

# MATHS CHALLENGE

## KS4



**This Book Belongs to**

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## WELCOME TO LEEDS CASTLE

There are 5 sections in this booklet and they are not linked. Although they follow the standard visitor route, you can complete them in any order you want.

Section 1 The Princess Alexandra Garden

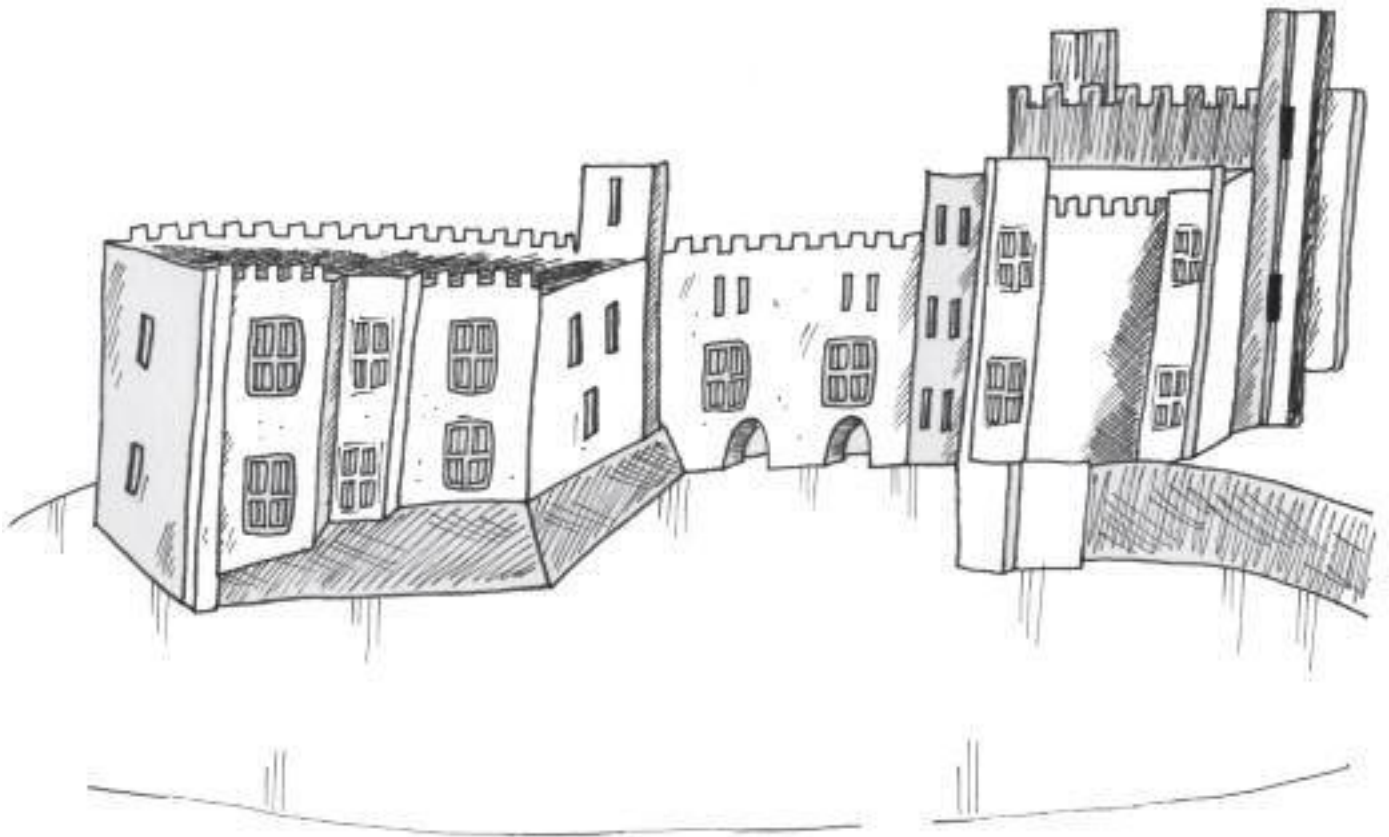
Section 2 The Mill & outside the Castle

Section 3 Inside the Castle

Section 4 The Culpeper Garden, Maze & Grotto

Section 5 Stand Alone Questions

The back page is blank for calculations.



