Contents

Introduction

Hello! We hope you enjoy using this book and that the ideas in it help add to your toolbox of resources for teaching mathematics. This revised edition also includes a CD supplement for high achievers.

About the series

The main idea behind *Using Stories to teach Maths Ages 9 to 11*, is to provide a way of looking at the maths that the children have to learn in school, from a fresh angle. This means that their learning can be enhanced by looking at maths ideas in different ways. Using the stories can be a fun way of helping the children with their learning and their revision. It also helps children to understand maths by encountering it in different contexts, such as the imaginary situations in the stories and in real-life situations. Every different way in which a child (or an adult!) comes across a maths concept, enhances a child's ability to learn and understand the concept and to remember it. The age categories we have put each story in are of course only a guide – as all children are different and they can be of interest and use to older or younger children using the same or different contexts.

By making maths fun, the barriers to learning that they often create ("I can't do maths", "maths is boring" or similar phrases that they may have picked up from others) can be dissolved and the children gain more confidence and facility to understand and use mathematical concepts. This can lead to a far more positive approach and attitude to the rest of their mathematical learning. Having used these stories and poems in many schools around the UK, we are confident that the children will enjoy engaging with them and learning from them.

Inevitably, over the years the maths curriculum has changed and been modified, however as the core skills and concepts children need to learn at any age are essentially the same, we have been able to link the stories to the new curriculum. For this reason we hope that the stories and poems can provide a resource for initiating or supporting work to cover the Programmes of Study for each year group.

Therefore in the teachers' notes accompanying each piece we quote the Programmes of Study and supporting Notes and Guidance specified within the new curriculum. In the teachers' notes we also suggest follow-up work, often incorporating worksheets or the illustrations that accompany the pieces, which you can use to create a whole lesson, or several lessons, around each piece. Of course, suggested lesson plans are only a guide and so you can pick and choose the suggestions and ideas that will work best in your school, with your class etc.

Reading the stories

When you read the children the story, we recommend that you read them the story twice. The first time as a story in its truest sense – a story they can listen to and enjoy as a piece of narrative, without it being broken up and dissected as it's told. Hopefully the enjoyment they get from the story will enhance their enjoyment of the mathematics they are learning.

However on the first reading of the story, they may have been so involved in the plot etc that they miss some of the maths ideas that are used in the story. So on the second reading you can get the children to focus on the maths ideas that weaved into the story by stopping at the points where a new concept enters into the narrative and discussing its role in the story, using an enlarged copy. This also means that the children will be able to enjoy seeing – and learning from! – the illustrations as well and many of the children will enjoy reading the story with you.

Using the lesson plans

Within the planning we have added reference statements headed **WALT**, **WILF** and **TIB** as these or similar systems are often used to ensure lessons are focused, objective led and in context for the learner. They help summarise the purpose of the lesson, what is required of the children in order for them to successfully learn that lesson and why what they are learning is important.

WALT stands for "We Are Learning Today."

WILF stands for "What I'm Looking For."

TIB stands for "This Is Because."

The worksheets are designed to support the learning the children are making in mathematics. We recognise that completing them will often require literacy skills, which in some cases the children will not have at the required level. In order that the work remains focused on mathematics we suggest that you or your classroom assistants etc. scribe for such children so that their capability in mathematics is not held back by specific difficulties with literacy.

