2018 November Maths eAssessment

Question 1 (4 marks)

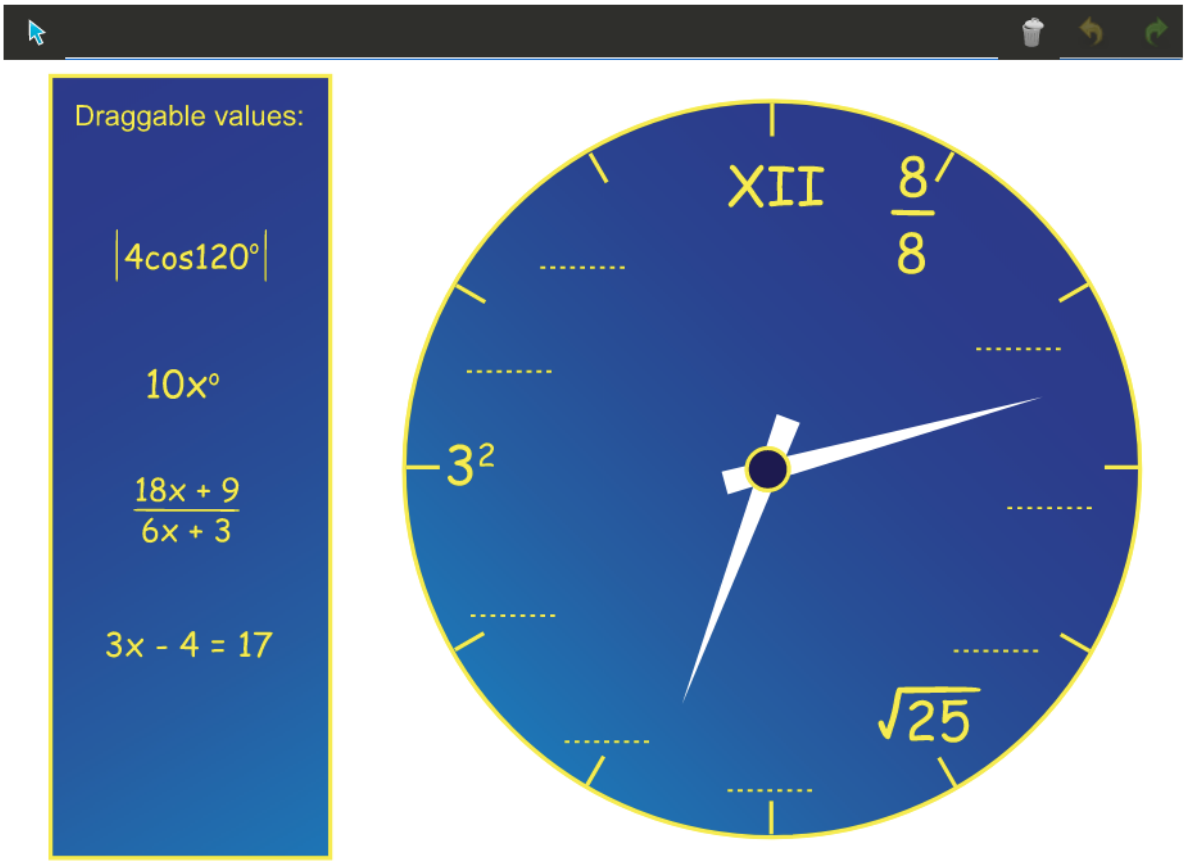
Below is an example of a mathematical wall clock.

©

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 the diagram.

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

Diagram 1



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.

Favourite activity / Year group	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

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.

Question 2b (2 marks)

Examine the following statement:

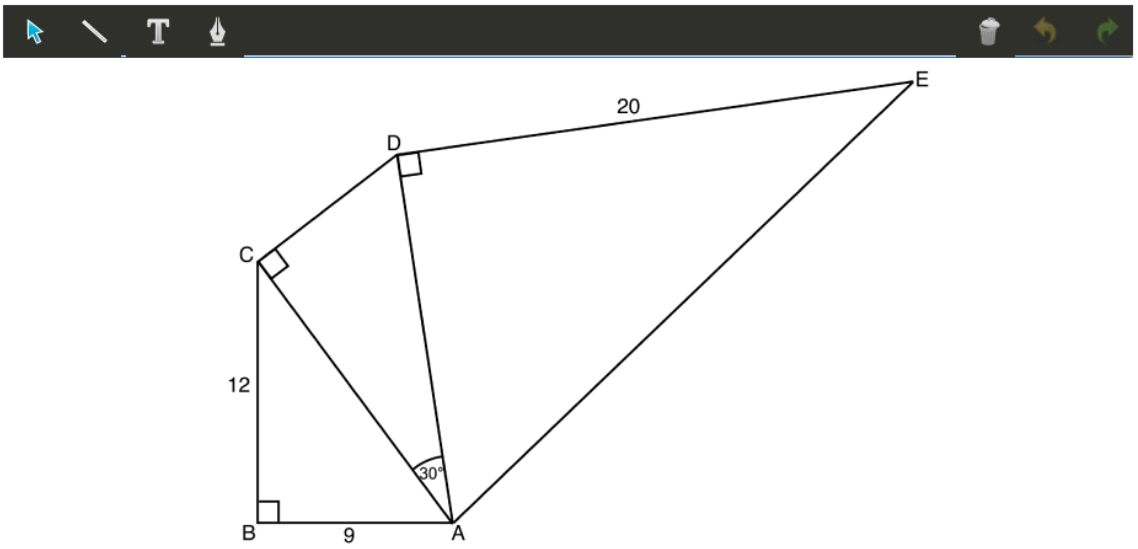
"MYP year 1 and MYP year 5 students are equally likely to choose gaming as their favourite activity."

