1 Ashten chooses three different whole numbers between 1 and 50

The first number is a prime number.
The second number is 4 times the first number.
The third number is 6 less than the second number.

The sum of the three numbers is greater than 57

Find the three numbers.

Same as Q1 on Draft SAMs

(Total for Question 1 is 3 marks)

2 Given that $3(x - c) = 2x + 5$ where c is an integer,

show that x cannot be a multiple of six.

(Total for Question 2 is 3 marks)

Same as Q2 on Draft SAMs

3 Jane made some almond biscuits which she sold at a fête.

She had:

5 kg of flour
3 kg of butter
2.5 kg of icing sugar
320 g of almonds

Here is the list of ingredients for making 24 almond biscuits.

Ingredients for 24 almond biscuits
150 g flour
100 g butter
75 g icing sugar
10 g almonds

Jane made as many almond biscuits as she could, using the ingredients she had.

(a) Work out how many almond biscuits she made.

(3)

Jane sold 70% of the biscuits she made for 25p each.
She sold the other 30% at 4 for 55p.

The ingredients Jane used cost her £45 and the total of all other costs was £27

(b) Work out the percentage profit.

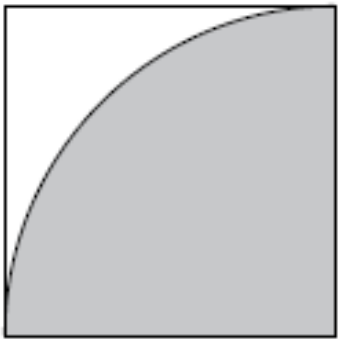
(6)

(Total for Question 3 is 9 marks)

Same as Q3 on Draft SAMs

4 The diagrams show two identical squares.

A



B

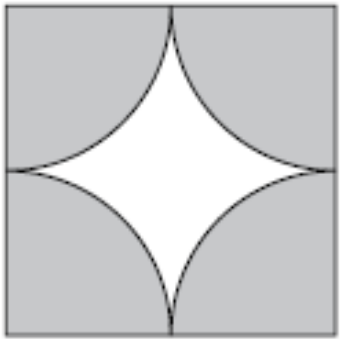


Diagram **A** shows a quarter of a circle shaded inside the square.
Diagram **B** shows four identical quarter circles shaded inside the square.

Show that the area of the region shaded in diagram **A** is equal to the area of the region shaded in diagram **B**.

Same as Q4 on Draft SAMs

(Total for Question 4 is 3 marks)

5 Here is part of a map showing the position of a port A.

B is a lighthouse 36 km from A on a bearing of 050°

(a) (i) Construct a diagram to show the position of B.
Use a scale of 1 cm represents 4 km.

(ii) Write down the bearing of A from B.

(3)

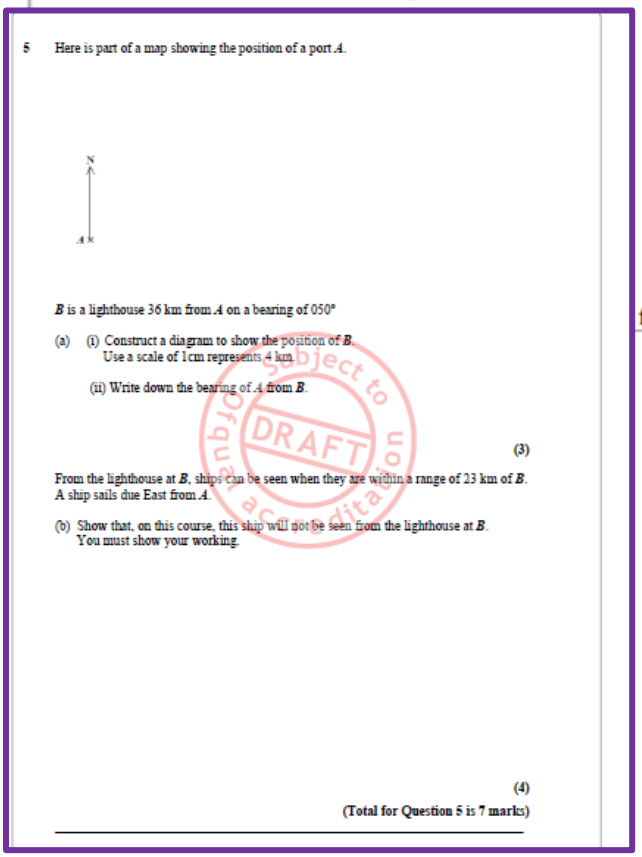
From the lighthouse at B, ships can be seen when they are within a range of 23 km of B.
A ship sails due East from A.

