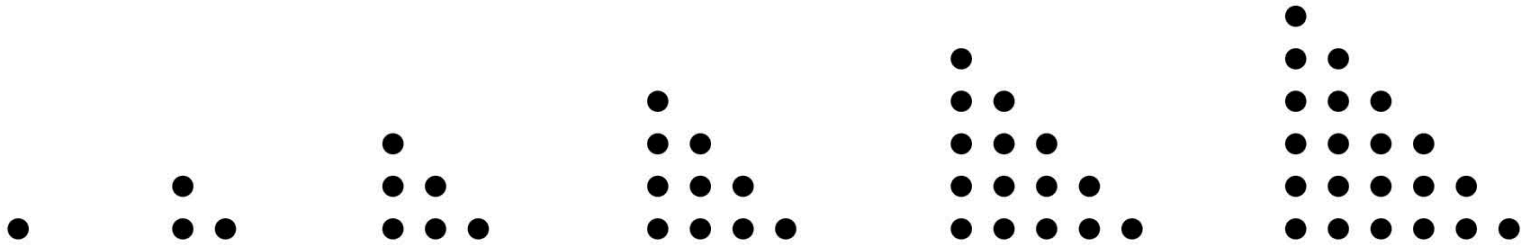
Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d

T_n

©

Here are the first five triangular numbers illustrated with dots.



©

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d

Question 8a (3 marks)

n	T_n	T_{n-1}	$T_n + T_{n-1} = n^2$	
1	1			
2	3	1	4	
3	6	3	9	
4		6		

Reset

Verify the general rule for the triangular numbers $T_n = \frac{n(n+1)}{2}$.

B I U x_2 x^2 Ω Σ Styles

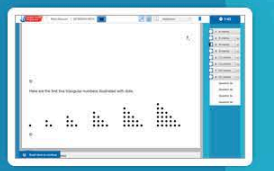
Question 8b (4 marks)

Use $T_n = \frac{n(n+1)}{2}$ to **prove** that the sum of

two successive triangular numbers will

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d



n	T_n	T_{n-1}	$T_n + T_{n-1} = n^2$	
1	1			
2	3	1	4	
3	6	3	9	
4		6		

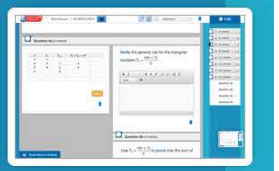
Reset

Question 8b (4 marks)

Use $T_n = \frac{n(n+1)}{2}$ to **prove** that the sum of two successive triangular numbers will always be a square number.

Styles

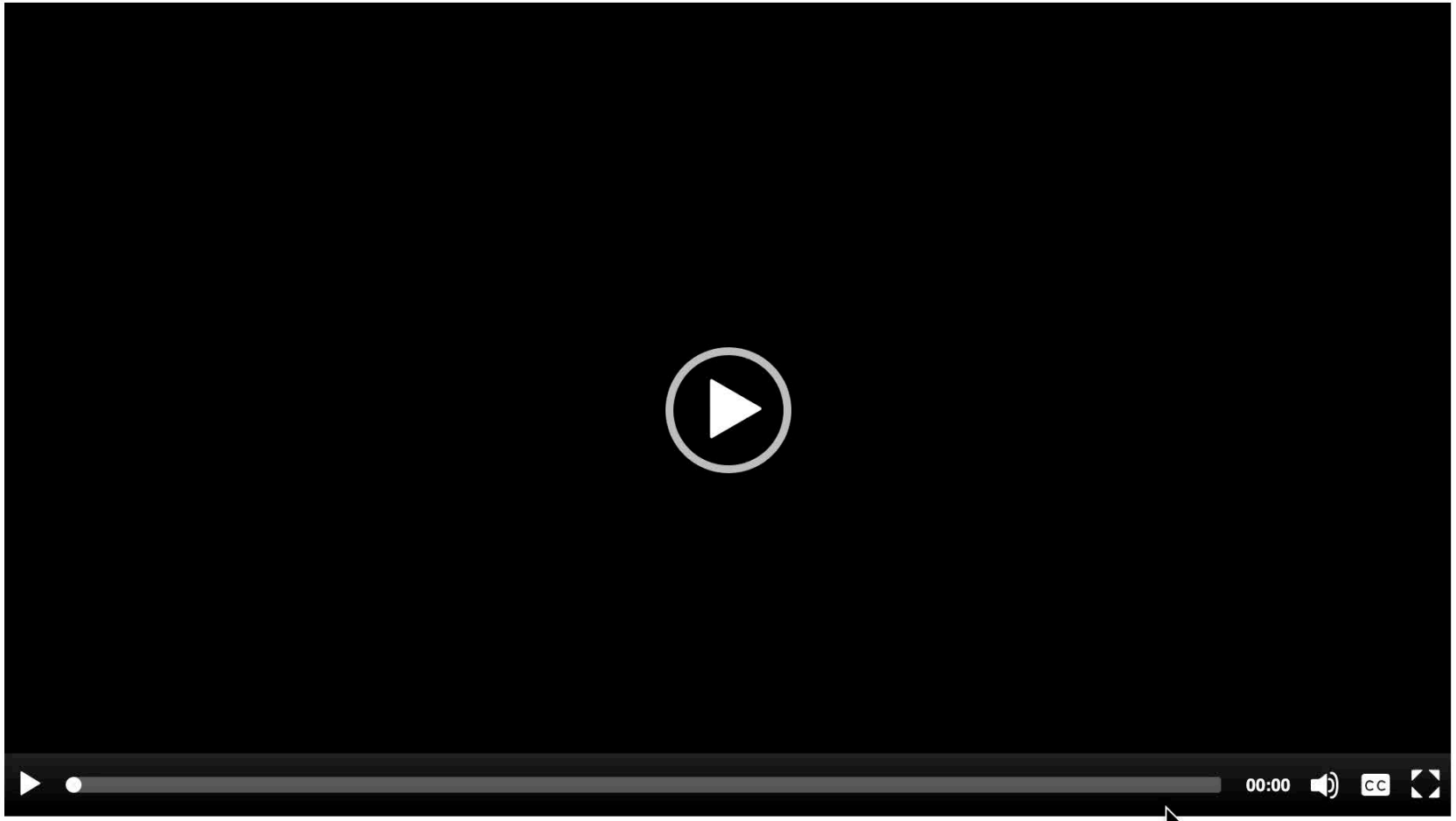
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d