Question 2c (2 marks)

A student is selected at random from the whole group. **Determine** the probability that this student did not choose playing sport as their favourite activity.

Question 3a (2 marks)

In the diagram below, angles ABC, ACD and ADE are 90°. The lengths AB, BC, and DE are 9 cm, 12 cm and 20 cm respectively.



Determine the length of AC.

Question 3b (3 marks)

Hence, **show that** the length of AD is $10\sqrt{3}$ cm.

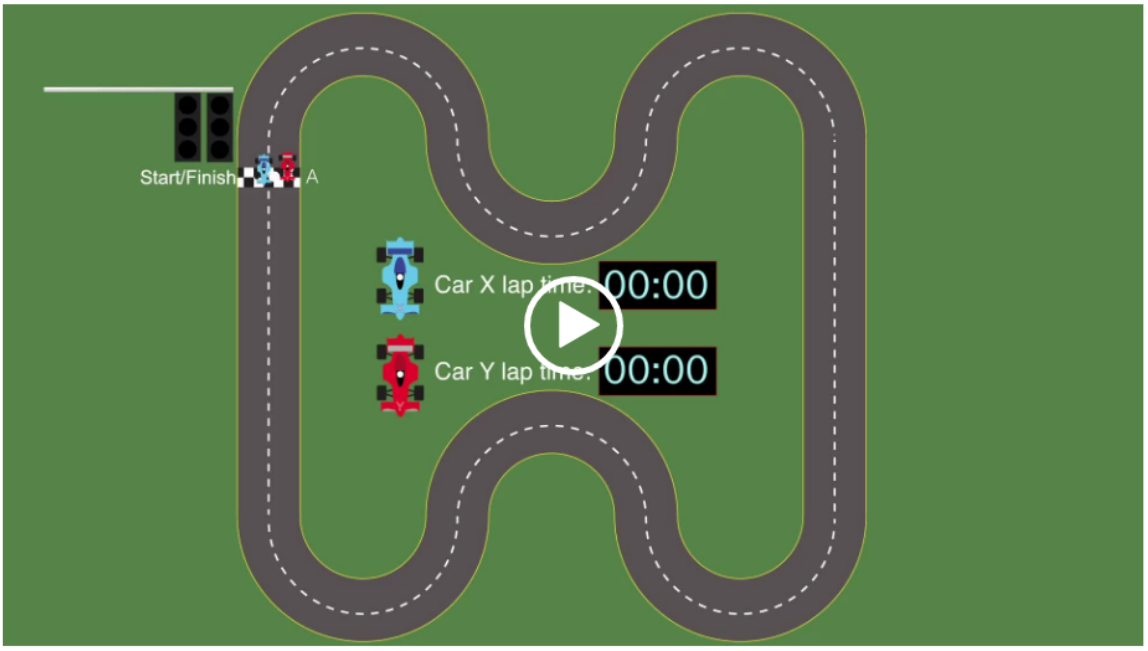
Question 3c (3 marks)

Find the angle DAE to the nearest degree.

Question 4a (2 marks)

The animation shows racing cars completing laps around a racing track. Car X and car Y start the race at the same time from the starting point A.

This media contains no audio



Car X completes one lap in 6 minutes and car Y completes one lap in 8 minutes.

Determine after how many minutes the two cars will meet again at the starting point A.