(b) Show, **by calculation**, that on this course this ship will not be seen from the lighthouse at B.

You must not use a scale drawing.

(4)

(Total for Question 5 is 7 marks)



5 Here is part of a map showing the position of a port A.

N
A

B is a lighthouse 36 km from A on a bearing of 050°

(a) (i) Construct a diagram to show the position of B.
Use a scale of 1 cm represents 4 km.

(ii) Write down the bearing of A from B.

(3)

From the lighthouse at B, ships can be seen when they are within a range of 23 km of B.
A ship sails due East from A.

(b) Show that, on this course, this ship will not be seen from the lighthouse at B.
You must show your working.

(4)

(Total for Question 5 is 7 marks)

Based on Q5 on Draft SAMs

6 The nth term of an arithmetic sequence is $3n + 2$ where n is a positive integer.

(a) Determine whether 93 is a term in this arithmetic sequence.

(2)

(b) Find an expression for the sum of the nth term and the $(n + 1)$th term of this sequence. Give your answer in its simplest form.

(2)

The sum of two consecutive terms in this sequence is 91

(c) Find the smaller of these two terms.

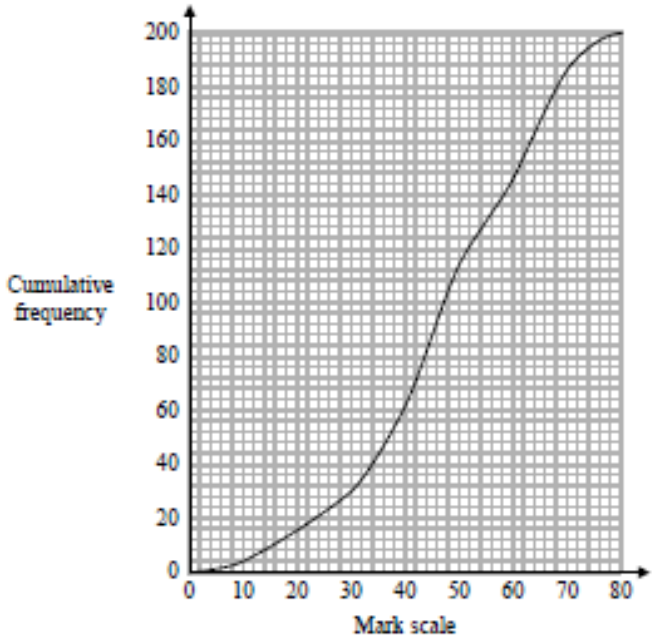
(2)

(Total for Question 6 is 6 marks)

Same as Q6 on Draft SAMs

7 A teacher recorded the marks that 200 students got in an exam.

He produced a grouped frequency table with class intervals of width 10 marks.
He then drew this cumulative frequency graph.



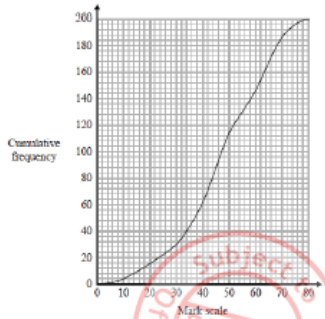
The maximum possible mark for the exam was 80
Any student with more than 72% of the marks got a grade A.

(i) Calculate an estimate of the number of students who got a grade A.

that could affect your answer to part (i).

(Total for Question 7 is 4 marks)

7 A teacher recorded the marks that 200 students got in a French exam.
He produced a grouped frequency table with class intervals of width 10 marks.
He then drew this cumulative frequency graph.



The same 200 students took an English exam.
The median mark for the English exam, as a percentage of the total number of marks was 55%.

The maximum possible mark for the French exam was 80

Keith claims that the median mark, as a percentage of the total number of marks for the exam, was higher in the French exam than in the English exam.

(i) Use the cumulative frequency diagram to investigate Keith's claim.

(ii) Explain one assumption you have made that could affect your answer to part (i).