Links to curriculum

Story	Maths topic(s) covered	Curriculum links Year Five Programme of Study (PS) Notes & Guidance (NG)	Curriculum links Year Six Programme of Study (PS) Notes & Guidance (NG)
Sneaky circles	Problem solving involving circles – diameter and circumference		Algebra (PS & NG) Geometry: properties of shapes (PS & NG)
Hank Bullman rides into certain city	Use of language describing probability, such as certain, likely, impossible etc		Reason mathematically (KS 3 curriculum) Probability (KS 3 curriculum)
Space chase	Problem solving adventure in 11 chapters		
Overall story	Problem solving	Addition and subtraction (PS) Multiplication and division (PS) Fractions (including decimals and percentages) (PS) Measurement (PS & NG)	Addition, subtraction, multiplication and division (PS)
Chapter 1	Equivalent fractions	Fractions (including decimals and percentages) (PS)	Fractions (including decimals and percentages) (PS)
Chapter 2	Problem solving using 4 rules of number	Addition and subtraction (PS) Multiplication and division (PS)	Addition, subtraction, multiplication and division (PS)
Chapter 3	Factors	Multiplication and division (PS)	
Chapter 4	Currency conversions	Multiplication and division (PS) Fractions (including decimals and percentages) (PS) Measurement (PS & NG)	Fractions (including decimals and percentages) (NG)
Chapter 5	Simplifying ratios		Ratio and proportion (PS & NG)
Chapter 6	Measurement conversions	Multiplication and division (PS & NG) Measurement (PS & NG)	Measurement (PS)
Chapter 7	Averages		Statistics (PS & NG)
Chapter 8	Times tables	Multiplication and division (NG)	Addition, subtraction, multiplication and division (NG)
Chapter 9	Triangles and 3D shapes	Geometry: properties of shapes (PS)	Geometry: properties of shapes (PS & NG)
Chapter 10	Volume & surface area	Multiplication and division (PS) Fractions (including decimals and percentages) (PS) Measurement (PS)	Measurement (PS)
Chapter 11	Square numbers	Multiplication and division (PS & NG)	

Story	Maths topic(s) covered	Curriculum links Year Five Programme of Study (PS) Notes & Guidance (NG)	Curriculum links Year Six Programme of Study (PS) Notes & Guidance (NG)
Courtroom conundrums			
Prosecuting percentages & fighting fractions	Percentages and fractions	Fractions (including decimals and percentages) (PS & NG)	Fractions (including decimals and percentages) (PS & NG)
Decimal dilemmas	Percentages, fractions and decimals	Fractions (including decimals and percentages) (PS & NG) Ratio and proportion (PS)	Fractions (including decimals and percentages) (PS & NG) Ratio and proportion (PS)
Percentage, decimal and fraction poem	Percentages, fractions and decimals	Fractions (including decimals and percentages) (PS & NG) Ratio and proportion (PS)	Fractions (including decimals and percentages) (PS & NG) Ratio and proportion (PS)
Medieval mode	Averages		Statistics (PS & NG)
Metric measures poem	Metric units of measure	Multiplication and division (PS & NG) Measurement (PS & NG)	Measurement (PS)
Ratios poem	Ratio		Ratio and proportion (PS & NG)
Yorkshire challenges	Problem solving exercises		
Overall series	Prime numbers Problem solving	Multiplication and division (PS & NG) Addition and subtraction (PS) Multiplication and division (PS) Measurement (PS & NG)	Addition, subtraction, multiplication and division (PS) Addition, subtraction, multiplication and division (PS)
Challenge 1	Addition & subtraction of large numbers	Addition and subtraction (PS & NG)	Addition, subtraction, multiplication and division (PS & NG)
Challenge 2	Sequencing events/time	Measurement (PS & NG) Statistics (PS)	
Challenge 3	Problem solving using multiplication	Multiplication and division (PS & NG)	Addition, subtraction, multiplication and division (PS)
Challenge 4	Simple algebra		Algebra (PS & NG)
Challenge 5	Sequencing events/time	Measurement (PS & NG) Statistics (PS)	
Place value poem	Place value of large numbers	Number and place value (PS & NG)	Number and place value (PS & NG)
Chicken division	Exploring methods of division	Multiplication and division (PS & NG)	Addition, subtraction, multiplication and division (PS & NG)
Raving over ratios	The connection between ratios and fractions		Ratio and proportion (PS & NG)

Sneaky circles

Links to curriculum

Year Six
Algebra
Express missing number problems algebraically. (PS)

Use simple formulae. (PS)

Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand, such as:
- formulae in mathematics. (NG)

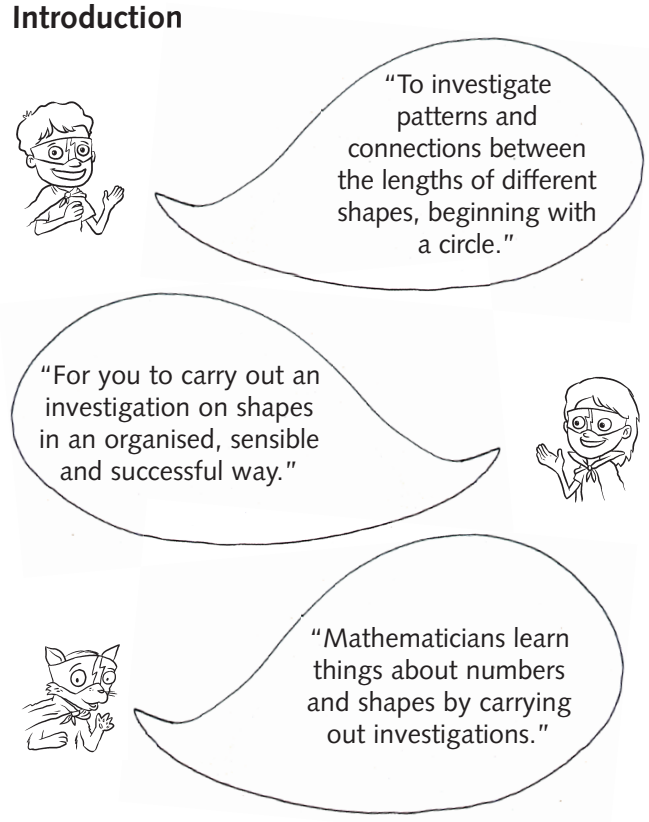
Geometry
Compare and classify geometric shapes based on their properties and sizes. (PS)

Illustrate and name parts of circles, including radius, diameter and circumference. (PS)

Pupils should draw shapes… accurately, using measuring tools. (NG)

Pupils should describe the properties of shapes and explain how unknown lengths can be derived from known measurements. (NG)

Introduction



We suggest that the follow up to this story is for the children to find out what it was that the character Thomas knows about the relationship between the circumference of a circle and its diameter, that his friend Henry doesn't know. Thomas, portrayed as someone who appreciates the benefit of learning about things, knows that the circumference of a circle is a little more than three times longer than the diameter – it's actually pi times longer – whereas Henry roughly guesses that it's only about two times longer. In a bet, the athletic but ignorant Henry loses a race with Thomas, when he runs around the circumference of a large circle and Thomas crosses the diameter (with a rest or two on the way!) Whilst Henry's active lifestyle is to be commended, the story will also hopefully give a positive "spin" on the benefits of exploring mathematical relationships!

Given that the purpose of the exercise is problem solving, the children could be asked to see if they can investigate the relationship on their own, or with varying levels of teacher input, depending on ability. The story gives only a slight clue regarding the relationship between the two dimensions, i.e. that Thomas knows the circumference is more than twice the diameter. Also the race involves a very large circle. The children can therefore investigate two things; firstly to find out what the relationship is between the diameter and circumference of the circles they draw and secondly whether this, or another, relationship applies for different sized circles. (The incredible thing is the relationship always applies!) This exercise can be differentiated as the children could be asked to explore this relationship with increasing accuracy and higher achievers could be asked to research the history of the increasing accuracy of measuring pi throughout history. (One of the saddest tales is of schoolteacher William Shanks who for 15 years up until 1873 spent his evenings using a complicated formula to work out pi to 707 decimal places. Unfortunately 71 years later it was realised that he made a mistake at the 528th decimal place so all the figures after then were wrong!)

The children could also then investigate the relationships they may find between the dimensions of other simple shapes. (For example, squares and rectangles of equal perimeter – the squares cover most area, which could be tested by cutting and placing one over the other.)