Question 4b (5 marks)

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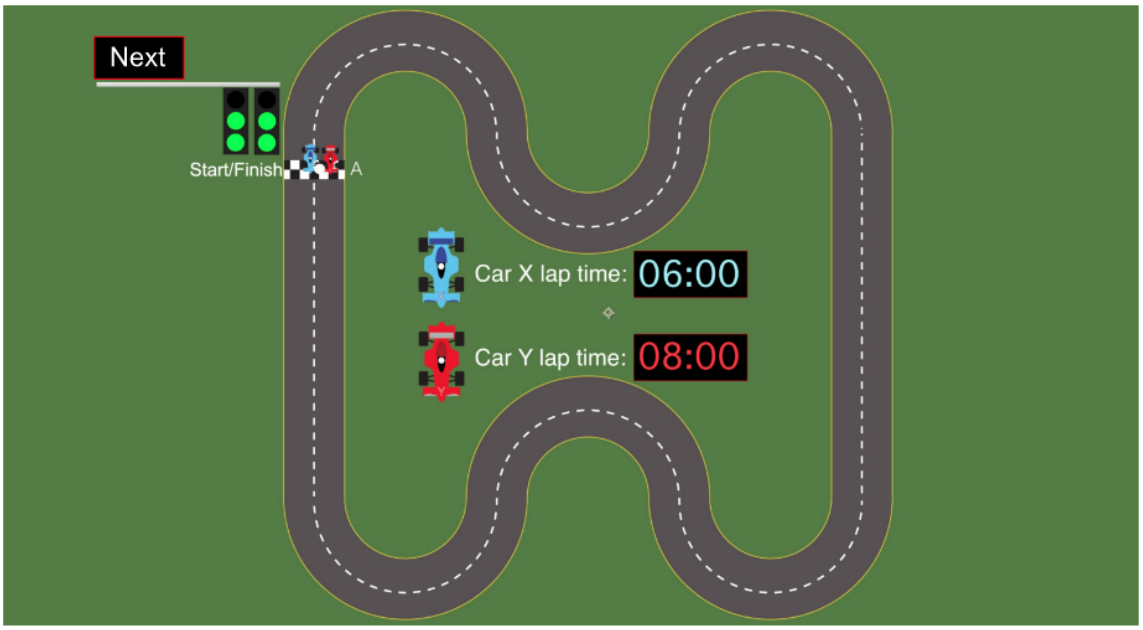
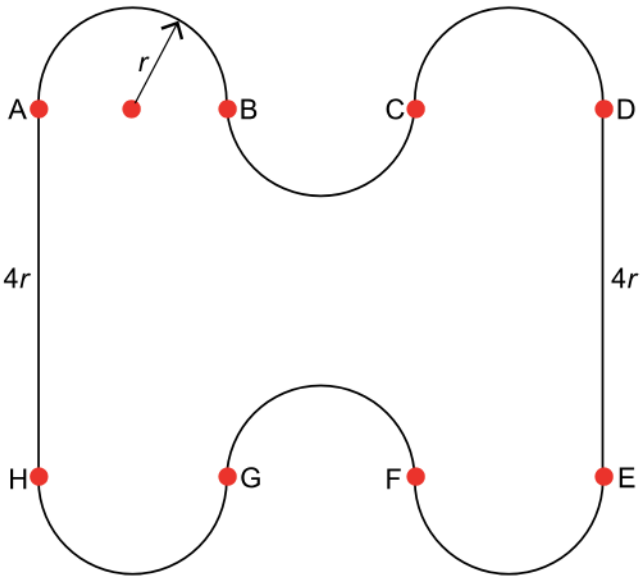


The racing track from the animation can be modelled by Diagram 1 below. There are six semi-circles with radius r and two straight line sections of length $4r$.

Given that the total length of the track is 15 km, **show that** the radius r of the semi-circle is 560 m to the nearest 10 metres.

Diagram 1



Question 4c (3 marks)