(Total for Question 7 is 3 marks)

Based on Q7 on Draft SAMs

BUT now worth 4 marks (not 3)

Based on Q8 on Draft SAMs

ONLY (a) changed

8 (a) Expand and simplify $x(x + 1)(x - 1)$

(2)

In a list of three consecutive positive integers at least one of the numbers is even and one of the numbers is a multiple of 3

n is a positive integer greater than 1

(b) Prove that $n^3 - n$ is a multiple of 6 for all possible values of n.

(2)

$2^{61} - 1$ is a prime number.

(c) Explain why $2^{61} + 1$ is a multiple of 3

(2)

(Total for Question 8 is 6 marks)

8 (a) Show that $x^3 - x \equiv x(x + 1)(x - 1)$

(2)

9 The diagram shows the cross-section of the water in a drainage channel.

The cross-section is in the shape of a trapezium with one line of symmetry.

The base of the drainage channel is horizontal.
The two equal sides of the trapezium are each inclined at 45° to the horizontal.

The length of the base of the trapezium is 3 metres.
The depth of the water is d metres.

The area of the cross-section is A m^2.

(a) Write a formula for A in terms of d.
Give your answer in its simplest form.

Same as Q9 on Draft SAMs

(3)

The depth of the water in the drainage channel is 1.5 metres.

(b) Find the area of the cross-section of the water.

The water flows along the drainage channel at a rate of 486 000 litres per minute.
The depth of the water is constant.

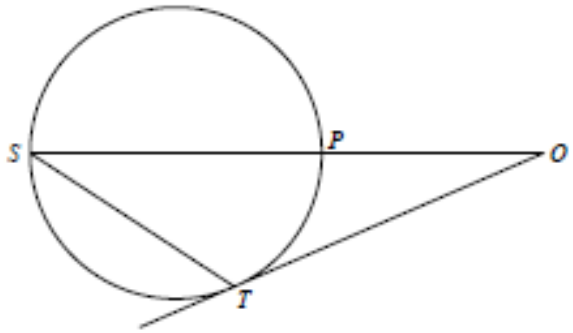
(c) Work out the speed of the water.
Give your answer in metres per second.

(2)

(4)

(Total for Question 9 is 9 marks)

10



In the diagram, P, S and T are points on the circumference of a circle.

O is the point such that

OPS is a straight line.

OT is a tangent to the circle.

Prove that triangle OPT is similar to triangle OTS.

Same as Q10 on Draft SAMs

NOT now worth 3 marks (not 4)

(Total for Question 10 is 3 marks)

11 There are 80 students at a language school.

All 80 students speak at least one language from French, German and Spanish.

9 of the students speak French, German and Spanish.
19 of the students speak French and German.
28 of the students speak French and Spanish.
17 of the students speak Spanish and German.
45 students speak French.
50 students speak Spanish.

(a) Draw a Venn diagram to show this information.

Same as Q11 on Draft SAMs

NOT now worth 6 marks (not 5)

(3)

One of the 80 students is selected at random.

(b) Find the probability that this student speaks German but not Spanish.

(1)

Given that the student speaks German,

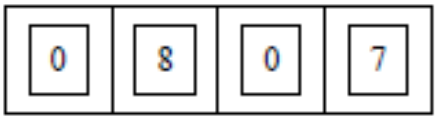
(c) find the probability that this student also speaks French.

(2)

(Total for Question 11 is 6 marks)

12 Pavel has a combination lock.

Pavel has to set each part of the lock to a digit between 0 and 9 inclusive.
One possible way to do this is shown in the diagram.



(a) How many different ways can Pavel do this?

(2)

Pavel decides that the 1st and 3rd digits will be odd numbers and that the 2nd and 4th digits will be even numbers greater than 0.

(b) How many different ways are possible now?

(2)

(Total for Question 12 is 4 marks)

Same as Q12 on Draft SAMs

Except the name have changed to Pavel!