Resources

- Paper
- Wool/cotton
- Scissors
- Rulers

- Compasses
- Circle templates
- Simple calculators
- Planning sheet (provided).

Lesson plan

Explain to the children that after reading them a story called "Sneaky circles" that you are going to ask them to investigate the relationship between some of the measurements (or "dimensions") of a circle and then possibly other shapes. Tell them that to begin with they will be investigating the relationship between the length of the diameter of a circle and the circumference of a circle. Draw a circle and ask them to tell you which measurement is the diameter and which the circumference.

Read the story

Having read the story, discuss with the children how they could investigate, as accurately as possible, the relationship between the two dimensions. We suggest using cotton or wool to place around the circumference and then measure but should some of the children suggest other possible methods it would be worth considering letting them pursue their ideas, reviewing their success as they proceed. You could also ask the children to make a prediction based on the slight clue given in the story, i.e. that the circumference is more than twice as long as the diameter.

It would be useful to review/discuss how the children might calculate how many times greater or longer one measurement is than the other. One way could be to fold or cut the circumference measurements into as many diameter lengths as possible, or to divide the circumference length by the diameter using a simple calculator. (So for example, you could show that 12cm is 4 times longer than 3cm by doing 12 ÷ 3. Explain that this may be a simple example but the actual numbers they see on their calculators might have several decimal places, they will have to decide what would be sensible to record.) You may find the planning sheet provide useful for the children to use to plan their investigation.

The children may be confident in using compasses to draw circles, however if this is not the case you could have circle templates to hand for them to use. (Some of these templates could be larger than the circles they can draw using compasses.) Should you use templates you could discuss with the children how they accurately find the centre of the circle, in order to draw the diameter accurately – if their line doesn't go through the centre (a "chord") it won't be the correct length. (They could fold the circle twice.)

The children should discover what the Ancient Greeks discovered – that the circumference is always just over three times longer than the diameter. (If it's done perfectly accurately the number is always the same i.e. "pi" however the Ancient Greeks and Egyptians may have used something more accurate than cotton – though they didn't work out pi completely accurately! The Egyptians were particularly interested in measuring circles accurately as their taxes were based on the size of their circular plots of land! So the general relationship/formula the children should end up with would look something like this:

Circumference = 3 (and a bit) x Diameter

As stated above you could introduce the idea of the number pi to higher achievers and ask them to research the history of its increasingly accurate measurement.

The children who successfully complete this investigation could then investigate other relationships between the dimensions of circles or other simple shapes. Once again the planning sheet provided may come in useful.

A small, separate challenge the children could be asked to think about would be a way to set up the race to ensure that Henry and Thomas finish at the same point. (In the story they both start off on opposite sides of the circle so that they both end up at the same "Finish" line.) If they set off at the same point, Henry will finish back at the same point, having run all the way around the circle but Thomas would have finished at the opposite side of the circle having run across it. Perhaps Henry could go around twice and Thomas could run from one side to another? (Though it seems unlikely Thomas would agree to run that far!)

Plenary

Ask the children to describe the relationship they found between the diameter and circumference of the circles they investigated. Ask whether they found the same, or a similar, relationship for every size of circle. Ask how they might improve the accuracy of their investigation if they carried it out again.

Ask any children who have carried out further investigations to describe their work. Discuss possible further investigations they or others could do.

Planning sheet 1: Looking around circles

Name: _____

This planning sheet will help you organise your ideas for your investigation of simple shapes. In your first investigation you are going to see if there is a relationship between the diameter length of a circle and the circumference length. You will also be finding out if this changes for circles of different sizes.

Before your investigation
Before you begin do you have a prediction about what you may find out by carrying out your investigation?

_____

_____

_____

_____

How are you going to carry out your investigation? For example how will you make your measurements, how will you make sure your measurements are accurate?

_____

_____

_____

_____

How will you record your measurements and how will you use your measurements to see if there is a relationship or pattern that they show?