Scroll down to continue

Video | Script

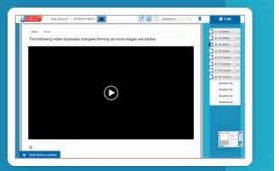
The following video illustrates triangles forming as more stages are added.



©

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d



Video | Script

Here is an equilateral triangle with sides of 2 units.

Three more triangles are added.

A perpendicular bisector is drawn to join A to M. The length of AM is square root 3.

d_1 is the length of AC_1.

Here we have a right-angled triangle AMC_1.

d_2 is the length of AC_2.

Here we have a right-angled triangle AMC_2.

And so on...

Scroll down to continue

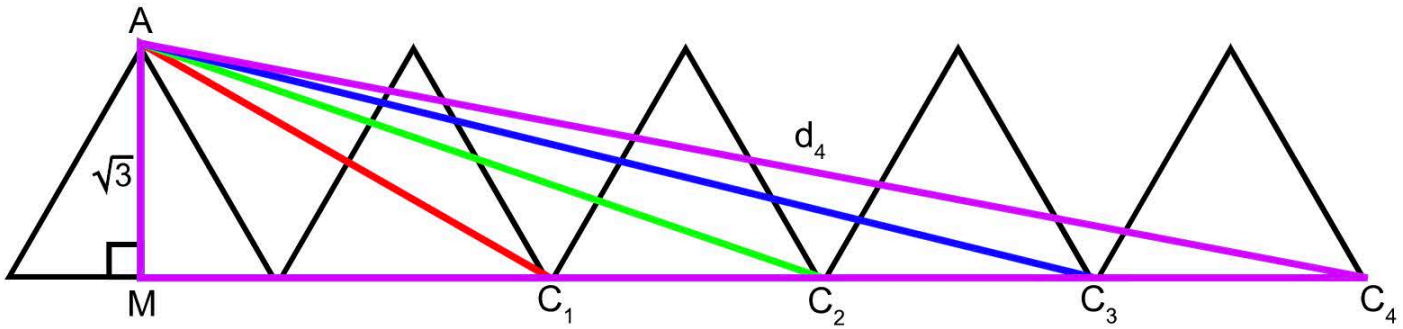
1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d

Question 8c (2 marks)

Show that $d_4 = 2\sqrt{21}$.

Equilateral triangles of side 2

AM = $\sqrt{3}$



Styles

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d

Question 8d (22 marks)

Investigate the values in the table to find a relationship for length d_n in terms of n. In your answer, you should:

- predict more values and record these in the table below
- describe in words any patterns you see in the table
- find a general rule for l_n in terms of n
- find a general rule for d_n in terms of n
- test your general rule for d_n
- prove or verify and justify your general rule for d_n
- ensure that you communicate all your working appropriately.

n	Length MC_n (l_n)	Length AC_n (d_n)	
1	3	$2\sqrt{3}$	
2	5	$2\sqrt{7}$	
3	7	$2\sqrt{13}$	
4		$2\sqrt{21}$	
5			
6			

Scroll down to continue

1 (4 marks)
2 (5 marks)
3 (8 marks)
4 (8 marks)
5 (11 marks)
6 (10 marks)
7 (23 marks)
8 (31 marks)
Question 8a
Question 8b
Question 8c
Question 8d