KS2 Outdoor Maths Opportunities

For pupils in or working at KS2 level

How to use these resources

The aim of these slides is to provide practical ideas to take curriculum maths learning outside the classroom.

Please take and adapt these ideas in any way that suits you and your class. You may need to tweak an activity to suit the needs or numbers of your cohort, or you might see an idea for a different area that you feel would work in your current topic. The hope is that there is the flexibility to make the resources work for you.

The activities can be as quick or extended as you choose. They can be used as starters, main activities, plenaries, revision lessons or intervention sessions.

Learning outdoors does not have to be the whole hour, but taking an activity outside and interacting directly or indirectly with the outside space around you can provide a different perspective and approach for all pupils, particularly those who might find it difficult to engage in a classroom setting.

Set yourself an achievable target: can you deliver an outdoor maths activity once a half term, fortnightly or even weekly? Making the outdoors an extension of your classroom builds confidence in both teachers and learners, and an understanding that this can be another space where we learn.

Number and Place Value

Outdoor number lines

Create a large number line, either using chalk or cones, to mark out powers of 10 up to the ‘boundary number’ for your year group.

Pupils have to estimate where to place their number cards on the line. These could be pre-made or written on whiteboards.

Ask pupils to explain their reasoning for their placement as mathematically as they can. What other known benchmarks helped them to make their decision?

Outdoor number lines can also be used for tasks ordering decimals or fractions.

How much is 100?

3NPV-1 Teaching guidance (DfE):

Pupils need to experience:

- what 100 items looks like
- making a unit of 1 hundred out of 10 units of 10

Using a range of natural objects (this could be anything – sticks, leaves, blades of grass, stones, etc), ask pupils to collect 100 of each item and lay them out in sets.

Then ask pupils to compare the different sets of 100:

What is the same? (All sets have 100 items)

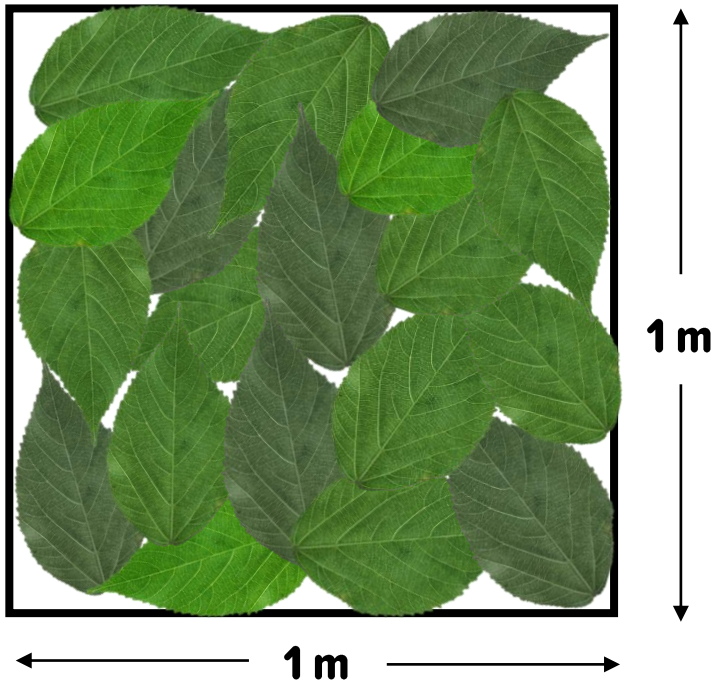
What is different? (The size/space taken up by the different objects)

Estimating with place value

Allow pupils the opportunity to ‘feel’ place value by estimating and measuring various distances.

For example:

- How far is 1000 steps?
- Mark out 100 metres. How many of these are there in 10,000 metres?
- Estimate how many leaves fit into 1 square metre. Scale this up by 100,000.



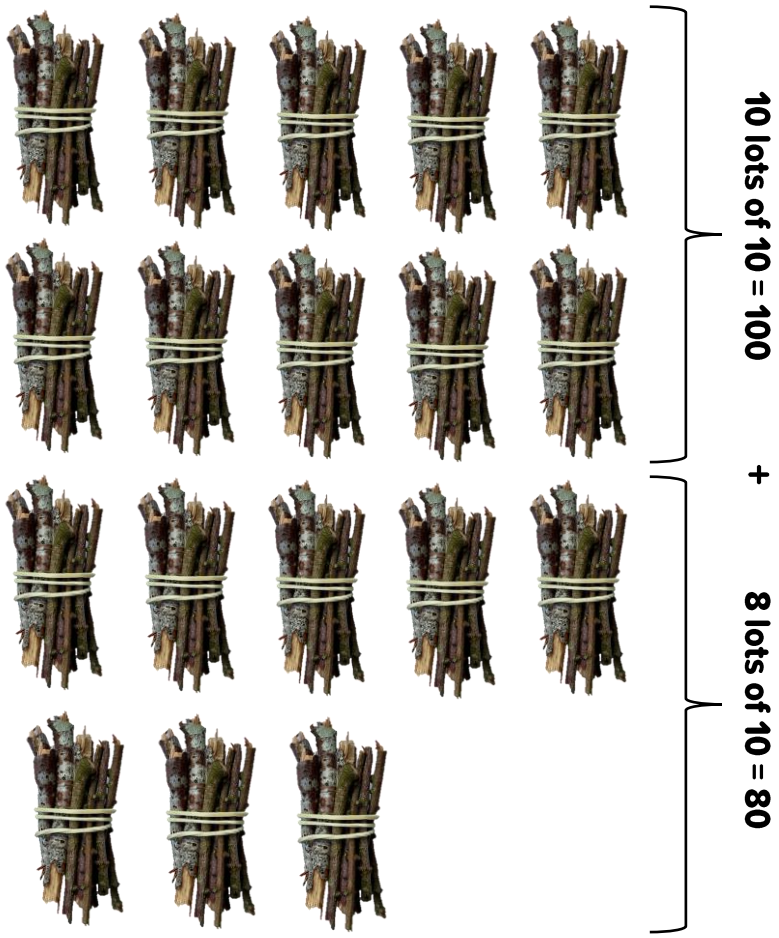
Tens in 3-digit numbers

Pupils can combine their groups from the previous activity to work out how many tens there are in other 3-digit multiples of ten.

For example, if we combine 10 groups of ten and 8 more, how many groups of ten is this altogether? What are 18 tens equal to?

This could then be linked to corresponding multiplication equations: 18 x 10 = 180 or 180 = 10 x 18

Pupils could also use these groupings to work in reverse: for example, how many groups of ten can 210 be divided/split into?



Tenths and hundredths

Following a similar principle to the previous activity:

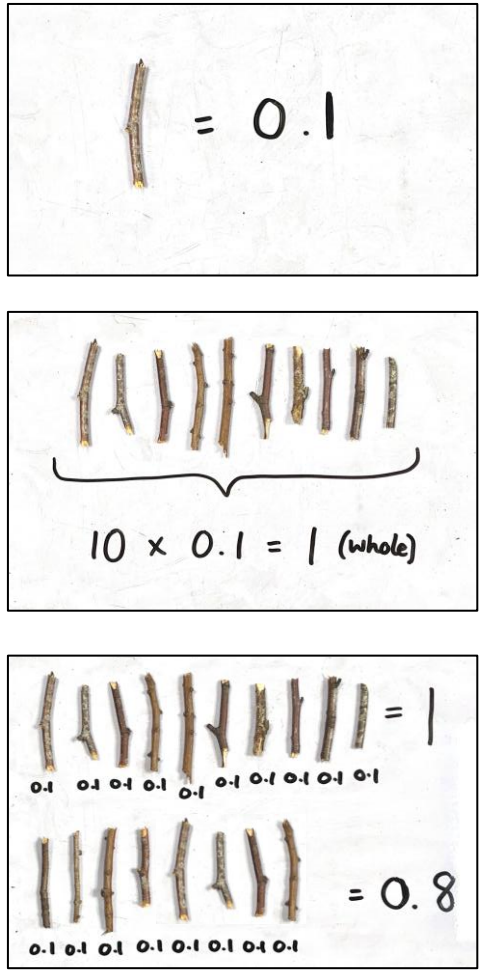
If a stick is equal to one-tenth (0.1), how many lots of one-tenth would we have to bundle together to make 1 one?

Once pupils are confident with values that only involve the tenths place, they can then start to reason with numbers that have ones and tenths:

E.g. if we have a group of ten-tenths, and another group of eight-tenths, how many tenths is this altogether?

“18 tenths is equal to 1 one and 8 tenths, and is written as 1.8”

This activity can be adapted to incorporate/focus on hundredths in a similar way.



10 tenths is equal to 1 one

18 tenths = 1.8

0.1 x 18 = 1.8

Roman numerals

Create Roman numerals using sticks. Pupils could either be tasked with making given numbers or identifying values made by a teacher or partner.

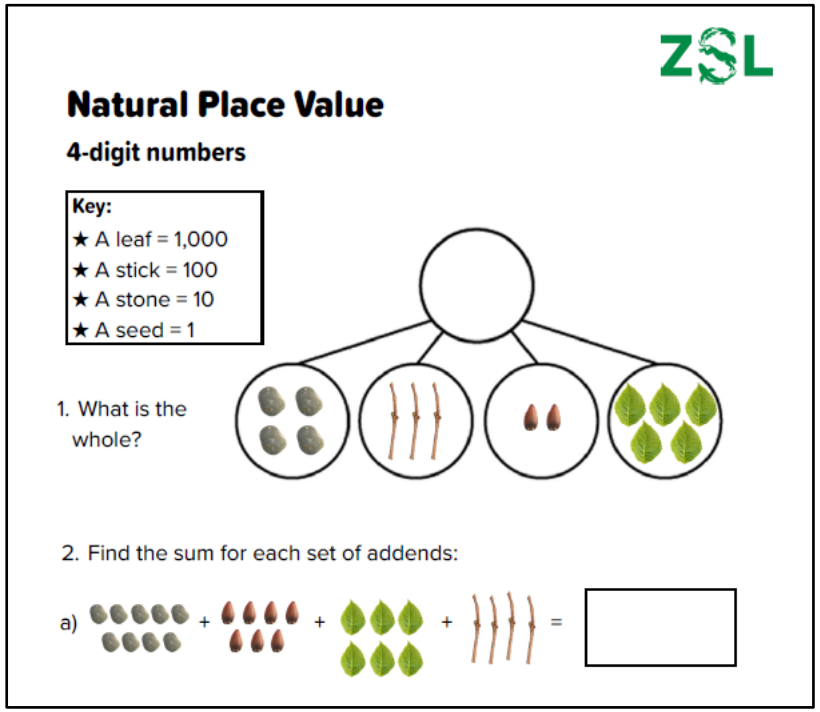
Those confident identifying different values could solve equations using sticks to represent the answer.

Another engaging activity is to challenge pupils to create their birth year or full birth date in Roman numerals.

Natural numbers

Assign different natural materials a place value and challenge pupils to combine partitioned amounts.

Pupils can explore this physically outdoors using natural objects, and there is also the option of using our worksheets for **4-digit values (LKS2)** and **decimal values (UKS2)**.