_____

_____

_____

Good luck with your investigation!

Planning sheet 2: Looking around circles

During your investigation
In this space you could record your final measurements and results.

After your investigation
Did you find a relationship between the measurements you were investigating?
Was it the same for different sizes of circles/shapes?

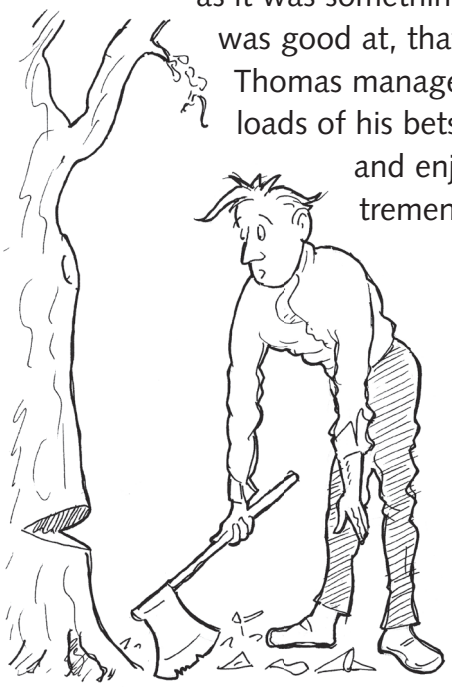
How could you improve the way you carried out your investigation if you did it again?

What further investigations could you do now? Why?

Sneaky circles

Once there were two friends who were so rich they didn't have to go to work everyday. Now to most people that would seem to be a perfect situation to be in – and it was pretty good – but they did have one problem. They didn't actually have anything to do they could very easily become bored. Now you and I might love to have that problem but it was still a problem. The way they made life interesting was by always making bets with each other. It didn't matter how crazy the bet was they would make bets about absolutely anything.

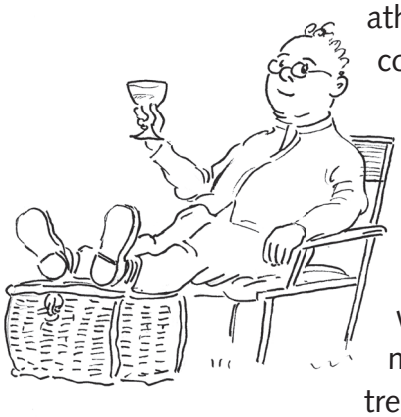
Now one of the friends was called Henry, who was tall, strong and handsome. He was a natural athlete, as he would throw himself into any kind of physical challenge. That is why his friend, Thomas, who was short, large and not the least bit athletic could so often get the better of him. You see, Henry would never stop to think when he threw himself into something, whether it was actually possible in the first place. Thinking was not something Henry was particularly good at and as it was something Thomas was good at, that was why Thomas managed to win loads of his bets with Henry and enjoy himself tremendously watching Henry exhaust himself completely while losing his money.



Once, for example, while the two of them were strolling around Henry's enormous estate, they came across a dead tree which needed cutting down. Thomas examined it very carefully and then said to Henry: "I bet you couldn't chop this tree down with your axe in half an hour".

"I BET I COULD!!! YOU SHOULD SEE ME CHOPPING UP LOGS FOR MY FIRE! YOU WOULDN'T BELIEVE HOW MANY LOGS I CAN CHOP UP IN HARDLY ANY TIME AT ALL!!!" declared Henry loudly and stupidly, falling straight into Thomas' trap. Thomas had watched Henry chopping up his logs very carefully.