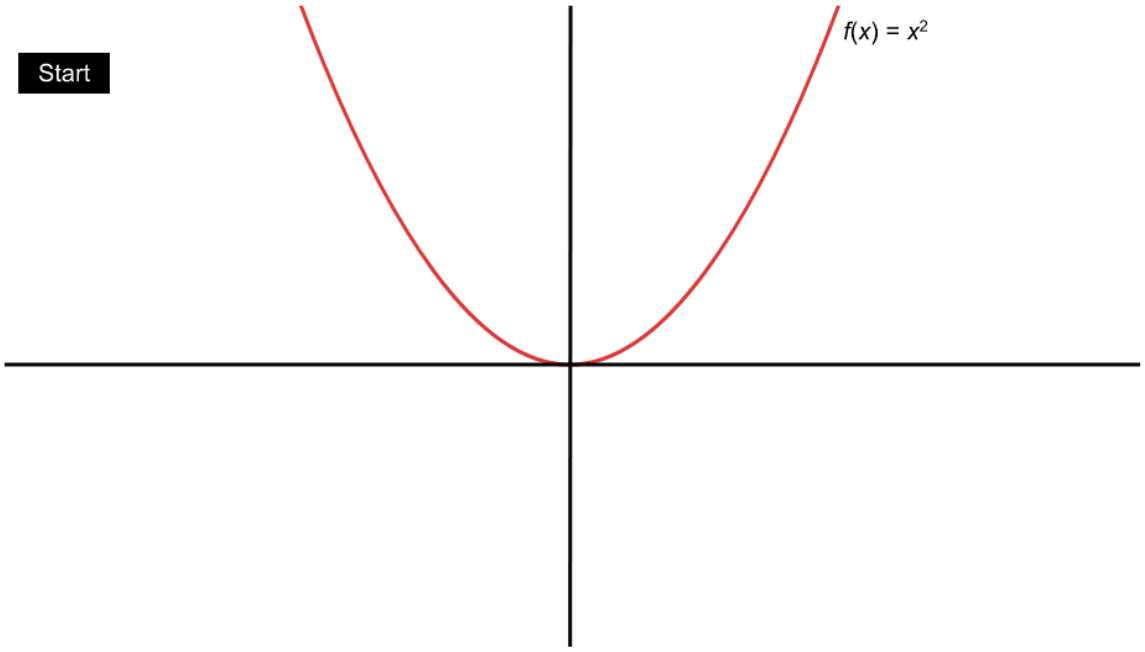
Diagram 2

The layout of the race track has inspired a company to create a logo in a similar shape. Diagram 2 is an example of the use of the logo. **Find** the area of the logo when r is 5 mm.

B I U x_2 x^2 Ω Σ Styles

This media is interactive

Start

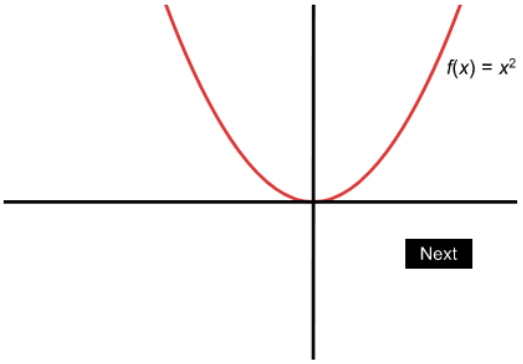


©

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

Question 5a (4 marks)

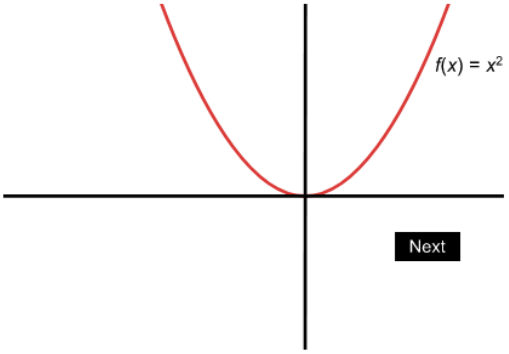
This media is interactive



Transformation 1:

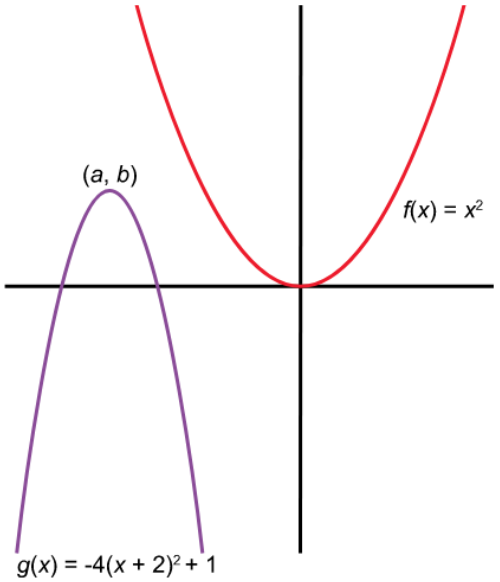
Transformation 2:

This media is interactive



Transformation 3:

Transformation 4:



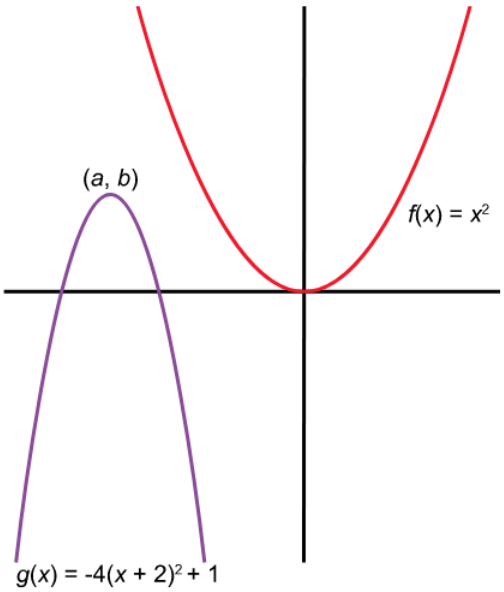
Question 5b (1 mark)

Write down the values of a and b of the function $g(x)$.

$a =$ $b =$

Question 5c (4 marks)

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



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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.

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.