ZSL

Natural Place Value

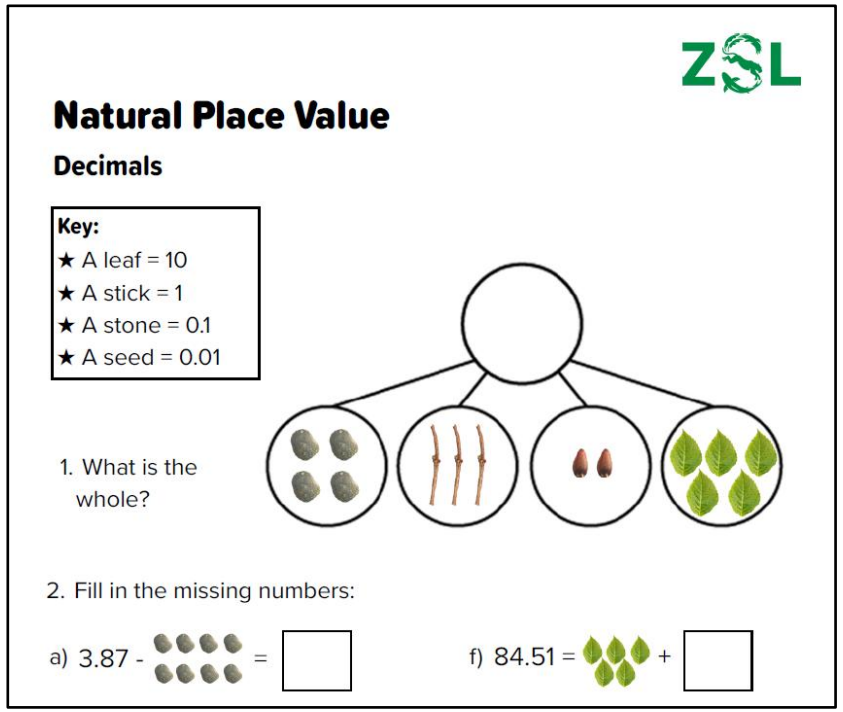
4-digit numbers

Key:
★ A leaf = 1,000
★ A stick = 100
★ A stone = 10
★ A seed = 1

1. What is the whole?

2. Find the sum for each set of addends:

a) + + + =



ZSL

Natural Place Value

Decimals

Key:
★ A leaf = 10
★ A stick = 1
★ A stone = 0.1
★ A seed = 0.01

1. What is the whole?

2. Fill in the missing numbers:

a) 3.87 - =

f) 84.51 = +

Decimal numbers/place value

As in the previous activity, assign different natural materials a place value and ask pupils to create given values, ensuring they have used the correct number of materials in the correct place value columns.

Values could be self-generated by pupils by rolling dice or using packs of playing cards.

Language focus: “There are four hundreds, two tens, three ones and three tenths.

The number is four-hundred and thirteen point three.”

Further place value revision

Assign different natural objects a place value, for example: stones = ones, sticks = tens, leaves = hundreds, acorns = thousands.

Task pupils with a range of activities that make use of these:

- Build the largest and smallest possible numbers with the resources you can find using the digits 4, 7, 3 and 6.
- Build a number that rounds to 500.
- Use sticks to represent what 30 x 3 would look like.

Change the objects to represent decimal place values:

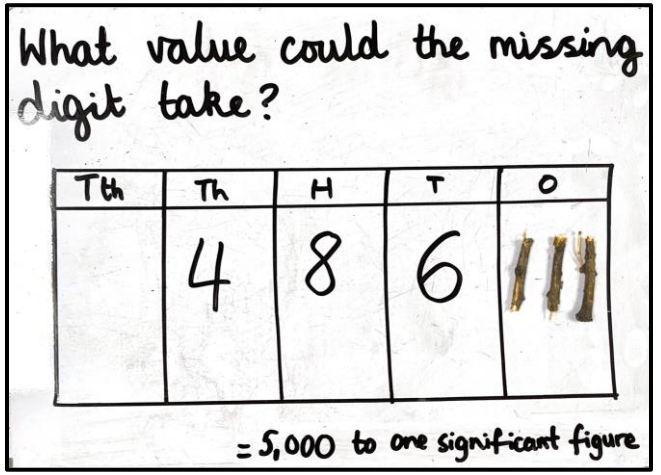
- Build a number between 0.5 and 0.7 to at least three decimal places.
- Build a number equivalent to $\frac{3}{5}$
- Build the value equal to 0.0019 x 100

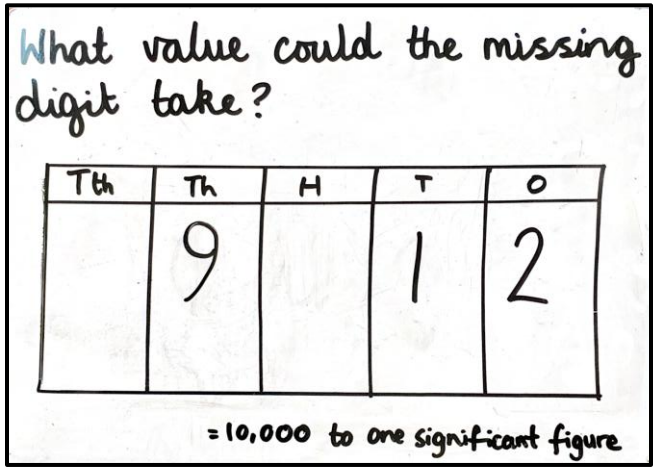
Missing values and rounding rules

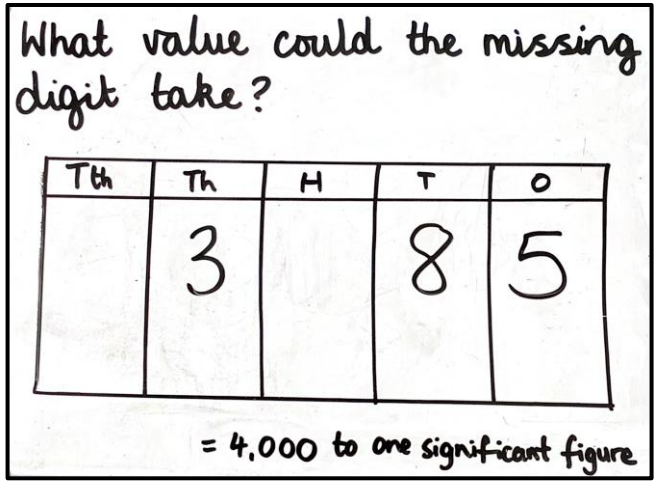
Provide pupils with missing digit values that must round to a power of 10.

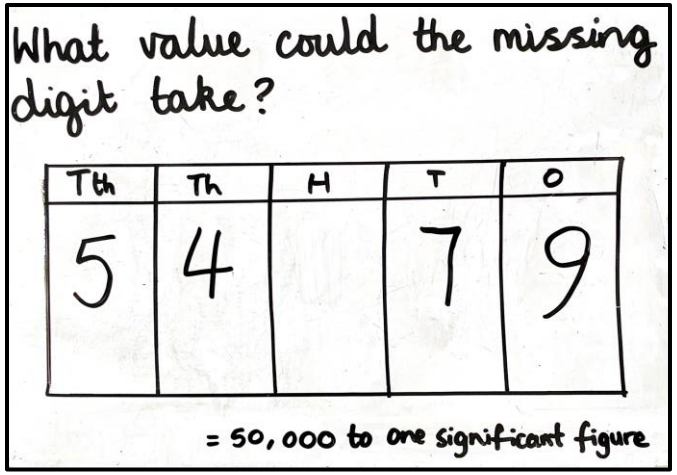
Pupils place the correct number of sticks (or another natural object) in the empty column to represent the missing place value and make the statement correct.

How many possibilities can they find for each example?









Finding Fibonacci

The Fibonacci Sequence is a sequence in which each number is the sum of the two preceding numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 and so on.

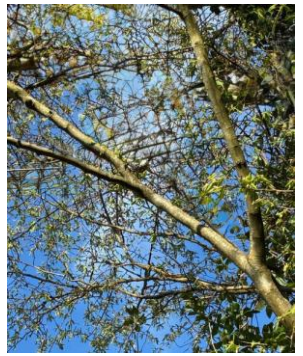
This pattern and its numbers are found a lot in nature. For example, many flowers have 3, 5, 8, 13, 21 or more petals.

Can pupils find any examples that demonstrate this?

Other examples of the Fibonacci numbers or curve in nature include snail shells, sunflowers heads, pinecones, the furled fronds of young ferns, and some aloe plants.

Are there any other places you can find Fibonacci around the site?

1 berry



The branch splits into 3 other branches

This leaf has 3 points

Each blossom flower has 5 petals

8 petals

34 petals

Addition and Subtraction

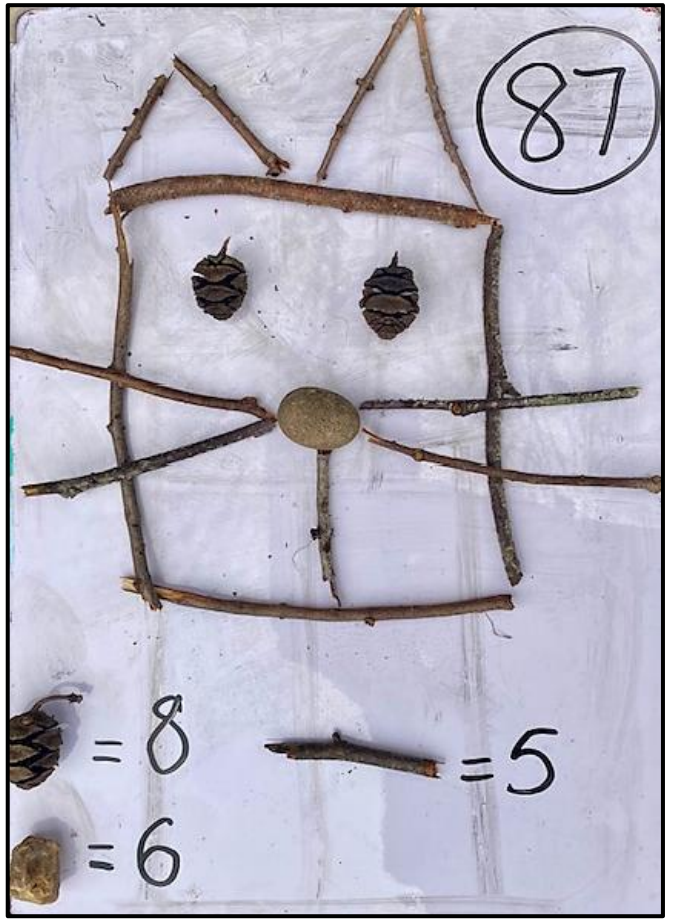
What is your picture worth?

Either individually or in small groups, task pupils with creating a picture using natural objects found in your outdoor area. You may want to specify from the outset how many different types of objects they are allowed to use (not necessarily the number of each).

After this, gather as a class to collectively assign values to each object. Values could be assigned based on your current focus in class, such as a particular times table or decimal numbers.

Pupils then return to their pictures and calculate the value of the whole based on the assigned values.

Once pupils are secure with the idea, they could create new pictures to which they assign their own values. Add or remove a level of challenge by increasing or decreasing the number of different objects pupils can make use of.