### Staying safe

Leeds Castle is set in 500 acres of parkland, which has a variety of wildlife inhabitants. It is a visitor attraction with lots of water in the grounds. Please do not touch any of the wildlife, they may bite and please stay away from the water, it's very cold if you fall in

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 1

### THE PRINCESS ALEXANDRA GARDEN

Leeds Castle sits in 500 acres of land, which includes the Princess Alexandra Garden, the Culpeper Garden, the Lady Baillie Garden as well as several stretches of water from small streams to the Great Lake, not forgetting the Castle Moat!

When you have gone through Ticket Check, walk to the bridge over the stream. Once over the bridge, look to your left where you will see .....

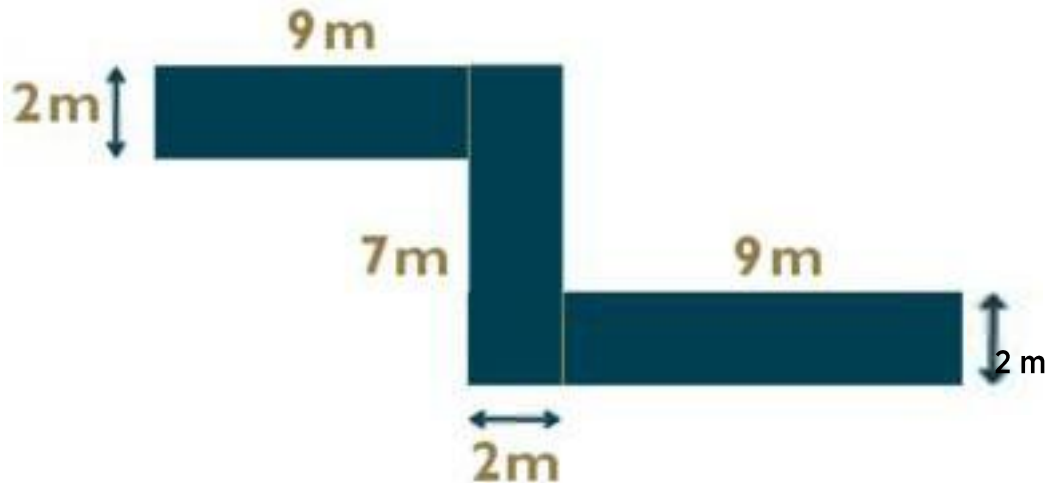


The Footbridge

Go to the middle, from here you will get your first sight of the castle. This bridge was rebuilt in 2010 by the 70 Gurkha Field Support Squadron.

- 1) Work out the decking area of the bridge.

Answer .....



- 2) If decking costs £15 per  $m^2$  how much would the materials cost to resurface the bridge?

Answer: \_\_\_\_\_

## SECTION 2

### THE GREAT WATER OPPOSITE THE MILL



Ratty in the Wind in the Willows was not a rat, but a Water Vole.

Water vole numbers have declined dramatically. There has been a loss of 90% of the population over the past 3 decades, due mainly to predation from mink, pollution and loss of habitat. The water vole is now the most endangered mammal species in the UK.

Water voles are small animals that do not live for very long. They are very strong swimmers and can swim up to 500m on the surface or 15m underwater. They usually live in small family groups. They live in waterside burrows, which they dig in the banks of slow-flowing lowland rivers and canals, or ponds and streams – wherever the water level is constant. They are generally herbivores eating a large variety of bankside vegetation.