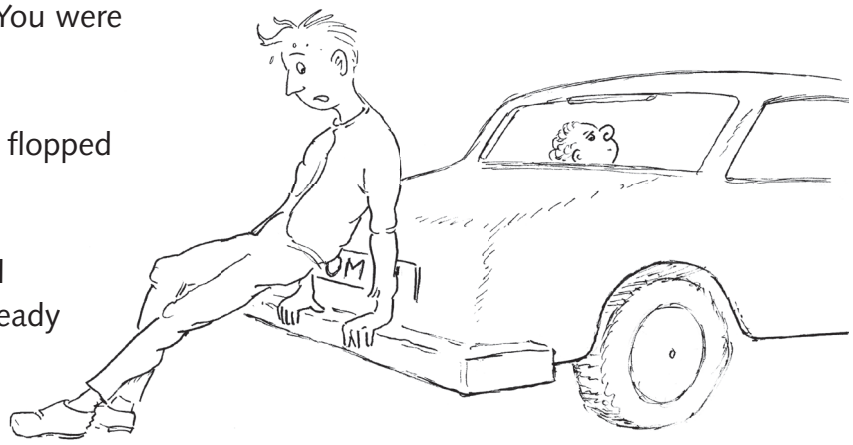
So Henry charged off to get his axe while Thomas wondered what to do with the money he was going to win from Henry. Henry returned with his axe, rolled up his sleeves and began chopping away furiously at the trunk of the tree. Meanwhile Thomas got a deck chair and a flask of tea out of the trunk of his Rolls Royce and sat watching Henry attacking the tree. He loved to watch Henry looking so impressive as he was sweating and straining away so athletically and making a complete fool of himself at the same time. When his half-hour was up Henry had made a very impressive notch in the trunk of the tree but it would have to be made much bigger before the tree came down.



"Well tried Henry," said Thomas. "You were so close!"

"You were lucky," said Henry as he flopped onto the ground.

"Hmm, yes I was, wasn't I", agreed Thomas smiling to himself. He'd already thought of another way of making Henry sweat, strain and lose more of his money.



A few days later Thomas was taking Henry for a drive in his Rolls Royce. He had deliberately made sure that there was hardly any petrol left in the petrol tank. Sure enough as they were driving along the engine stopped and they glided to a halt.

"Oh dear," said Thomas, as if he were surprised. "We seem to have run out of petrol."

"You ought to watch the petrol gauge more carefully," said Henry, reprimanding his friend.

"Yes, I should, shouldn't I?" replied Thomas making himself sound stupid.

"Look, there's a petrol station about a mile away. We'll push your car to it. It won't take long," said Henry.

"I'll tell you what," said Thomas. "I bet you can't push the car there yourself in ten minutes."

"I BET I CAN!!" replied Henry. "YOU SHOULD SEE ME IN THE ANNUAL TRACTOR PUSHING CONTEST AT OUR VILLAGE FAIR!!!"

Thomas loved it when Henry spoke loudly. That always meant Henry had fallen for his trick. Thomas had watched Henry pushing tractors very carefully.

So Henry took off his jacket and rolled up his sleeves and began madly pushing Thomas' enormous car towards the petrol station. Thomas got a flask of tea he'd made out of his glove compartment and watched Henry straining away in his rear view mirror. He wondered what to do with the money he'd win this time.

Henry put absolutely everything he had into pushing the car to the petrol station. After ten minutes he was as red as a beetroot, covered from head to toe in sweat and completely out of breath. He'd managed to push the car over half the way there.

"Well done Henry," said Thomas. "You did very well."

"You were lucky," said Henry as he flopped over the boot of the car.

"Hmm, yes I was, wasn't I," agreed Thomas smiling to himself. He was wondering whether

he would be able to begin developing his next trick on Henry. It all depended on whether he could make him bad-tempered as well as exhausted.

Henry lifted himself off the boot of the car. He smiled at Thomas. "Well, I might have lost a bet with you again. But at least I'll have the pleasure of seeing you do some work for once because we'll both have to push the car now."

"You're right," agreed Thomas, pretending to look upset. Really he was beginning to think that his plan just might work. "My goodness, you'll never believe what I'd forgotten," he said doing even more pretending.

"What had you forgotten?" asked Henry, correctly suspecting that something was up.

