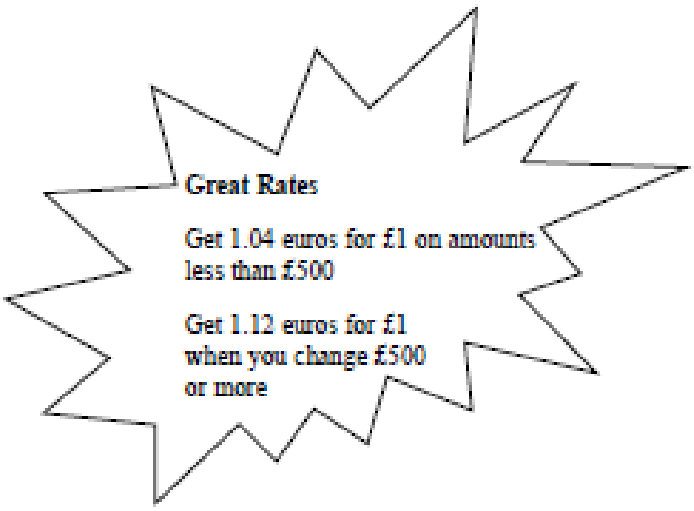
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Mr and Mrs Sharma are going to France.

They each have £300 which they want to change into euros.
They see this deal in a bank.



Mr and Mrs Sharma want the best deal.

They put their money together before changing it into euros.

How much extra money do they get by putting their money together before they change it?

Same as Q1 on Draft SAMs

(Total for Question 1 is 3 marks)

2 Stephen throws a fair dice until he gets a six.
Work out the probability that Stephen throws the dice

(i) exactly once

(ii) exactly twice

(iii) more than twice.

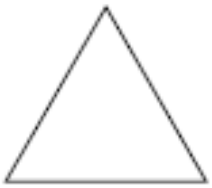
(Total for Question 2 is 4 marks)

Same as Q2 on Draft SAMs

3 Here are a square and an equilateral triangle.

The length of a side of the square is x cm.

The length of a side of the equilateral triangle is 2 cm more than the length of a side of the square.



The perimeter of the square is equal to the perimeter of the equilateral triangle.

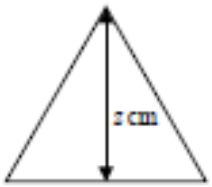
(a) Work out the perimeter of the square.

(3)

Here are the same square and the same equilateral triangle.

The length of the diagonal of this square is y cm.

The height of this equilateral triangle is z cm.



(b) Which has the greater value, y or z?

Same as Q3 on Draft SAMs

(4)

(Total for Question 3 is 7 marks)

4 Linda keeps chickens.
She sells the eggs that her chickens lay.

She has 140 chickens.
Each chicken lays 6 eggs a week.

Linda gives each chicken 100 g of chicken feed each day.
The chicken feed costs £6.75 for a 25 kg bag.

Work out the cost of the chicken feed for every 12 eggs.

Same as Q4 on Draft SAMs

(Total for Question 4 is 5 marks)

5 Bella invests £5000 in an account for two years.
The account pays 3% compound interest per annum.

Bella has to pay 20% tax on the interest earned each year.
This tax is taken from the account at the end of each year.

How much money will Bella have in her account at the end of the two years?

Based on Q5 on Draft SAMs

5 Bella invests £5000 in an account for 2 years.
The account pays 3% compound interest per annum.

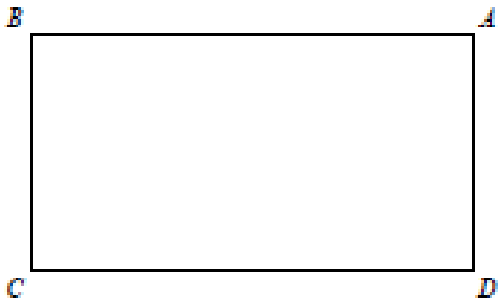
Bella has to pay 20% tax on the interest earned each year.
This tax is taken from the account at the end of each year.

Bella says that at the end of the 2 years, she will have at least £5250 in this account.
Is Bella correct?
You must show all your working.