Magic number square

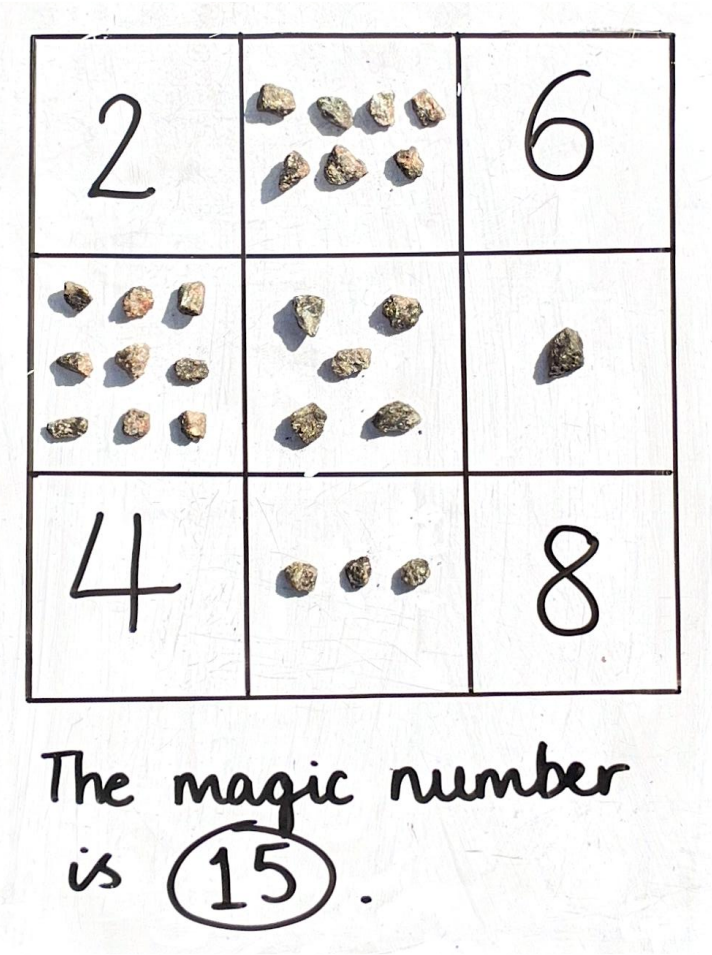
A magic square is a grid in which every row, column and diagonal adds up to the same number. It is a fun way for pupils to problem solve through trial and error. It can also be used to strengthen number bonds recall.

Tell pupils to draw 3 x 3 grids on their whiteboards or use sticks or chalk to create versions directly onto the playground.

You will also need a range of small tokens (e.g. pebbles, fir cones, acorns, conkers).

Tell pupils the ‘magic number’ which is to be the sum of each row, column and diagonal of their grid. They then have to work out which numbers to put in each square to make this total.

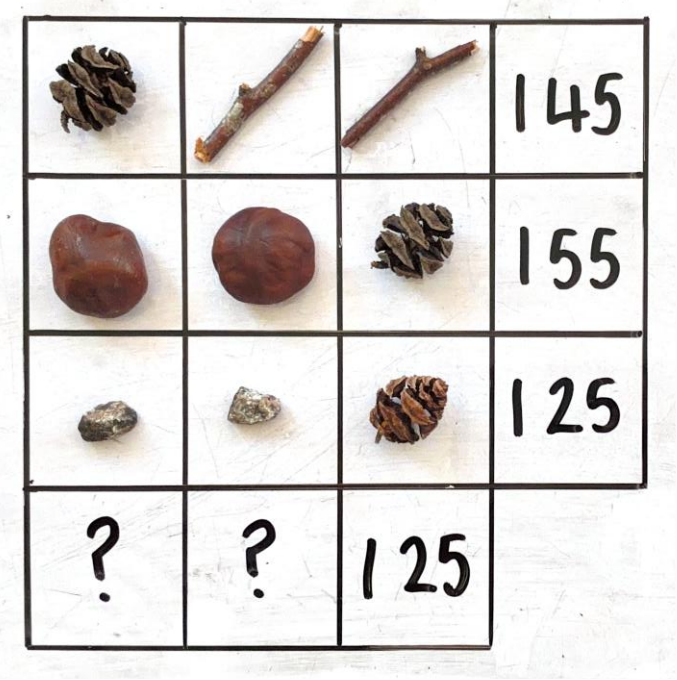
You can vary the level of challenge by telling them the range of values that appear in their grid (e.g. in the one opposite, all the digits from 1 to 9 are used), or you could provide some of the values before beginning and telling pupils where to place these on their grids.

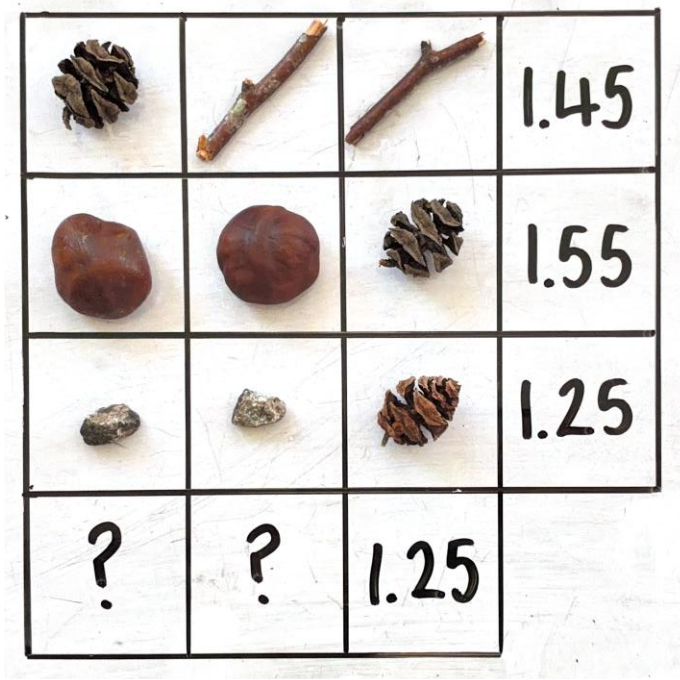


Solve problems with two unknowns

Place natural objects in a grid with a given value for each row and column. Can pupils work out the unknown amounts?

Once pupils are confident with this, they could be tasked with creating their own examples for their classmates to solve.





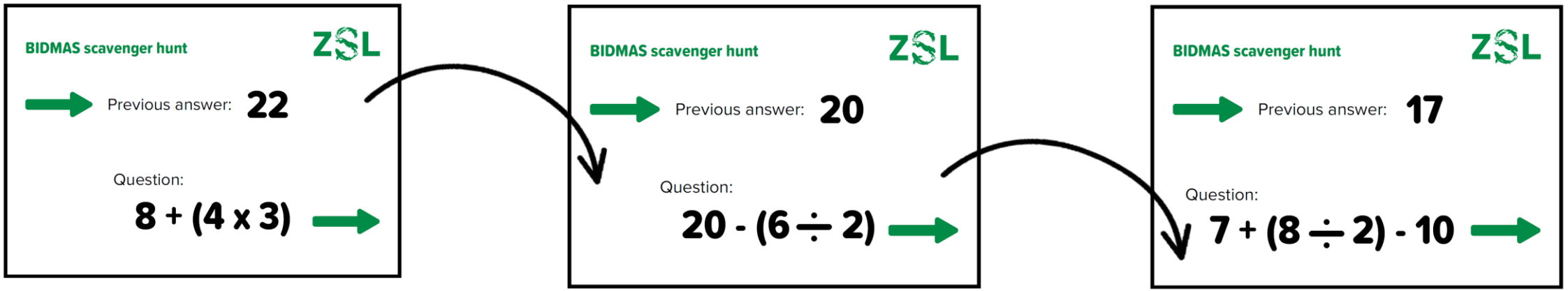
Choose values based on your current focus, i.e. positive or negative integers; decimals; fractions, etc.

BIDMAS scavenger hunt

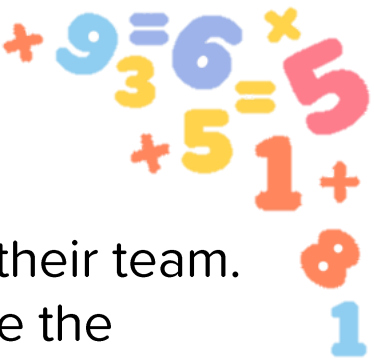
To revise and embed the order of operations, place twenty question cards (available **here**) around your outdoor site.

The answer to each equation will direct them to the next challenge card to find and solve. For example, if pupils calculate the answer on the card they have found is 9, they would then search for a card that shows 9 as the previous answer with a new question to solve.

It doesn't matter which card pupils start with as the questions are circular, so everyone will end up answering all the cards. Equally, pupils will be able to identify if they have calculated wrongly if they cannot find a card with a corresponding answer!



BIDMAS relay ideas



★ **Option 1:** Create sets of BIDMAS question cards and split your class into teams.

Place the question cards at one end of the playground and line the teams up at the other end.

The first pupil in each team has to run to collect a question card and bring it back to their team. Everyone must work to solve the question and check with one another that they have the same answer. Once the whole team has agreed on an answer, they must bring it over to be checked before they can collect their next question card. If incorrect, they have to try again!

★ **Option 2:** To reduce the running element, start each team with a question card.

Once they have agreed on an answer, one person from the team brings it over for checking. If it is correct, provide the team with a new challenge to solve.

You could increase the level of difficulty with each card handed over.

★ **Option 3:** As in Option 1, pupils take it in turns to run across the playground to collect a BIDMAS question card.

However, these question cards have incorrect worked solutions on each. Teams have to identify the mistake as well as agreeing on the correct answer.

Multiplication and Division

Create natural arrays

Allow pupils the opportunity to use natural objects to create arrays for different times tables facts.

Encourage them to explore the most efficient way to arrange their materials to make the total easier to count.

Explore the principle of commutativity: how does changing the factors around affect the groups and the product?

Pupils can also use these multiplication facts to derive related division facts.

Language focus: “3 times 6 is 18, so 18 divided by 6 is 3.”

Shape multiplication

For the times table your class are focusing on, there is a 2D shape to match!

Allow pupils to work in groups to use sticks to create up to 12 of the same shape. For example, if you are working on the 4 times table, pupils will make 12 squares; if you are working on the 6 times table, pupils will make 12 hexagons.

Tell them to arrange their shapes as a number track. Inside each shape, use chalk to write the products, increasing sequentially. If there is a point where they get stuck, they can count on from the previous number using the sticks to support 1-to-1 correspondence.

Ensure pupils have the correct multiples on their tracks and encourage them to practice counting forwards and backwards. You could then tell everyone in each group bar one person to close their eyes. The person with their eyes open covers one or more of the multiples for the group to try to identify as quickly as possible.

Shape multiplication continued

Using the shape number tracks from the previous activity, an active way to make use of these is to have each group stand in a line at the end of their track.

When you call out a multiplication equation, the pupil at the front of each line has to jump along the multiples the correct number of times to find the answer.

For example, if your pupils have made hexagonal number tracks to represent the 6 times table and you call out “four times six”, the pupils would have to make four jumps along their track and find which product they land on.

You can add a layer of challenge by asking the commutative equation, e.g. “six times four”. If a pupil made six jumps along the track, they would end up with too great a product.

The tracks could also be used to practice division, by telling pupils which number on their track to start from, then counting how many jumps it takes them to get back to the start. For example, “Eighteen divided by six” would mean making three jumps back to the beginning.

Counting stones

Collect stones so that you have enough for multiples of each value between 2 and 12 (or just for the specific table your class is working on). Write the numerical values on one side and a corresponding pictorial representation on the other.

Pupils can use these to create both multiplication and division equations, with the stones providing opportunities for the total number of items to be both seen (pictorial representations) and not seen (numerical values).

There are four groups of 4:
4 x 4 = 16
16 ÷ 4 = 4

Minibeast multiples

After completing a minibeast hunt, challenge pupils to work out the total number of legs that each species has, using their multiplication knowledge.

Insect	Tally	Number	Number of legs
ant	𝍸 𝍸 III	13	13 × 6 = 78*
woodlouse	𝍸 II	7	14 × 7 = 98**
snail	I	1	1 × 0 = 0
slug		0	–
bee		0	–
ladybird	𝍸	5	5 × 6 = 30
butterfly	I	1	1 × 6 = 6
spider	II	2	2 × 8 = 16

* Encourage use of known facts: if 12 × 6 = 72, then 13 × 6 is one more group of 6.