Question 6b (2 marks)

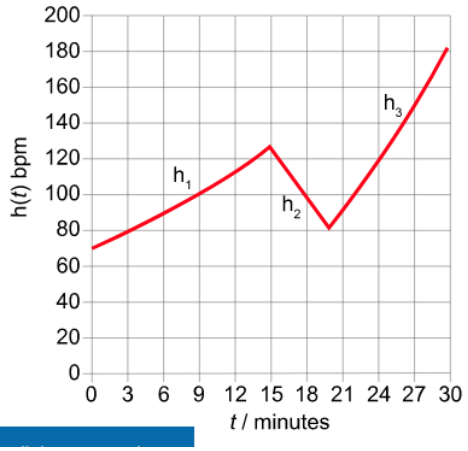
Research has shown that physical exercise is most effective when the heart rate reaches 80 % of the maximum heart rate and this should be maintained for 15 minutes.

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

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

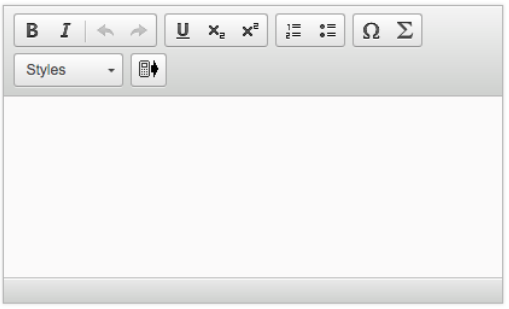
The changes in heart rate during the exercise are modelled by the function shown below, where t is the elapsed time from the beginning of the exercise, in minutes and h(t) is the heart rate, in bpm.

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



Question 6c (1 mark)

Write down the number of times the heart rate was 100 bpm during the 30 minutes of exercise.



Question 6d (3 marks)

t	h(t)	
$0 \le t \le 15$	$h(t) = 70 \times (1.04)^t$	h_1
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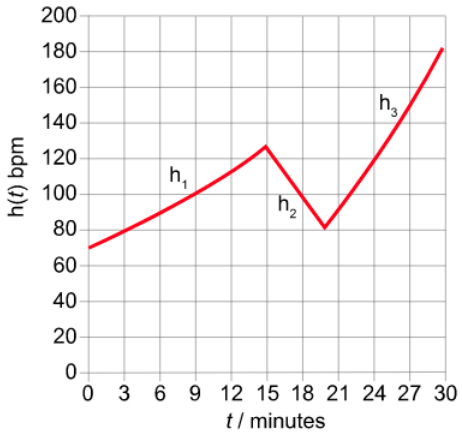
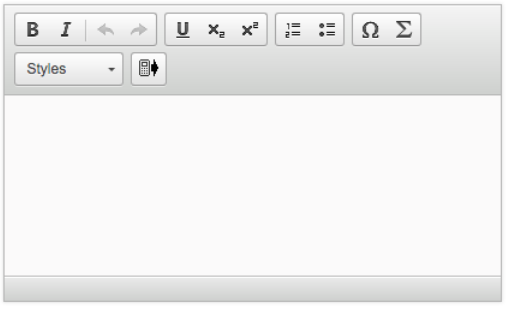


Question 6d (3 marks)

Calculate the heart rate after 11 minutes of training. Give your answer to the nearest beat.



Question 6e (3 marks)

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

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.

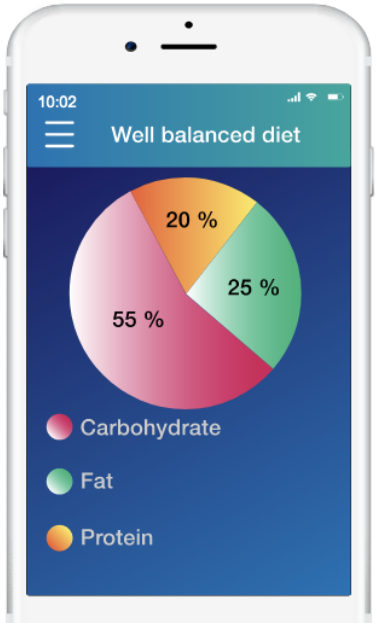
When nutrients and energy are balanced our bodies perform at their best and an imbalance of nutrients and energy can lead to poor performance.

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

Question 7a (2 marks)

This media is interactive

Hover over the pie chart sectors for details



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

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

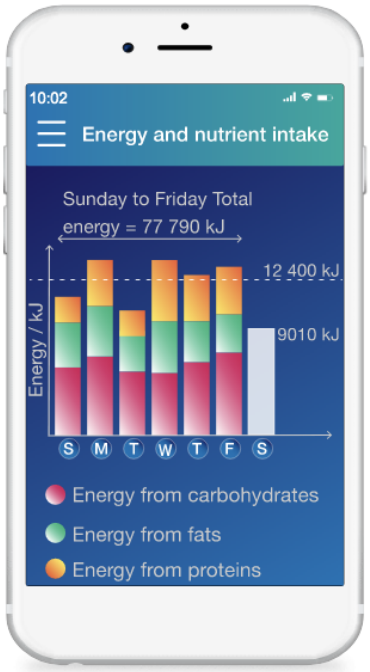
Gerry is a 16-year-old boy. He wants to divide his daily intake of energy over three meals in the following ratio:

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.