"I'd completely forgotten that I've got a full can of petrol in the boot. Oh dear, I wish I'd remembered about it earlier on before you had to work so hard," said Thomas.

"I BET YOU DO…" replied Henry who was bad tempered now. He was also falling for yet another trick. "I'M FED UP OF ALL THESE BETS WHERE I WORK HARD AND YOU DON'T DO ANYTHING!!!" shouted Henry. As you know Thomas loved it when Henry was loud.

"You're right," agreed Thomas. "It does seem as if you have to do everything."

"IT CERTAINLY DOES!" agreed Henry.

"Of course it's because you're so athletic and I'm not," said Thomas.

"I KNOW THAT!" agreed Henry.

"But we ought to have some kind of a bet where we both compete with each other," said Thomas.

"YES WE SHOULD!" agreed Henry.

"We'd have to find some way of making it fair though wouldn't we? I couldn't possibly do the same as you could I?" said Thomas.

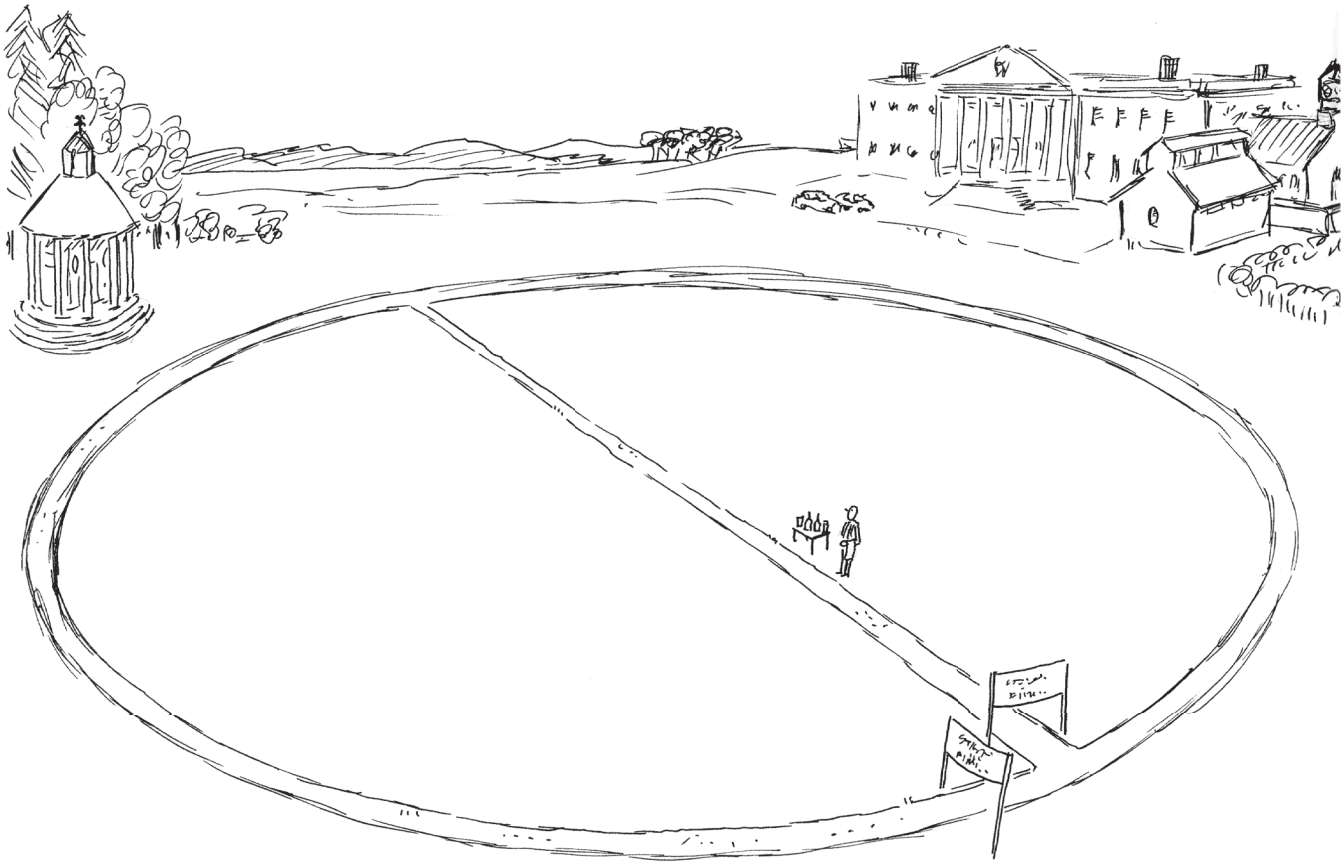
"OF COURSE YOU COULDN'T! YOU WOULDN'T STAND A CHANCE!" agreed Henry.