** If 7 × 7 = 49, then 14 × 7 will be double the product.

Extension: If I had seen 7 spiders, how many legs would this be altogether?

Dividing with remainders

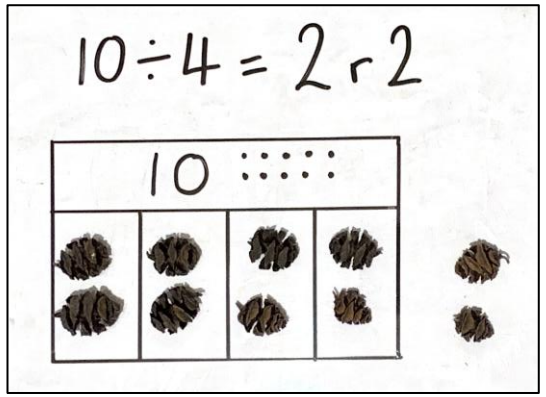
Provide pupils with random amounts of objects to sort into containers/chalked division mats/groups on a whiteboard. Start with examples that can be equally divided and use pupils' knowledge of skip counting to make the link with related multiplication facts.

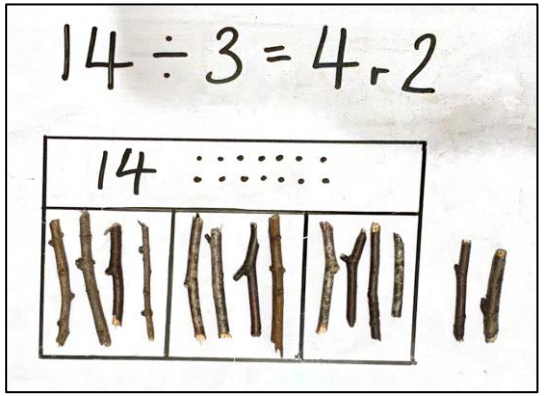
What happens when we introduce a number that isn't a multiple of the divisor? Model how the objects are now grouped with some left over. While writing the matching equations, make sure pupils can explain what each part means.

Allow pupils to continue to investigate with their natural objects, working through a series of questions either individually or in partners.

As an extension, challenge them to create division word problems that have answers with remainders.

Language focus: "Ten divided into groups of four is equal to two, with a remainder of two."





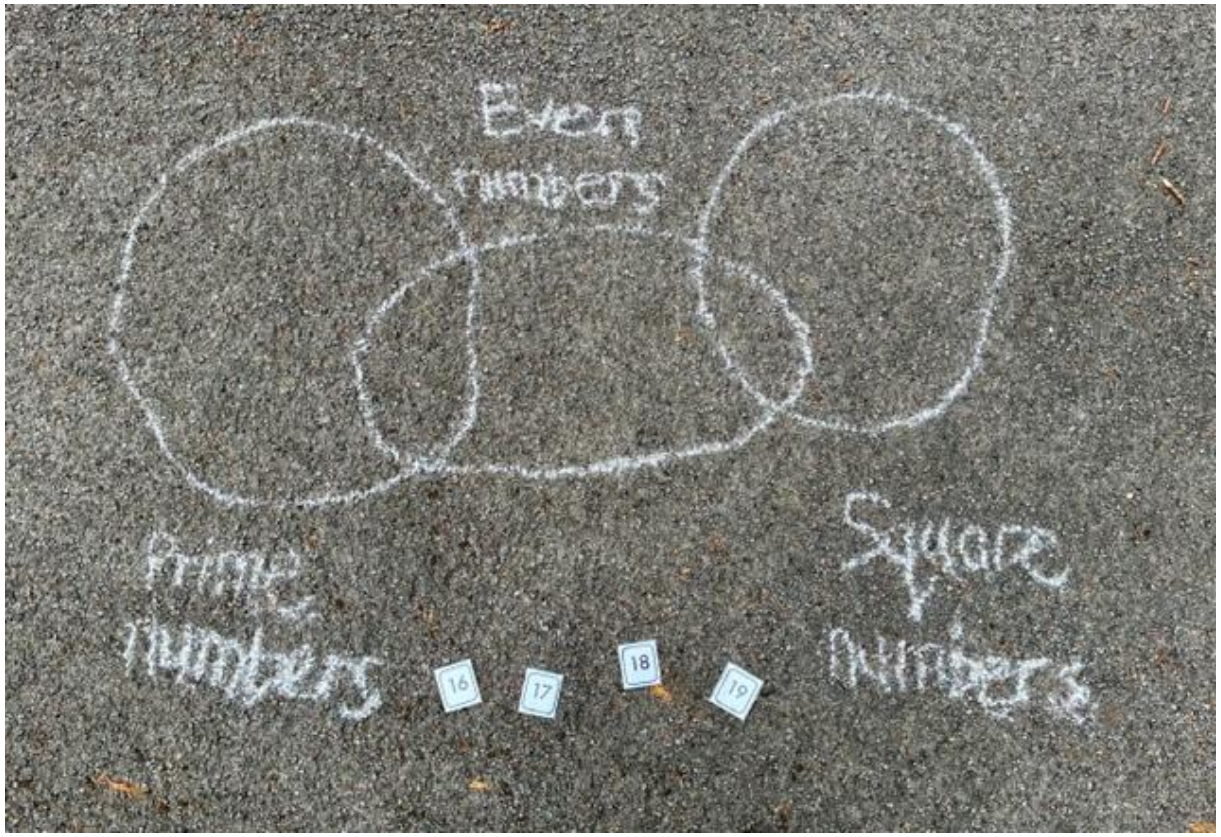
Word problem: A bird has fourteen sticks to share between three nests. How can the bird split the sticks?

Common multiples, factors and prime numbers

Create Venn diagrams in chalk to check pupils' understanding of concepts involving common multiples, common factors and prime numbers. Give pupils number cards or whiteboards with chosen values to sort into the diagram.

Working in groups or partnerships can encourage pupils to verbalise their reasoning and unpick any possible misconceptions around these topics.

'Place each number in its correct place on the diagram.'



Example taken from 2016 Key Stage 2 Mathematics Paper 2: reasoning, Q5

Fractions

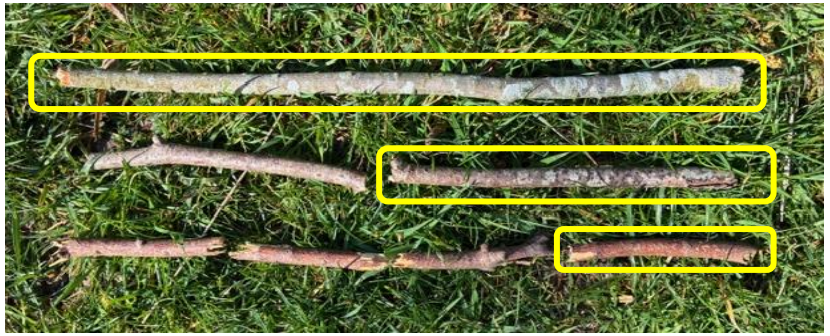
- including decimals – Year 4
- including decimals and percentages – Years 5 and 6

Fraction walls

Create fraction walls using sticks and use these to compare the size of the fractions, relative to one another.

- Which is larger – ⅓ or ½? Can you show me?
- How many quarters make one half?

This activity could also be completed using different sized sticks as a representative of 1 whole, to demonstrate that the size of each part is only relevant to the whole (i.e. half of one whole stick is not half of a different whole stick).



$$\frac{1}{3} < \frac{1}{4}$$

Unit and non-unit fractions of sets

Natural objects can be used to allow pupils the opportunity to explore and describe fractions of sets. Once pupils have gained a clear understanding of unit fractions (image 1), they can apply this to learning that a non-unit fraction is made up of a quantity of unit fractions (image 2).

Language focus: "The whole has been divided into 3 equal parts. Each part is one-third of the whole."

Language focus: "The whole is divided into 8 parts. $\frac{5}{8}$ of the leaves are brown. $\frac{3}{8}$ of the leaves are green. $\frac{5}{8}$ is 5 one-eighths. $\frac{3}{8}$ is 3 one-eighths."

Exploring mixed numbers and improper fractions

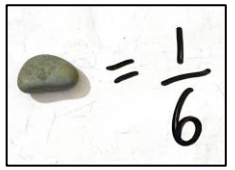
Get pupils to gather as many of the same natural object as they can (this could be done in groups).

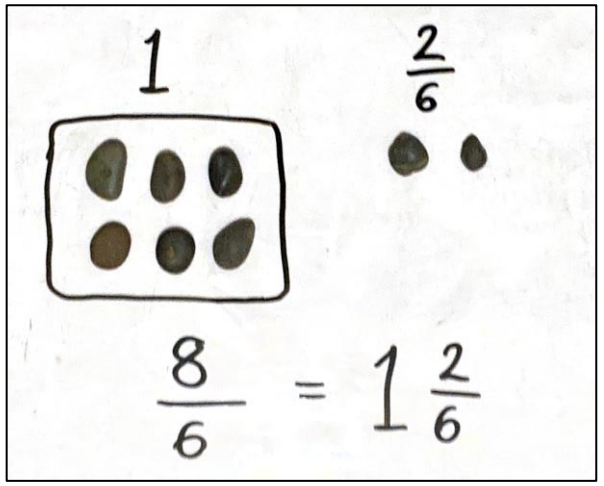
Tell pupils the numerator of the improper fraction and ask them to count out a corresponding number of objects.

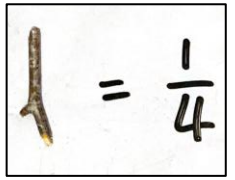
Then tell them the denominator of the fraction and ask pupils to put their objects into groups of this number.

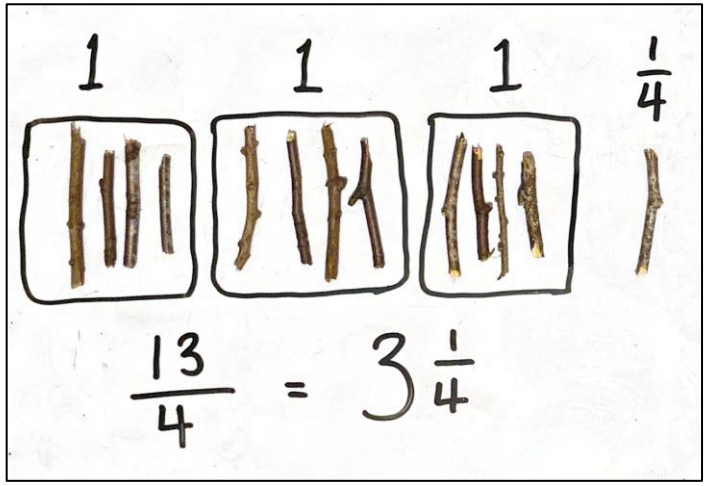
Ask pupils to identify how many ‘whole’ groups they have and the fraction that is left over.

Demonstrate how to represent the value as both a mixed number and an improper fraction.