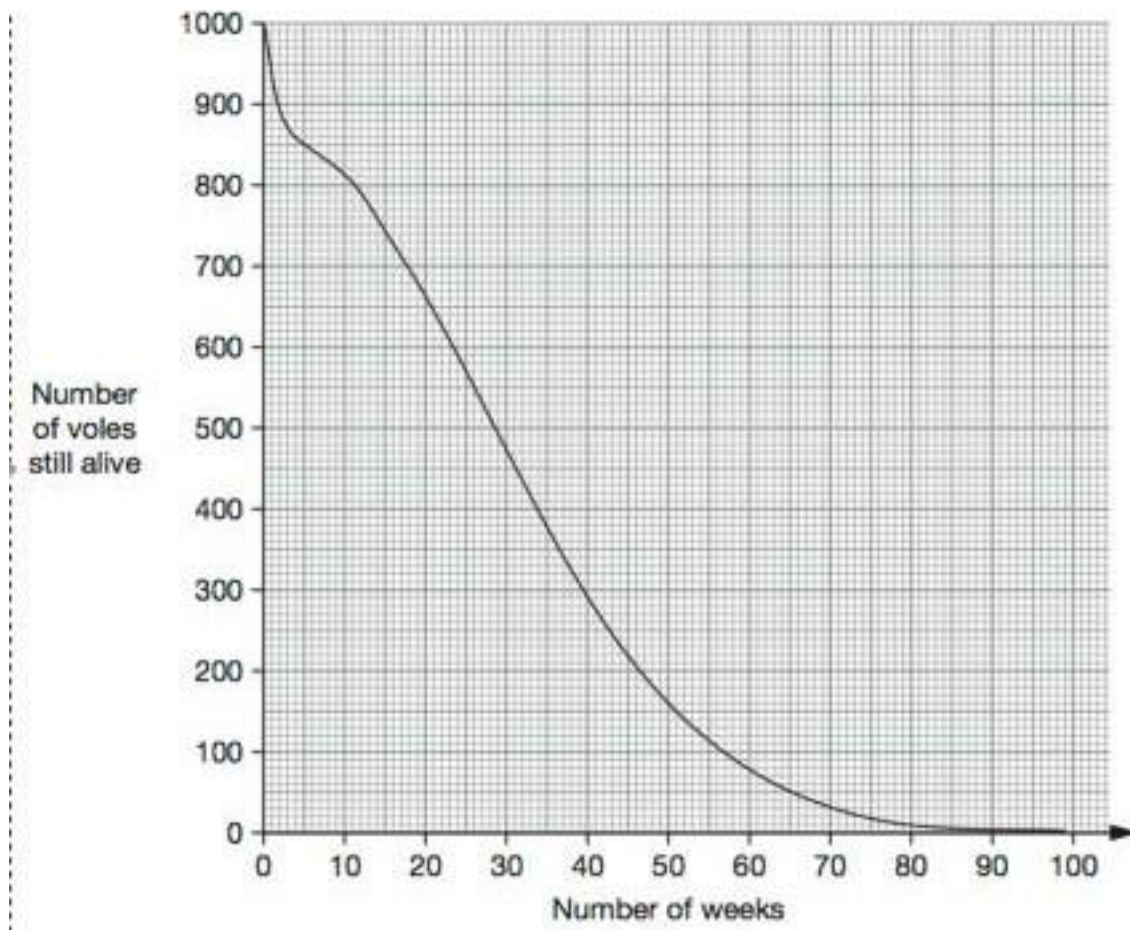
There are several key areas on the Leeds Castle Estate that have high populations of water vole and we are dedicated to their preservation.

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 2 CONT.

### THE GREAT WATER OPPOSITE THE MILL

In a recent study a scientist recorded data on 1000 voles that were born on the same day. The graph shows how many voles were still alive after a given number of weeks.



- 3) Using the graph estimate the probability that a water vole will live to be at least 20 weeks old.

Answer: \_\_\_\_\_

- 4) A water vole is 40 weeks old. Estimate the probability that it will live to be at least 50 weeks old.

Answer: \_\_\_\_\_

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 2 CONT.

### OUTSIDE THE CASTLE



Leeds Castle was originally the site of a manor built for the Royal Saxon Family. It was then a Norman stronghold, later becoming a Royal palace, and was for 300 years the home of Kings and Queens of England. In 1552 King Edward VI granted the Castle to Sir Anthony St Leger, thus commencing the 400 years of private ownership. A major rebuilding programme of the front part of the Castle was undertaken by the Wykeham Martin family and completed in 1823. One hundred years later the Castle was bought by an Anglo American heiress, Lady Baillie, who carried out a 2 year restoration programme on the Gloriette.

On her death, she bequeathed the Castle and its surrounding park to the Leeds Castle Foundation.

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 2 CONT.

### THE CASTLE

- 5) Using your knowledge of a Pythagorium triangle work out the approximate height of the twin towers at the front of the castle are.



Answer: \_\_\_\_\_

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 3

### THE LIBRARY

If the library is closed, feel free to miss this page out, however you should be able to answer the questions without setting foot in the room.

There are 3000 books in the library, made up from the collections of Lady Baillie and her father.