Question 7c (2 marks)

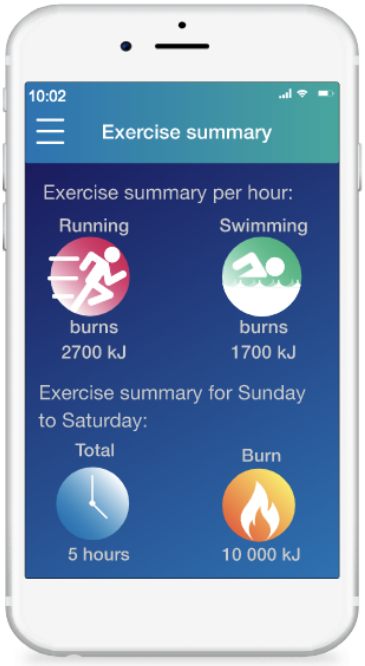
The bar chart shows Gerry's energy and nutrient intake over six days, Sunday to Friday. The total intake of energy is 77 790 kJ. He knows that the average intake per day should be 12 400 kJ.



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

Styles

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



Scroll down to continue

Question 7d (2 marks)

An equation relating the number of hours running (r) and the number of hours swimming (s) can be written as $r + s = 5$. Based on the information in the infographic, **write down** another equation relating r and s.

Styles

Question 7e (4 marks)

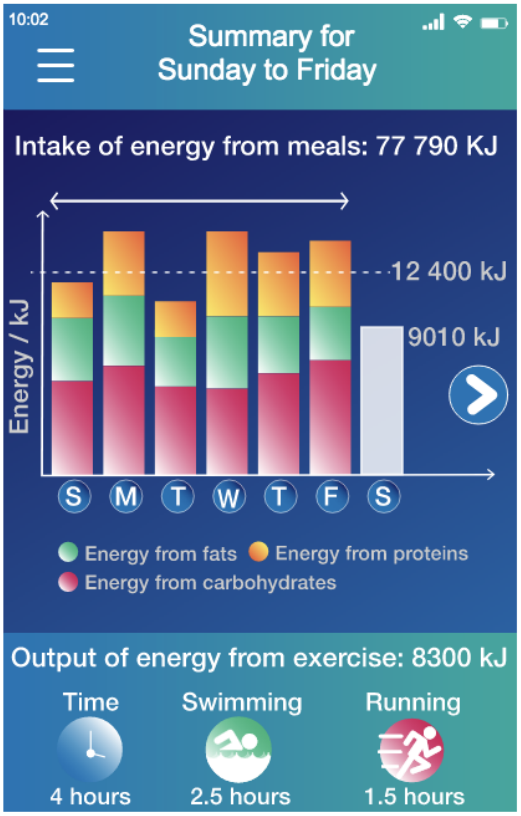
Hence, **find** the number of hours of running (r) and number of hours of swimming (s) that will allow Gerry to achieve his goal of burning exactly 10 000 kJ.

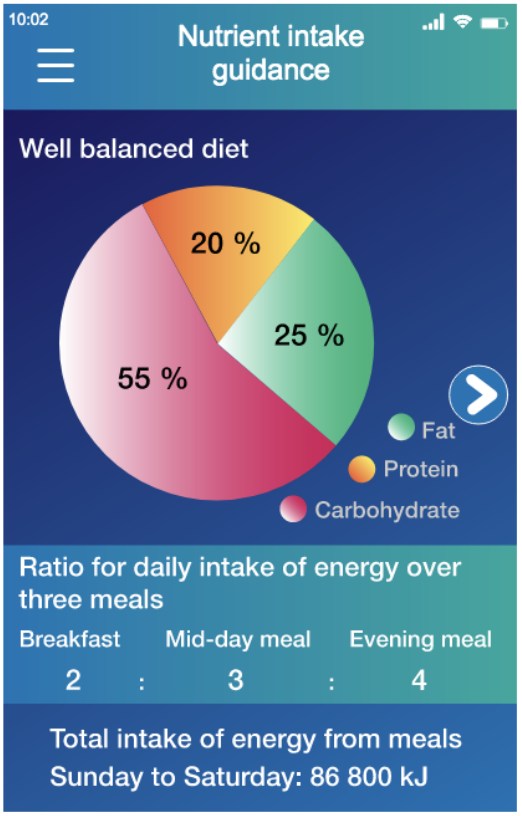
Question 7f (10 marks)

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.