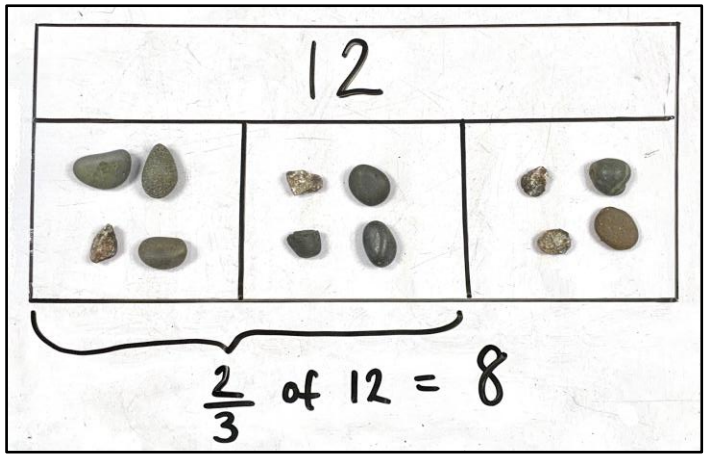




Fractions of amounts

Use natural resources and whiteboards to challenge pupils to find different fractions of amounts. Setting these out using the bar model method will encourage pupils to connect their learning to known division facts.

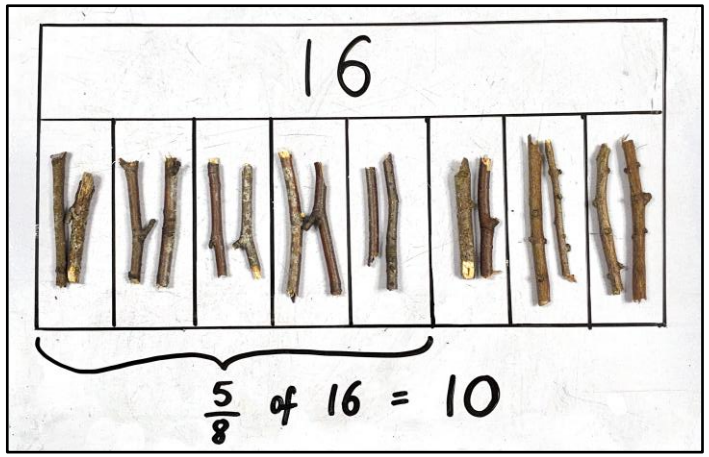
This can work in reverse by giving pupils one or more parts of the whole, which they then replicate in the remaining empty parts to find the whole.



Language focus: "The whole is 12.

The whole is divided into 3 equal parts.

Each part is $\frac{1}{3}$ of the whole. $\frac{2}{3}$ of 12 is 8."



Language focus: "The whole is 16.

The whole is divided into 8 equal parts.

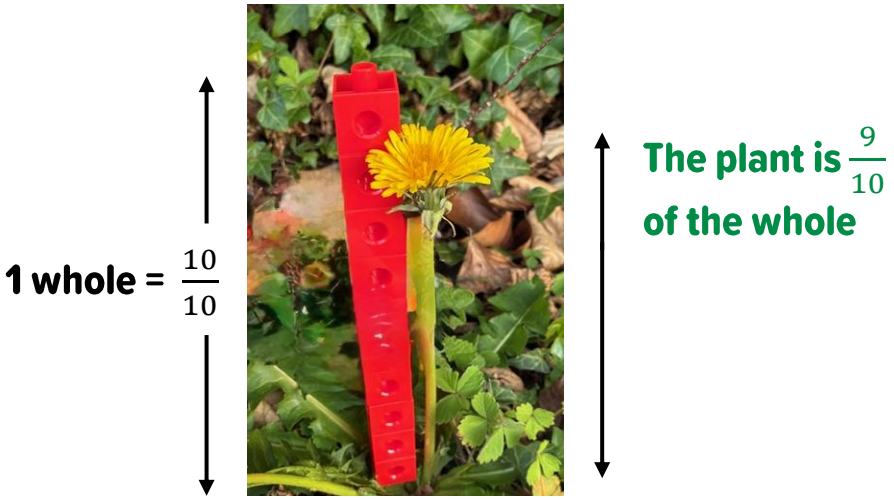
Each part is $\frac{1}{8}$ of the whole. $\frac{5}{8}$ of 16 is 10."

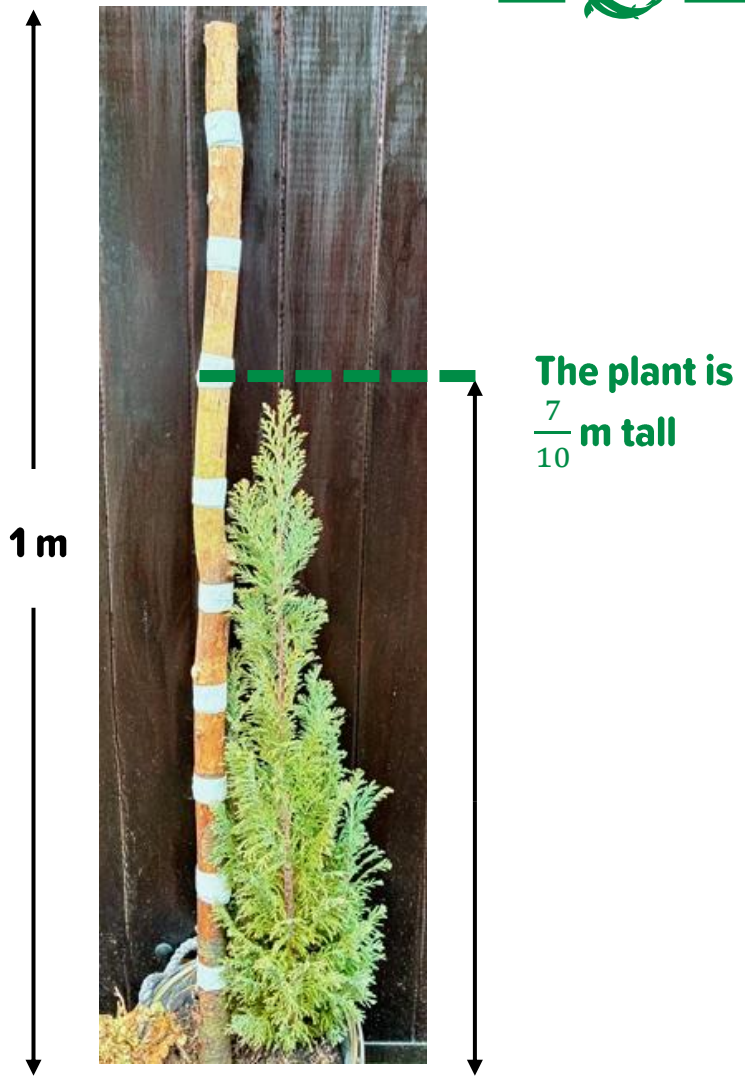
Fractions of measure

Provide pupils with measuring implements such as metre sticks and tape measures; you can also use non-standard measuring units such as cubes.

Allow pupils to measure objects in your outdoor area, giving their answers as a fraction of a measurement or a whole.

If pupils choose to measure something particularly tall or long, link this to their understanding of mixed numbers.





Outdoor measuring stick credit: **Creative Star Learning**

Calculating fractions of measure

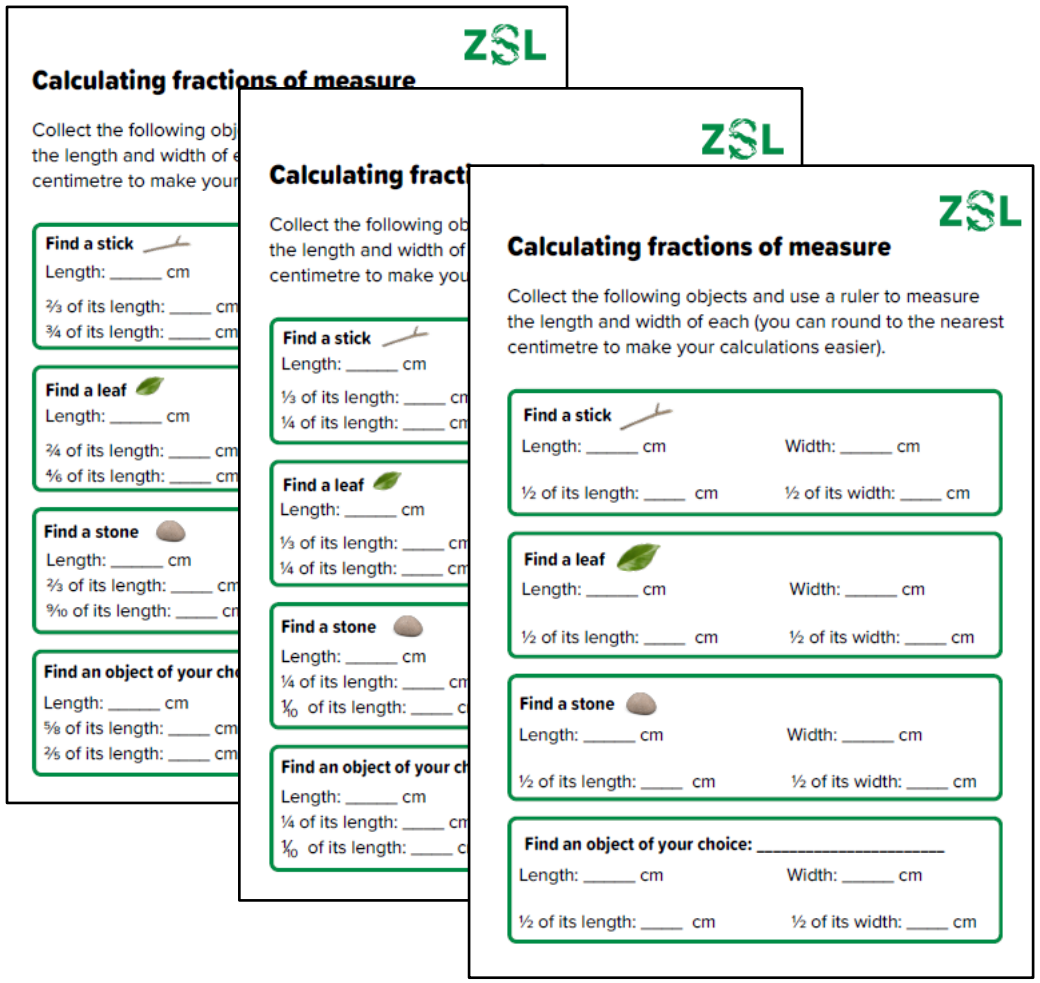
Ask pupils to collect items such as those suggested opposite. They measure the length and width of these objects (values could be rounded up or down to allow for easier calculating).

Pupils then have to find given fractions of each measurement.

Simplify: Find ½ of each measurement.

Extend: Find a non-unit fraction for each amount.