750 of the books are about interior design

900 are encyclopedias

300 are books of poetry

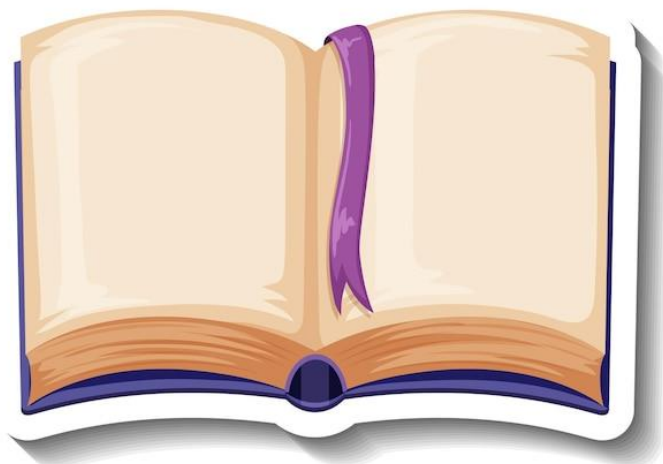
The rest belong to various other categories.

- 6) A) Imagine you pick a book at random, read it, then put it back. You then select a second book at random. What is the probability that you selected 2 poetry books?

Answer: \_\_\_\_\_

- B) If it took one week to read one book, how many years would it take to finish reading the entire library collection?

Answer: \_\_\_\_\_



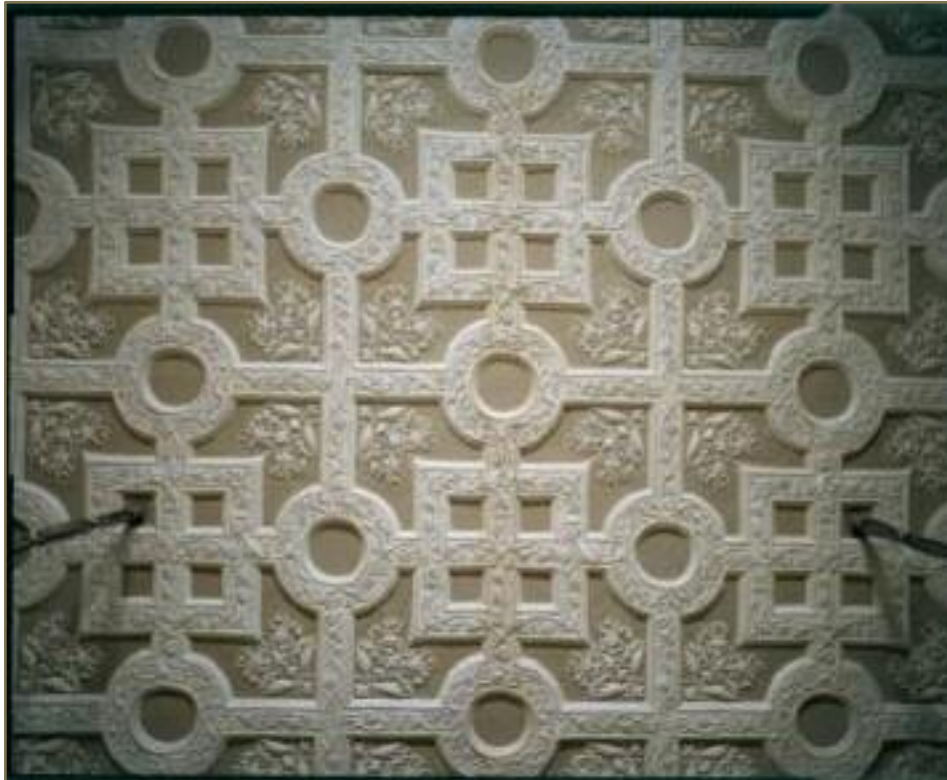


# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 3

### THE SERVANTS' QUARTERS

Look up to the ceiling where you will see a beautiful Jacobean strapwork\* ceiling. Lady Baillie's architect, Owen Little, introduced this in the 1920s. It was cast from moulds, which had been taken from originals dating from about 1620.



Admire the symmetry.

7) How many circles are there and how many squares? \*\*

Answer: \_\_\_\_\_

\*Strapwork

Decorative work, consisting of interlacing straplike bands, often used in low relief on ceilings, screens, and panels.

\*\* Clue - there are 4 smaller squares in each large square.

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 3 CONT.

### THE PRIVATE DINING ROOM

Lady Baillie used the Private Dining Room for entertaining on a more intimate scale. The servants who used an adjacent room to the right of the entrance serviced it.

Servants were an integral part of castle life. In the 1930s money was very different from today. Wages were paid in shillings (/-) and pence (d) and were much smaller amounts than you would expect to be paid today.