(Total for Question 5 is 4 marks)

r Question 5 is 4 marks)

6 The diagram shows a rectangle $ABCD$.



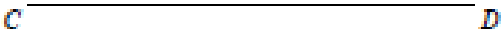
In the space below, use a ruler and a pair of compasses to construct a right-angled triangle equal in area to the area of the rectangle $ABCD$.

You must show all your construction lines.

The base of the triangle, which is equal in length to the side CD, has been drawn for you.

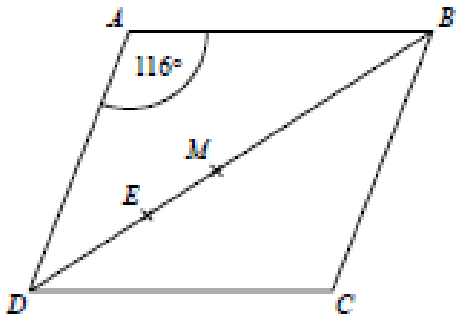
Same as Q6 on Draft SAMs

The line "you must show all your construction lines" has been added



(Total for Question 6 is 3 marks)

7



ABCD is a rhombus.
M is the midpoint of *BD*.
E is the point on *BD* such that *DE* = *CE*.

Calculate the size of angle *MCE*.

Same as Q7 on Draft SAMs

(Total for Question 7 is 3 marks)

8 A school has a biathlon competition.
Each athlete has to throw a javelin and run 200 metres.

(a) The points scored for throwing a javelin are worked out using the formula

$$P_1 = 16(D - 3.8)$$

where P_1 is the number of points scored when the javelin is thrown a distance D metres.

(i) Lottie throws the javelin a distance of 42 metres.
How many points does Lottie score?

(ii) Ingrid scores 584 points for throwing the javelin.
Work out the distance that the javelin was thrown by Ingrid.

The points scored for running 200 metres are worked out using the formula

$$P_2 = 5(42.5 - T)^2$$

where P_2 is the number of points scored when the time taken to run 200 metres is T seconds.

Suha scores 1280 points in the 200 metres.

(b) (i) Work out the time, in seconds, it took Suha to run 200 metres.

The formula for the number of points scored in the 200 metres should not be used for $T > n$.

(ii) State the value of n.
Give a reason for your answer.

(4)

(4)

(Total for Qu

Same as Q8 on Draft SAMs

9 Triangle ABC has a right angle at C.

Angle $BAC = 48°$.
$AB = 9.3$ cm.

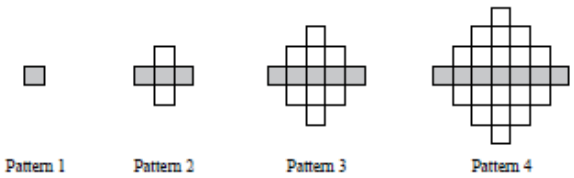
Calculate the length of BC.

(Total for Question 9 is 3 marks)

Same as Q9 on Draft SAMs

Same as Q10 on Draft SAMs

10 The diagrams show a sequence of patterns made from grey tiles and white tiles.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

The number of grey tiles in each pattern forms an arithmetic sequence.

(a) Find an expression, in terms of n, for the number of grey tiles in Pattern n.

(2)

The **total** number of grey tiles and white tiles in each pattern is always the sum of the squares of two consecutive whole numbers.

(b) Find an expression, in terms of n, for the **total** number of grey tiles and white tiles in Pattern n.
Give your answer in its simplest form.

(3)

(c) Is there a pattern for which the total number of grey tiles and white tiles is 231?
Give a reason for your answer.

(2)

The total number of grey tiles and white tiles in any pattern of this sequence is always an odd number.

(d) Explain why.

(2)

(Total for Question 10 is 9 marks)

11 Alfred studies animal populations on an island.

The size of an animal population at the start of 2014 was 2500.

The size of this animal population increases exponentially.

Alfred assumes that the rate of increase is 20% per year.

(a) Using his assumption, work out the size of this animal population at the start of 2009.