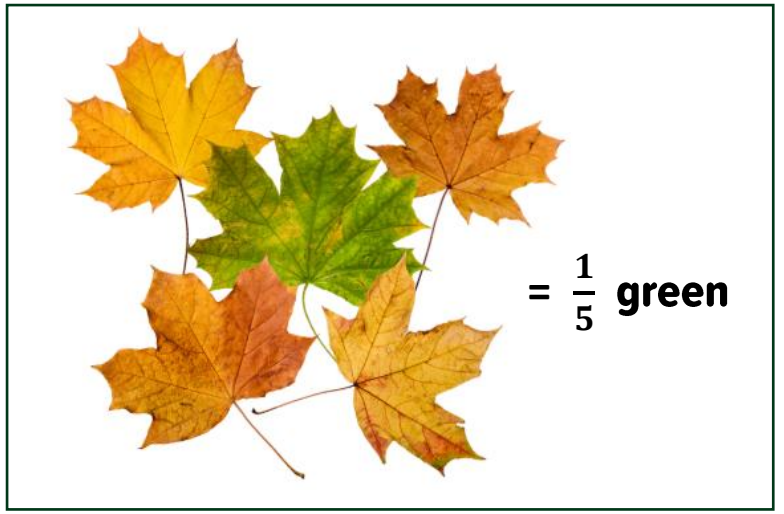
Differentiated worksheets available here

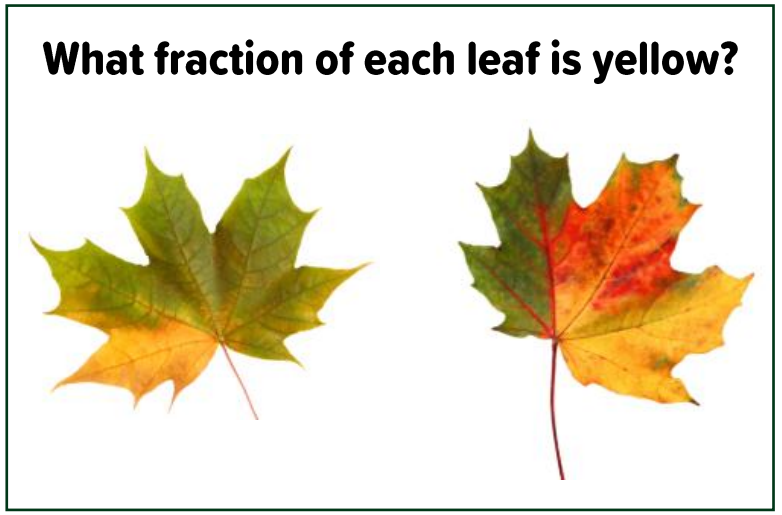


Fraction challenges

Provide pupils with a range of fractional challenges, which could also incorporate other areas of maths such as weight and measure. For example:

- Collect 10 leaves.
  What fraction of these are green?
- Collect a bundle of sticks.
  What fraction of the sticks are less than 10cm?
- Collect some rocks/stones.
  Estimate: what fraction are heavier than 10 grams?
- Collect some rocks/stones.
  What fraction are larger than your palm?
- Investigate some flowers.
  What fraction have more than 10 petals?





Finding fractions, decimals and percentages

Use natural resources outside the classroom to explore fractions, decimals and percentages (differentiated worksheets available **here**).

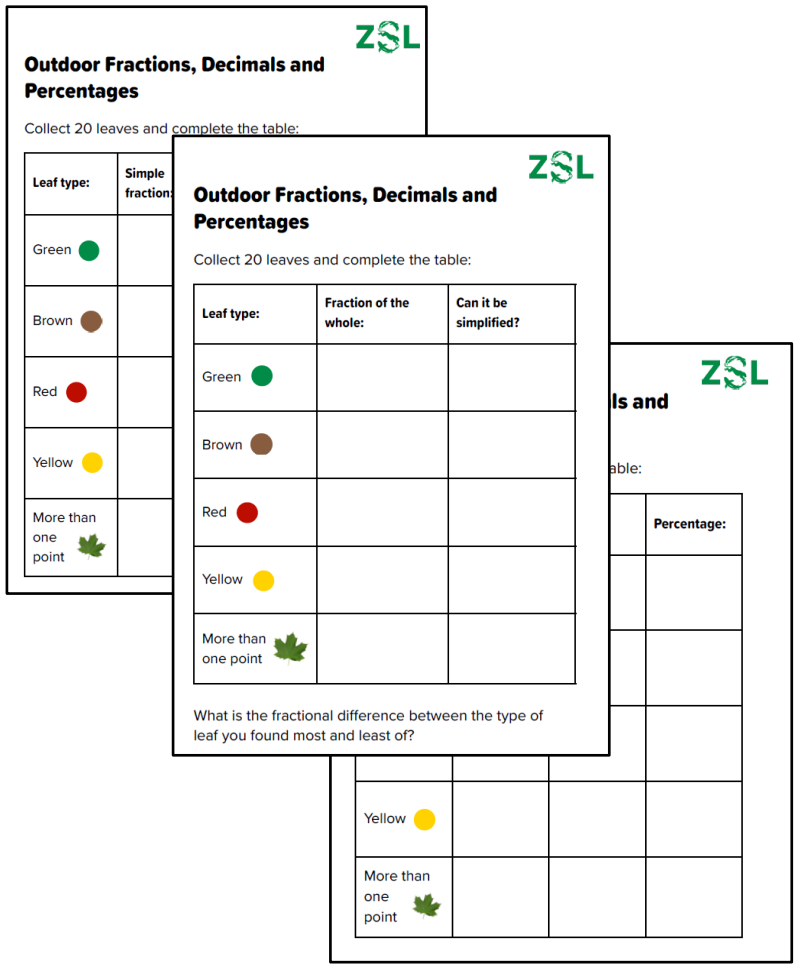
Simplify: Just find fractions of each amount (converting to simplest form if applicable)

Extend: Add extra challenge questions for pupils to solve, such as:

- Collect 8 acorns, with 25% still in their acorn cups.

  How many acorns cups is this?
- Collect 15 rocks, with 60% having a sharp edge.

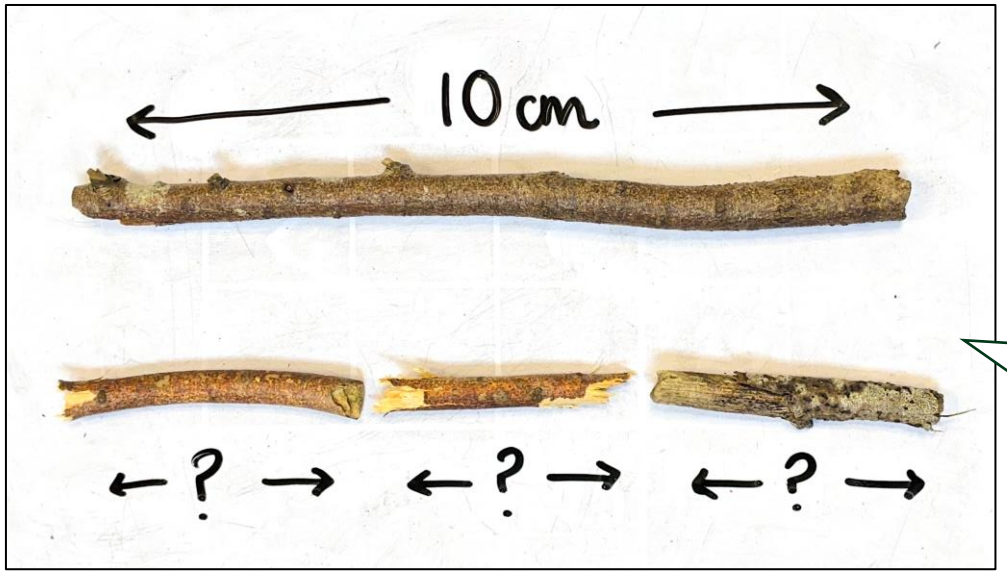
  How many sharp-edged rocks have you collected?
- Collect 9 sticks. This is 30% of the total number of sticks you need. How many more do you need to collect?



Decimal and fractional representations

Use sticks to assess pupils' understanding of fractions, decimals and recurring values, and how they prefer to express their answers.

Explain that the stick is 10 cm long and you are going to break it into three equal parts. How long will each part be? Ask pupils to discuss their responses/reasoning.



Potential answers could include:

- 3.3 cm long
- $3\frac{3}{3}$ cm long
- 3.33333 cm long
- $3.3\dot{}$ cm

Which do they most agree with and why?

Measurement

Estimating measure

In groups or individually, ask pupils to represent how long they think different measures are, such as 1 metre, 10 centimetres, half a metre, and so on.

Pupils should use natural objects to estimate a length, then use either rulers, measuring sticks or tape measures as appropriate to check their work.

How close were their estimations? Were there any surprises?

Outdoor measuring challenges

Challenge pupils to use their rulers to investigate natural objects, for example:

- Something smaller than 1cm
- Something bigger than 10cm
- The length of a blade of grass
- The height of a flower stem
- The length and width of a leaf

This can be simplified for pupils focusing on centimetres by asking them to round their measurements up or down. For pupils learning about different units of measurement, extend the task by asking for answers given in centimetres and millimetres or converting the whole measurement into millimetres.

At the end, you may have time for pupils to compare who has found the biggest/smallest or longest/widest measurements.

Estimation and measure

Ask pupils to estimate: How many blades of grass do they think there is in one square metre?

Take them outside to find and mark out small areas of grass (1cm x 1cm) and count the number of blades in this area. You may want to make a little cm^2 'window' like the one in the image opposite.

Once pupils have carefully counted the blades in their area, ask them to multiply this by 100 to find the average number there would be in $1m^2$.

See **this blog post** for an alternative idea – cut out a footprint and discover how many daisies or other signs of biodiversity it covers.

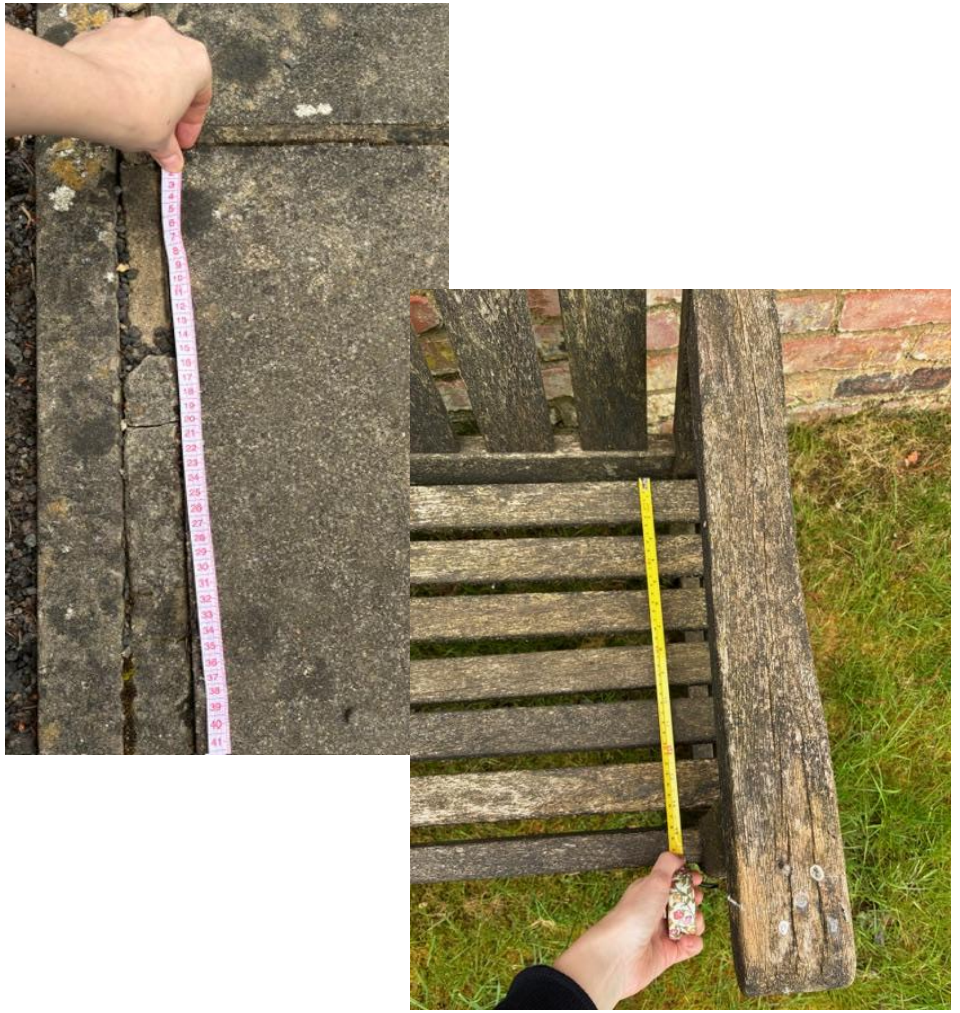
(For example, no daisies under my footprint, but several clovers!)