Twelve pence (12d) = 1 shilling (1/-) 20 shillings (20/-) = £1 (£1)

Conversion chart -

Old money	=	Today's currency
£1	=	£1
10/-	=	50p
5/-	=	25p
1/-	=	5p

8. Complete the chart below to work out the weekly wages in old shillings, new pence and the annual salary in pounds and new pence.

	Shillings per week	New pence per week	Annual salary in £ & p
Boot Boy		50p	
Hall Boy			£31.20p
Footman			£41.60
Maid	15/-		
Cook		85p	
Butler	19/-		

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 3 CONT.

### THE SALON

Walk through the next room until you arrive at The Salon.

This is where Lady Baillie hosted her extravagant parties. A lot of wine was drunk at the parties! Her staff knew to purchase twice as many bottles of wine as there were guests.

9 a) If one bottle of wine holds 750mls and Lady Baillie invited 125 guests to her party, how many litres of wine were needed?

Answer \_\_\_\_\_

9 b) 152 bottles of wine were left over after the party. How many litres of wine have been consumed?

Answer \_\_\_\_\_

9 c) Wine bottles come in crates of 12. How many crates must be ordered for the weekend, with a large party of 300 on Friday and a smaller party of 60 on Saturday?

Answer \_\_\_\_\_



# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 4

### THE CULPEPER GARDEN

The Culpeper garden occupies the site of the castle's kitchen garden. Russell Page transformed it in 1980 into a large cottage garden. It takes its name from the family, which owned the castle in the 17th century.

Each hedge is 3m x 3m x 2m



Look at the hedging along the path leading to the maze.

The truncated square pyramid is a special case of a pyramidal frustum for a square pyramid. Let the base and top side lengths of the truncated pyramid be  $a$  and  $b$ , and let the height be  $h$ . Then the volume of the solid is...  $V = \frac{1}{3}(a^2 + ab + b^2)h$ .

This formula was known to the Egyptians ca. 1850 BC.

Assume that the hedges are 3m x 3m x 2m tall and there are 12 of them.

10. Using the given formula work out the total volume of the box hedge running alongside the Culpeper gardens.

Answer: \_\_\_\_\_

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 4 CONT.

### THE MAZE AND GROTTO

The maze was created in 1987 using 2,400 yew trees. When viewed from the centre, part of its plan mirrors a queen's crown.

Assume that a team of 6 gardeners worked on creating the maze and that each gardener could plant 12 trees per hour.

They all worked from 8 – 4, taking 1 hour for lunch, a fifteen minute break in the morning and again in the afternoon.

Unfortunately, after 2 days work, one gardener caught a cold and did not come back to work.

11. How long would it take to plant the maze?

Answer: \_\_\_\_\_



12. The average time taken to complete the maze is 20 minutes, how long did it take you?

Answer: \_\_\_\_\_

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 5

A booklet is made from 5 rectangular pieces of paper.  
Each piece of paper measures 300mm x 210mm  
The mass of the paper is 80g per m<sup>2</sup>.

13. Calculate the mass of the booklet and give your answer correct to 2 significant figures.

Answer: \_\_\_\_\_



The table below shows information about the rainfall recorded at two castles in the United Kingdom.

Place	Mean Rainfall	No. of months	Months
Edinburgh Castle	10cm per month	8	Feb - Oct
	20 cm per month	4	Nov - Jan
Leeds Castle	5 cm per month	9	May - Jan
	40cm per month	3	Feb - April

14. Which of the places has more rainfall on average over the whole year?

Answer: \_\_\_\_\_

# LEEDS CASTLE'S KS4 MATHS CHALLENGE

## SECTION 5 CONT.

### THE WILDLIFE

One Canada Goose eats approximately 3 - 4lbs grass and defecates 2 -3lbs per day  
In general then, we are going to assume that one of our geese expels an average of 2lbs each per day.

One Mute Swan eats 8lbs of vegetation per day. Working on the assumption that the swan then expels  $\frac{2}{3}$  of its intake, just as the goose does, one of our swan expels an average of 5lbs per day.

Ducks have a very varied diet and eat foods such as flies, dragonflies, roots, seeds, small fish, insects, water snails and even frogs. We are going to assume that given their size, they will defecate a quarter the amount that a goose does, so an average of  $\frac{1}{2}$  lb per day.

We currently have 141 geese, 26 swans and approximately 180 ducks living on the estate at Leeds castle.

15. How much poop does Leeds Castle have in a leap year?! Convert your answer to Kilogrammes

Answer: \_\_\_\_\_

Hint: 1lb = 0.45Kgs



## NOTES & CALCULATIONS