"You're right Henry," said Thomas.

"WHAT ARE WE GOING TO DO THEN??" asked Henry.

"I don't know," replied Thomas – even though he did.

Henry did his best to think. Thomas pretended to think, even though he'd already done the



thinking. After a long pause he suddenly said; "I've thought of something."

"What?" asked Henry not being loud for the first time in eight sentences.

Thomas got out his diary so he could do a drawing to show Henry. "How about we mark out a circular running track around the edge of your enormous back garden," began Thomas, drawing a circle.

"That would be a very long track – I bet you've never even walked that far. You wouldn't have a hope of beating me even if I went round twice and you only went round once…" said Henry thinking he was being very clever.

"I completely agree," said Thomas delighted that Henry had walked even further into his trap. "I could never possibly run that far. So while you run around the outside of the circle, how about I run straight across it. Then at least I'll have a bit of a chance."

Henry looked at Thomas' drawing. "It doesn't look much more than twice as far around the circle as across it. That should give you a bit of a chance."

"Hmmm," hmmmed Thomas biting his lip. He had studied circles very carefully. He knew how many times further it was around a circle compared to the distance across it, but he certainly wasn't going to tell Henry that it was quite a bit more than twice as far because of course that was the idea behind the trick. He thought to himself how pleased he was that he'd studied circles in maths. Maybe you'll be as lucky as Thomas soon…

So Henry got his staff to mark out a circular track around his garden and a straight track across the middle from one side to another for Thomas to run across. As they were marking it out he heard his staff use words like "circumference" and "diameter". He had no idea what the words meant and he just got on with training for the race. Thomas knew what the words meant and he just went on with sipping tea while he watched the track being marked out. "Very important to drink tea when you're training for an event like this," he thought to himself. All the running and exercises Henry was doing looked far too much like hard work. He enjoyed watching Henry do them though. He also wondered what he'd do with the money he'd win this time.

Finally the track was ready and the race began when Henry's butler fired a gun! Thomas and Henry had to start on opposite sides of the circle, so they'd both end up at the same "Finish" line. Well Henry zoomed off like a rocket!! Thomas stopped to watch for a moment before he began trotting off himself. "Very impressive," thought Thomas to himself as he jogged along. "I could never hope to run that fast."

Henry had trained very hard for this event. He was determined to win the bet this time. He charged around the circle at the same pace he'd set off at and didn't show even the slightest hint of tiredness or effort. Meanwhile Thomas was as purple as an exhausted beetroot after only jogging along for two minutes. "Phew! This jogging is hard work!" Thomas thought to himself. So he stopped and got a flask of tea out of one of the pockets of his tracksuit. "Mustn't do too much at once. Besides I want to watch Henry. My goodness, look how fast he's going."

But even though Henry ran all the way around the circle at breakneck speed, Thomas still jogged up to the finishing post just before him.

"I CAN'T BELIEVE YOU'VE BEATEN ME AGAIN!!" said Henry in a loud voice, even though he was exhausted.

"It's almost unbelievable," agreed Thomas, delighted to hear Henry speaking in a loud voice again. You see he had another trick planned… but that's another story.

The End