(3)

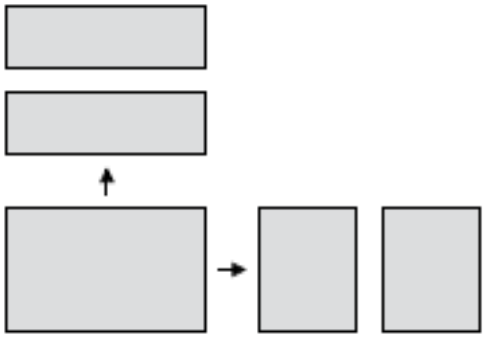
(b) Alfred's assumption is too high. Explain how your answer to part (a) is affected.

NEW

(1)

(Total for Question 11 is 4 marks)

12 A rectangular sheet of paper can be cut into two identical rectangular pieces in two different ways.



When the original sheet of paper is cut one way, the perimeter of each of the two pieces is 50 cm.

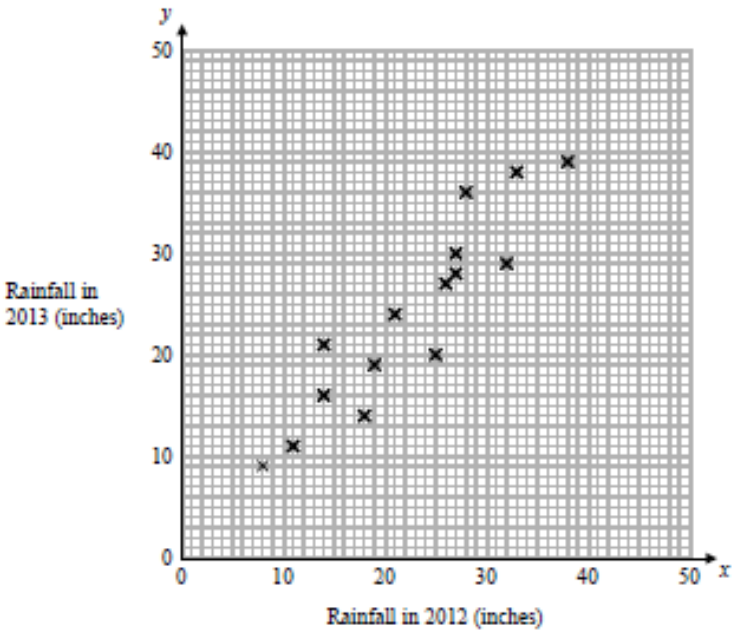
When the original sheet of paper is cut the other way, the perimeter of each of the two pieces is 64 cm.

What is the perimeter of the original sheet of paper?

Same as Q12 on Draft SAMs

(Total for Question 12 is 5 marks)

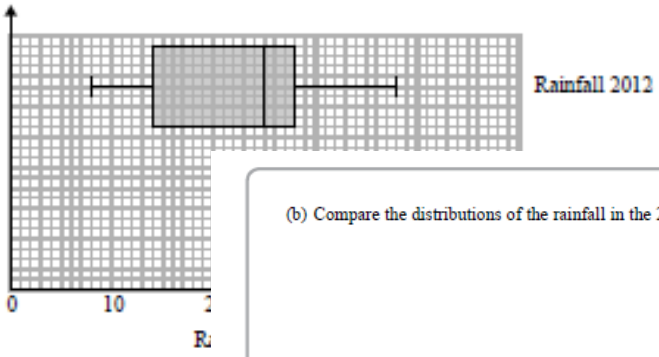
13 The scatter graph gives information about the rainfall, in inches, in 2012 and the rainfall, in inches, in 2013 for each of 15 countries.



(Source: data.worldbank.org)

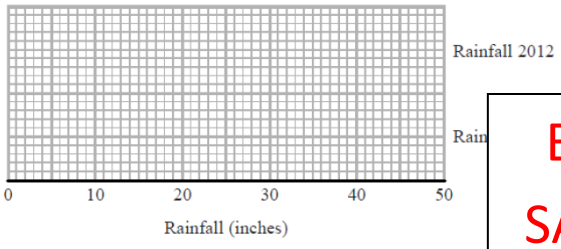
The box plot for the rainfall in 2012 for the 15 countries is drawn on the grid below.

(a) On the same grid, draw the box plot for the rainfall in 2013 for the 15 countries.



(b) Compare the distributions of the rainfall in the 2 years.