Daisy footprints credit: **Creative Star Learning**

Perimeter and area

Take pupils outside to measure different places and objects. They can then use these measurements to calculate either the perimeter, area or both.

To provide real life context to this activity, you could provide pupils with questions such as, ‘How many metres of fencing would we need to go around the perimeter of the playground?’



Measure including decimals

Have pupils take part in a long jump challenge. Working in groups, they need to record their distances in metres (the more accurate the better – you may want them to measure in centimetres initially then convert, depending on how confident they are).

Once each group has a set of results, pupils can use their data to answer related questions such as:

- Who jumped the furthest?
- What was the difference between 3rd and 4th place?
- How much further did _____ jump than ____ ?
- Using greater and less than symbols, put your group's jumps in order of least to most distance travelled.

Use this data to create bar charts in 'Statistics'

Name	Distance jumped (m)
Jenny	2.85
Mike	3.09
Finn	3.14
Ciara	2.7
Laura	3.02

Measure including decimals alternative

If pupils are unable to jump, you could instead have a foam rocket or tennis ball throwing challenge.

Pupils can still record their distances in metres; again, it might be easier to initially measure in centimetres and make the conversion depending on confidence levels.

Once each group has a set of results, pupils can use their data to answer related questions such as:

- Who threw the furthest?
- What was the difference between the longest and the shortest throw?
- Using greater and less than symbols, put the group's throws in order of least to most distance travelled.

These questions could be verbally answered, recorded on whiteboards, or represented using natural objects.

Name	Distance thrown (m)
Eve	0.43
Alex	0.26
Lilly	0.51
Harry	0.82
Ned	0.47

Comparing decimals and fractions

This can be used as an opportunity to do some maths and water some flowers!

Provide containers with a capacity of at least one litre, which pupils can use to investigate and compare fractional and decimal amounts.

For example, ask pupils to compare the amount of water that a plant would get if they were to fill up $^{1}/_{10}$ of a 1 litre container and 0.75 litres of a different container.

How about $^{4}/_{10}$ of a litre compared to $^{1}/_{4}$ l?

Which is greater: 0.8 l or $^{4}/_{5}$ l? How could they prove it?

Providing pupils with differently sized or shaped containers can lead to a wider discussion regarding appearance and volume.

Geometry

Recognising quarter turns

Take pupils outside to practice making quarter turns with their bodies.

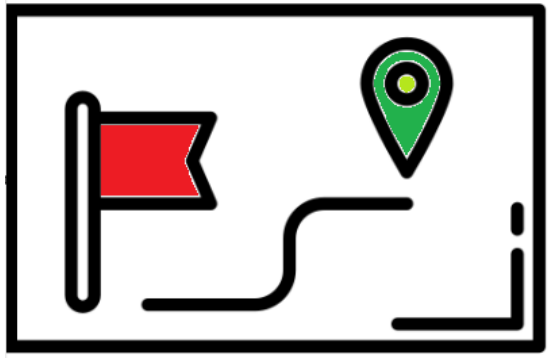
Practice from standing: “Make a quarter turn clockwise,” and including movement: “Walk in a straight line. Make a quarter turn anticlockwise.”

Create instructions for the whole class to follow. Pupils should all end up in the same place facing the same direction!

E.g. “Take 5 steps forward. Make a quarter turn clockwise.

Take 3 steps forward. Makea three-quarter turn anticlockwise.

Take 2 steps forward. Make a half turn clockwise.”



Pupils could then splinter into pairs or groups to follow written instructions starting from different positions around the playground and record where they end up.

Angle hunt

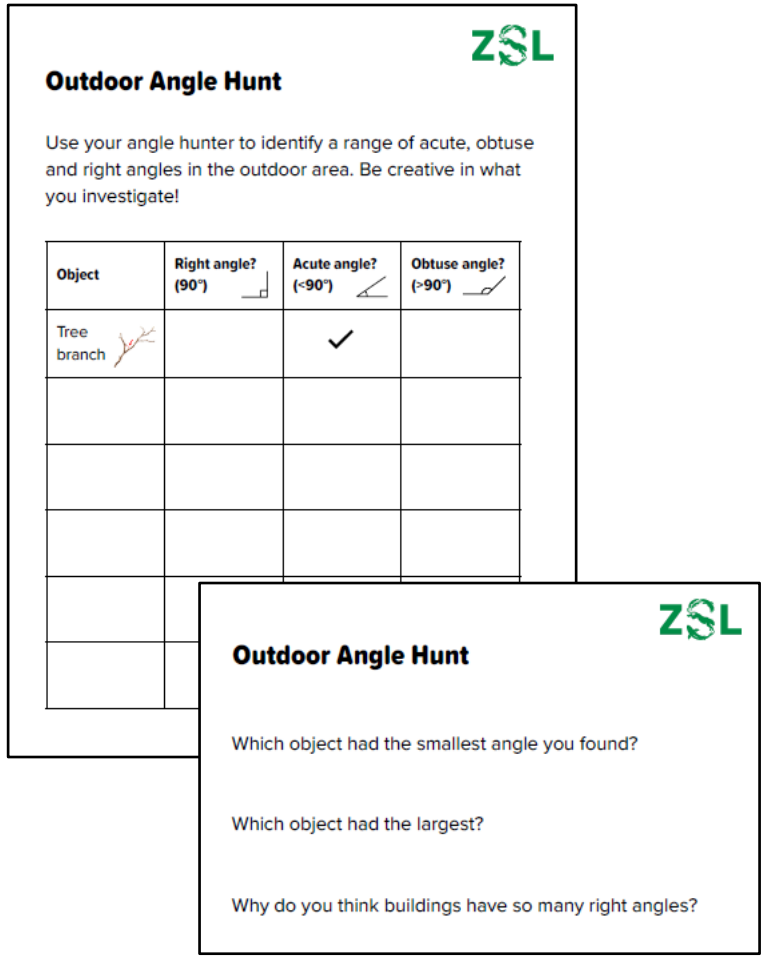
Provide pupils with a square piece of card, paper or a post it note and mark one corner with 90°. Alternatively, pupils could create their own right angle measurers using strips of card and butterfly pins. This is their ‘angle hunter’.

Pupils can then use their angle hunter to identify objects that have right angles, obtuse angles or acute angles.

Pupils could investigate:

- the angles of tree branches
- the offshoots of plants
- manmade objects such as benches or plant boxes

Encourage them to get creative in your outdoor area!



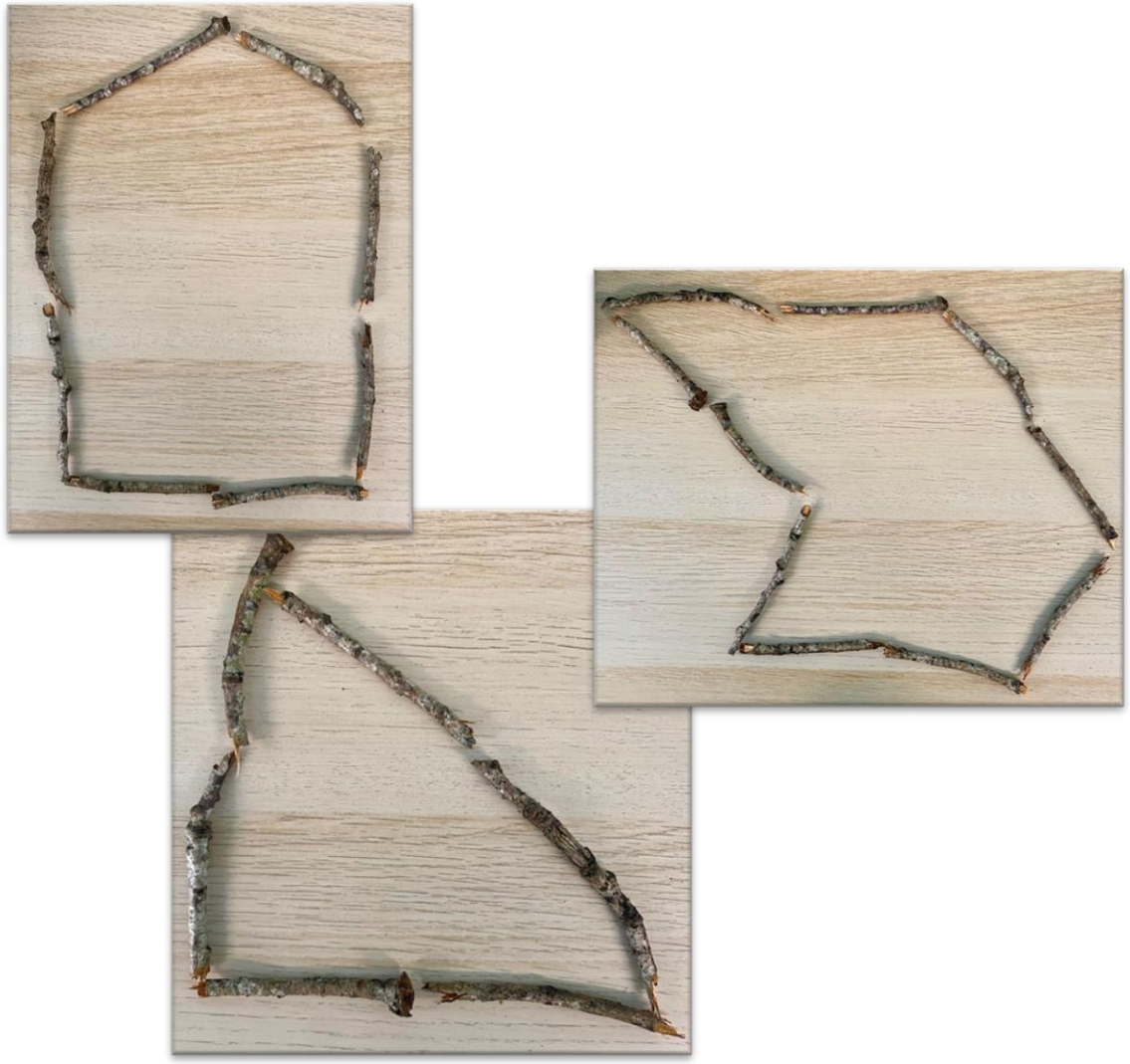
Worksheet available here

Shapes, lines and angles

Provide pupils with a range of shape-related challenges to complete using sticks, for example:

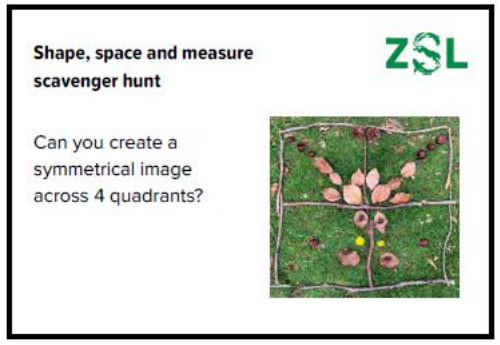
- Use six sticks to create a triangle that has one right angle
- Use ten sticks to create an irregular hexagon that has two acute angles
- Use eight sticks to create a pentagon that has two perpendicular sides

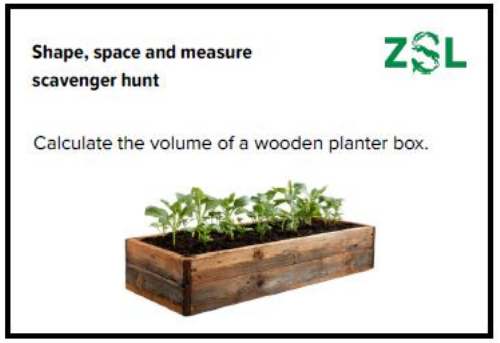
Adapt the level of challenge as appropriate to suit the needs of your learners.