13 **C** is the curve with equation $y = x^2 - 4x + 4$

L is the straight line with equation $y = 2x - 4$

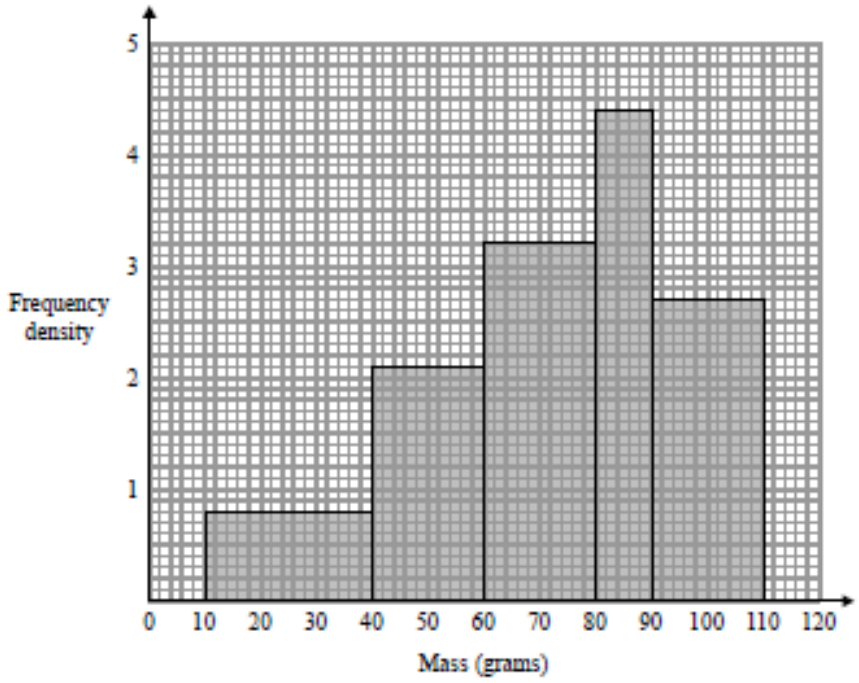
L intersects **C** at two points, A and B.

Calculate the exact length of AB.

Same as Q14 on Draft SAMs

(Total for Question 13 is 6 marks)

14 A biologist is studying the effects of global warming on animal size.
The histogram gives information about the masses of a species of snail in a sample he took in 2013 from a large lake.



The mean mass of the same species of snail taken from the lake in 2003 was 75 grams.

(a) Is there any evidence to support the hypothesis that the mass of this species of snail has decreased?

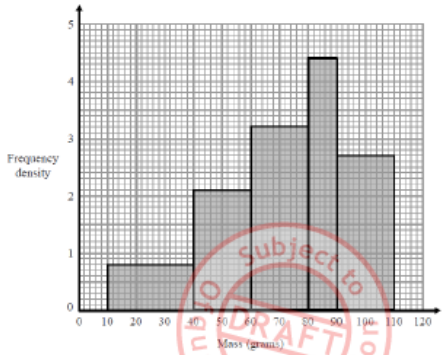
(5)

the mode is from this histogram.

(1)

(Total for Question 14 is 6 marks)

15 A biologist is studying the effects of global warming on animal size.
The histogram gives information about the masses of a species of snail in a sample he took in 2013 from a large lake.



The mean mass of the same species of snail taken from the lake in 2003 was 75 grams.
Is there any evidence to support the hypothesis that the mass of this species of snail has decreased?

(Total for Question 15 is 4 marks)

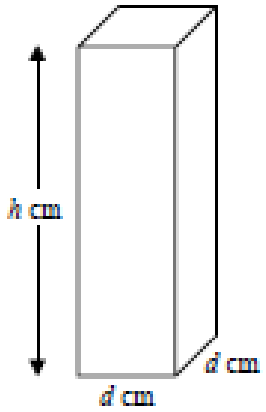
Based on Q15 on Draft SAMs BUT now worth 6 marks (not 4)

15 Here is a solid bar made of metal.

The bar is in the shape of a cuboid.
The height of the bar is h cm.
The base of the bar is a square of side d cm.

The mass of the bar is M kg.

$d = 8.3$ correct to 1 decimal place.
$M = 13.91$ correct to 2 decimal places.
$h = 84$ correct to the nearest whole number.



Find the value of the density of the metal to an appropriate degree of accuracy.
Give your answer in g/cm^3.

You must explain why your answer is to an appropriate degree of accuracy.

Same as Q16 on Draft SAMs

(Total for Question 15 is 5 marks)

THE FOLLOWING HAVE BEEN REMOVED:

13 Here is a result used in physics.

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

Given that $0 < u < f$

determine whether v is positive or negative.

You must show how you got your answer.

(Total for Question 13 is 3 marks)