(a) On the grid below, draw a box plot for the rainfall in 2012 and a box plot for the rainfall in 2013



(2)

(Total for Question 13 is 5 marks)

Based on Q13 on Draft SAMs (b) now includes 1 box plot

14 The quantity of heat, H calories, delivered by an electric current, I amps, acting for t seconds to heat an amount of water is given by the formula

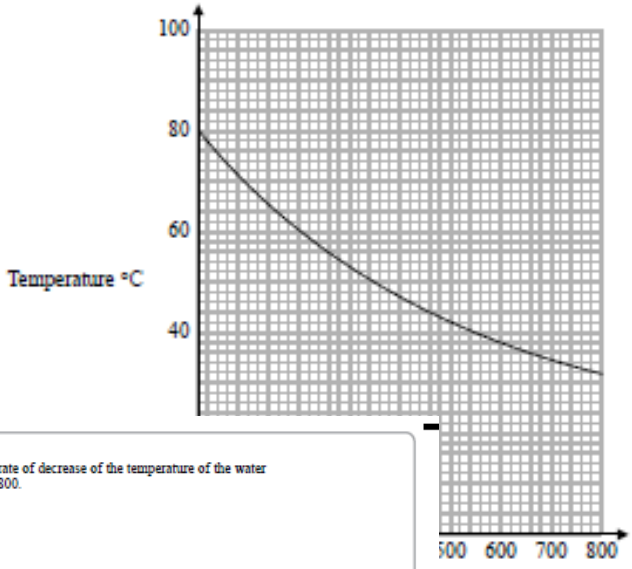
$$H = atI^2 - b$$

where a and b are constants.

(a) Rearrange the formula to make I the subject.

(2)

The graph gives information about the variation in the temperature, in °C, of an amount of water that is allowed to cool from 80 °C.



(b) (i) Work out the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.

The instantaneous rate of decrease of the temperature of the water at time T seconds is equal to the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.

(ii) Find an estimate for the value of T.
You must show how you got your answer.

(4)

(Total for Question 14 is 6 marks)

Same as Q14 on Draft SAMs BUT now worth 6 marks (not 7)

15 (a) Prove that the recurring decimal $0.\dot{1}\dot{5}$ has the value $\frac{5}{33}$

(2)

(b) $x = \frac{1}{2^{183} \times 5^{180}}$

Show that, when x is written as a terminating decimal, there are 180 zeros after the decimal point.

The reciprocal of any prime number p (where p is neither 2 nor 5) when written as a decimal, is always a recurring decimal.

A theorem in mathematics states

The period of a recurring decimal is the least value of n for which p is a factor of $10^n - 1$

Hugo tests this theorem.

He uses his calculator to show that 37 is a factor of $10^3 - 1$

Hugo then makes this statement,

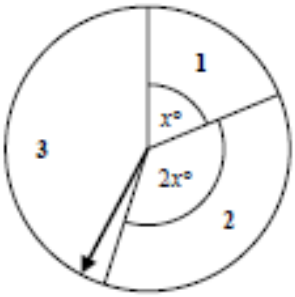
"The period of the recurring decimal equal to the reciprocal of 37 is 3 because 37 is a factor of $10^3 - 1$. This shows the theorem to be true in this case."

(c) Explain why Hugo's statement is incomplete.

(2)

Same as Q15 on Draft SAMs

16



Here is a spinner.
When the arrow is spun once, a 1 or a 2 or a 3 can be scored.

Bill is going to spin the arrow twice.
He will work out his total score by adding the two scores he gets on the two spins.

The probability that he will get a total score of 4 is $\frac{16}{81}$

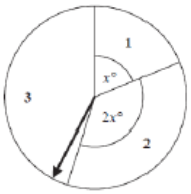
Assuming that the thickness of the three lines between the sectors may be ignored,

Work out the value of x.

(Total for Question 16 is 5 marks)

Based on Q16 on Draft SAMs

16



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Work out the value of x.

(Total for Question 16 is 5 marks)

THESE QUESTIONS HAVE BEEN REMOVED:

11 The population of animals on an island increases exponentially from the start of the year 2010 at a rate of 20% per year.

At the end of 5 years the size of the population was 2500

Work out the size of the population at the start of 2010

(Total for Question 11 is 3 marks)