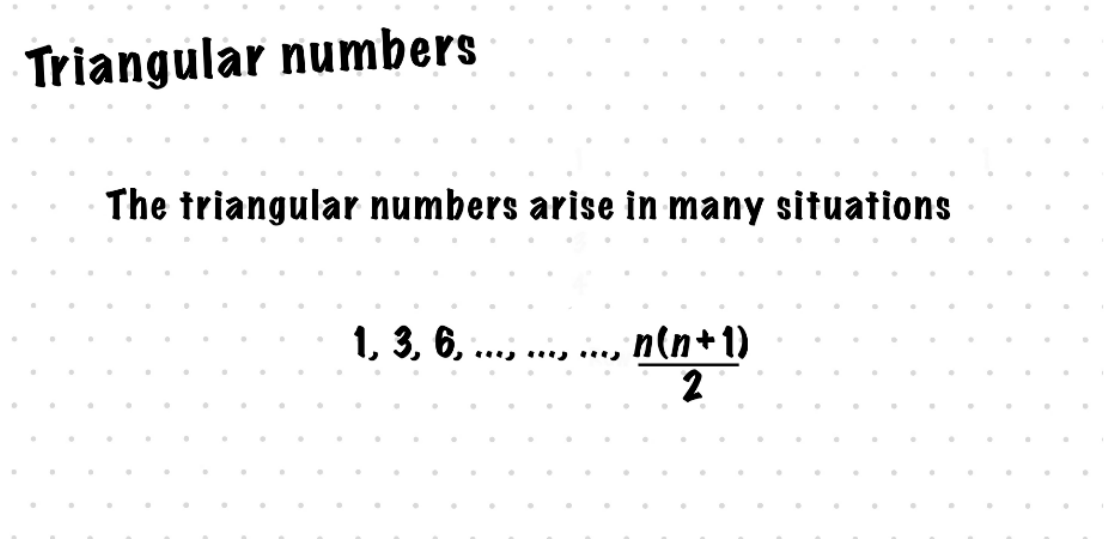
Evaluate Gerry's progress towards a healthy lifestyle. Use the information provided in the mobile app. In your answer, you should:

- 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.

Question 8 (31 marks)

The following animation shows patterns in triangular numbers.

This media contains no audio



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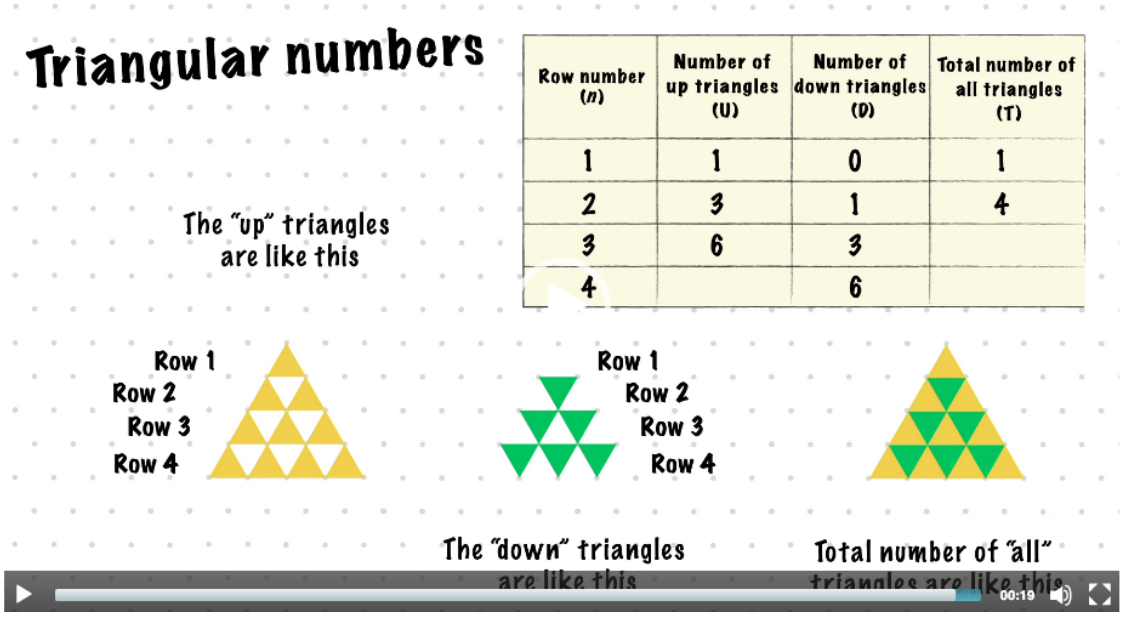


Row number (n)	Number of up triangles (U)	Number of down triangles (D)	Total number of all triangles (T)
1	1	0	1
2	3	1	4
3	6	3	
4		6	

Below is an example of the Up triangles and the Down triangles.

©

Question 8a (2 marks)

The table below is populated with some of the results.

Write down the missing values in the table up to row 5.

Row number (n)	Number of up triangles (U)	Number of down triangles (D)	Total number of all triangles (T)
1	1	0	1
2	3	1	4
3	6	3	
4		6	
5			

Reset

Question 8b (3 marks)

Describe in words three patterns you see in the table.

B I U x_2 x^2 Ω Σ Styles

Question 8c (1 mark)

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

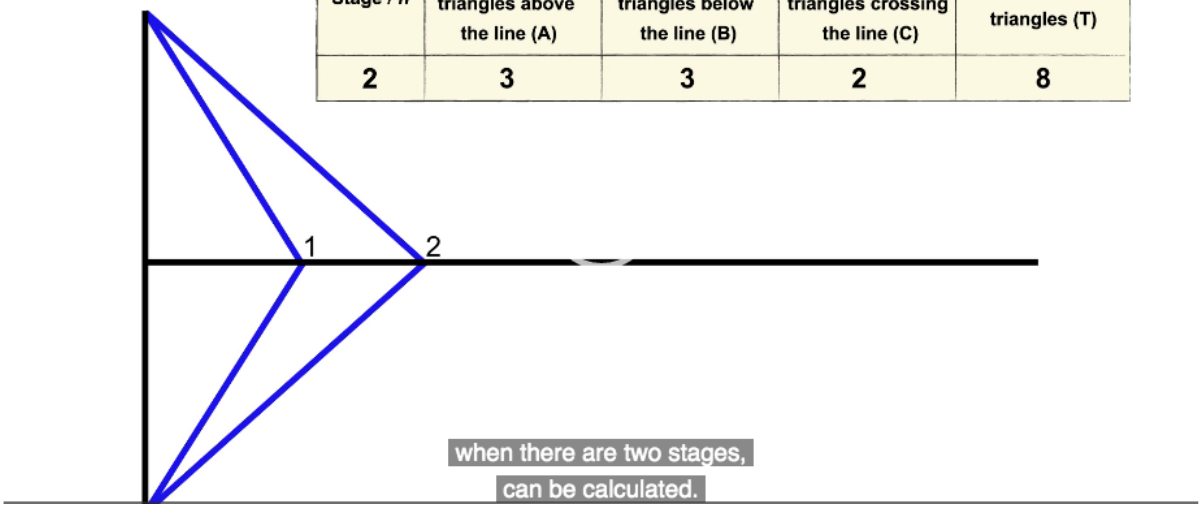
Question 8d (3 marks)

Verify your general rule for T.

Video Script

The following video shows a systematic method for counting triangles from a diagram.

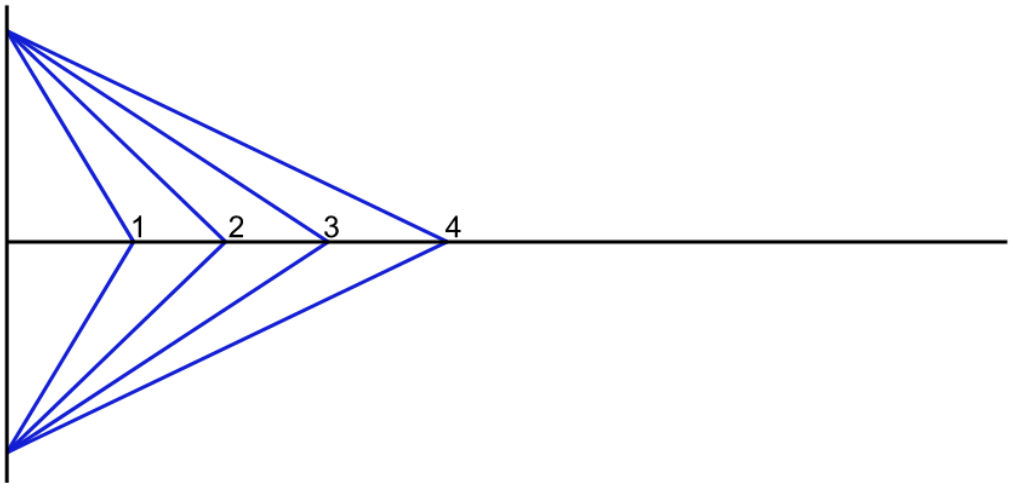
Stage / *n*	Number of triangles above the line (A)	Number of triangles below the line (B)	Number of triangles crossing the line (C)	Total number of triangles (T)
2	3	3	2	8



Question 8e (22 marks)

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

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



Stage (n)	Number of triangles above the line (A)	Number of triangles below the line (B)	Number of triangles crossing the line (C)	Total number of triangles (T)	
1	1	1	1	3	
2	3	3	2	8	
3	6	6	3	15	
4	10				
5					
6					