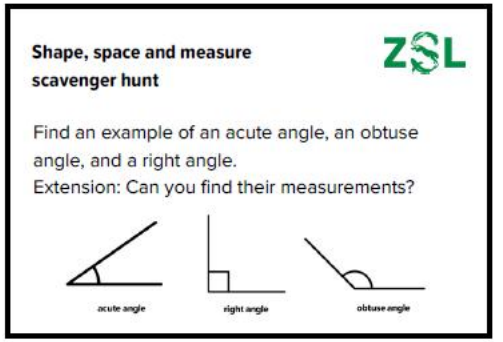


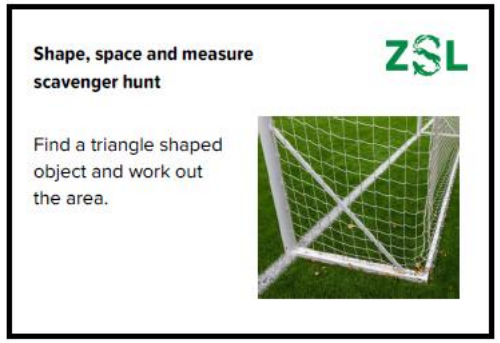
Shape, space and measure scavenger hunt

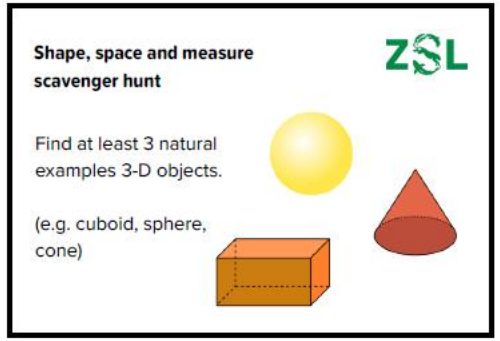
Provide pupils with task cards for a range of shape, space and measure-related challenges to complete outside.

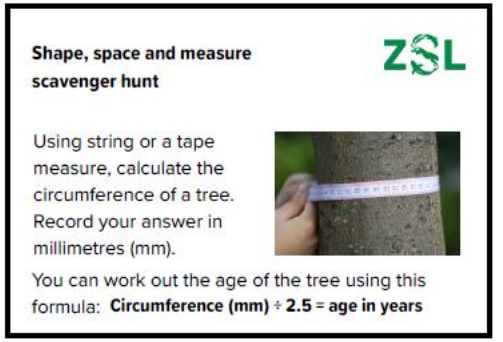












Challenge cards available here

Investigating circles

Measure the circumference of flowerpots, tree stumps and any other circular objects you can find outside.

If you do not have enough tape measures for all pupils or groups to use, demonstrate how to mark the width of the circle using string and then measuring this once a tape measure is available.

What is the biggest circle pupils can find?

What about the smallest?

The age of a tree can also be calculated using the measurement of its circumference in centimetres:

- Measure the tree's girth from roughly 1.5 metres above the ground to avoid the wider tree roots
- To find the age of the tree, divide its girth in centimetres by 2.5

$$\text{Age of tree} = \frac{\text{circumference in cm}}{2.5}$$

Statistics

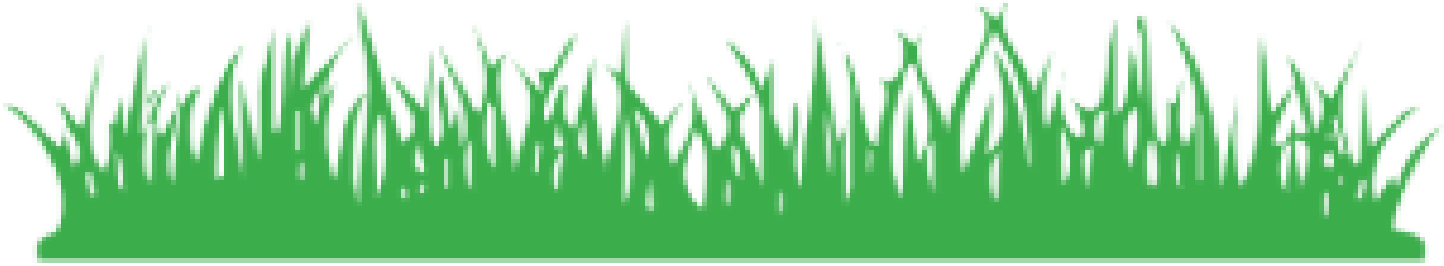
Outdoor pattern-seeking investigations

Introduce a question for the class to investigate, such as:

- “The tallest trees have the largest leaves.”
- “The longest blades of grass are always at the edge of a field/grass area.”
- “The largest fruits have the most seeds/pips.”

Allow pupils to decide how they will conduct their measurements and record their data. You may also want to consider how many results are needed to ensure a fair test/reliable data set.

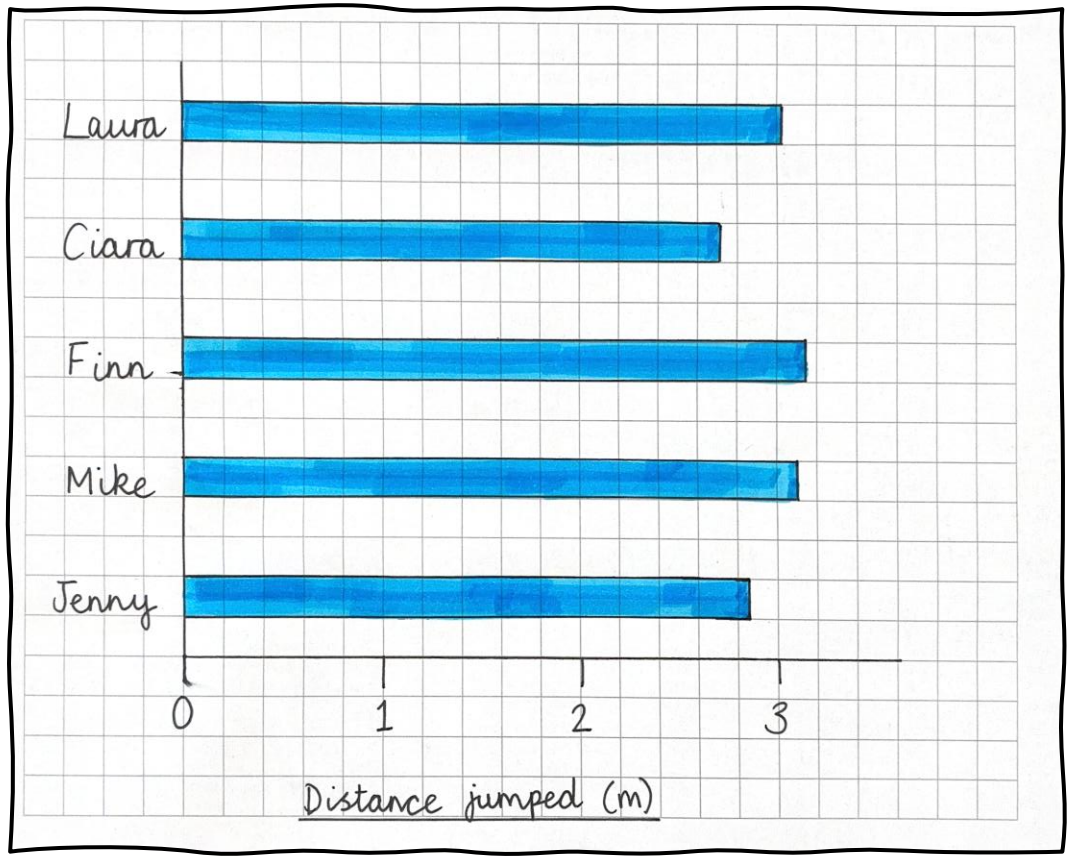
Ask what they think will be the best way to present their findings? This allows for discussion about the uses of different graphs, either as an introduction or revision.



Bar charts using data from outdoor challenges

Using the results from the long jump or throwing challenges (see **‘Measurement’**), task pupils with creating bar charts for their results.

Encourage them to consider how they will divide the space between each whole metre – what value will each square have on their graph paper?



Weather forecast data

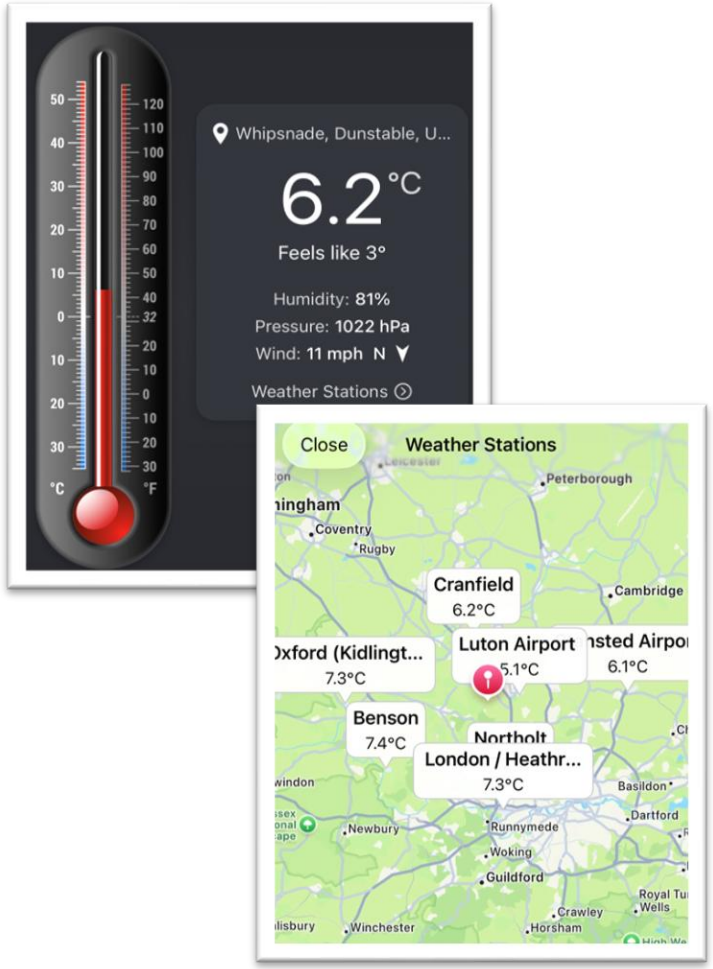
Using an outdoor thermometer or an app, head outside to record the temperature across 5 days.

Ask pupils to create graphs from the 5 days of recorded data, and use this to answer questions related to their results, e.g.:

★ For what fraction of the days was the maximum temperature below X°C?

★ What was the mean maximum temperature, to one decimal place?

Some apps also show temperatures of nearby locations. Pupils could use this information to calculate, for example, differences in temperature or an average across a given area.



Screenshots taken from the Thermometer++ app

Litter picking pie charts

As a class, complete a litter picking task to clean up your outdoor area.

Once you have collected the litter, you can create a results table in a variety of ways:

- Type of litter (e.g. plastic packaging; fruit peels; sweet wrappers; paper, etc.)
- The weight of the litter collected from different areas
- The amount of litter found in different areas
- Recyclable products vs. non-recyclable products (broken down into categories relating to the type of material)

Type of litter	Amount
Food waste	27
Food packaging	59
Paper	43
Broken glass	8
Plastic bottles	17

Pupils then use these results to create pie charts, working out the degree of the angle for each category:

Amount of litter	154	27	59	43	8	17
Angle size (°)	360°					

Ratio and Proportion

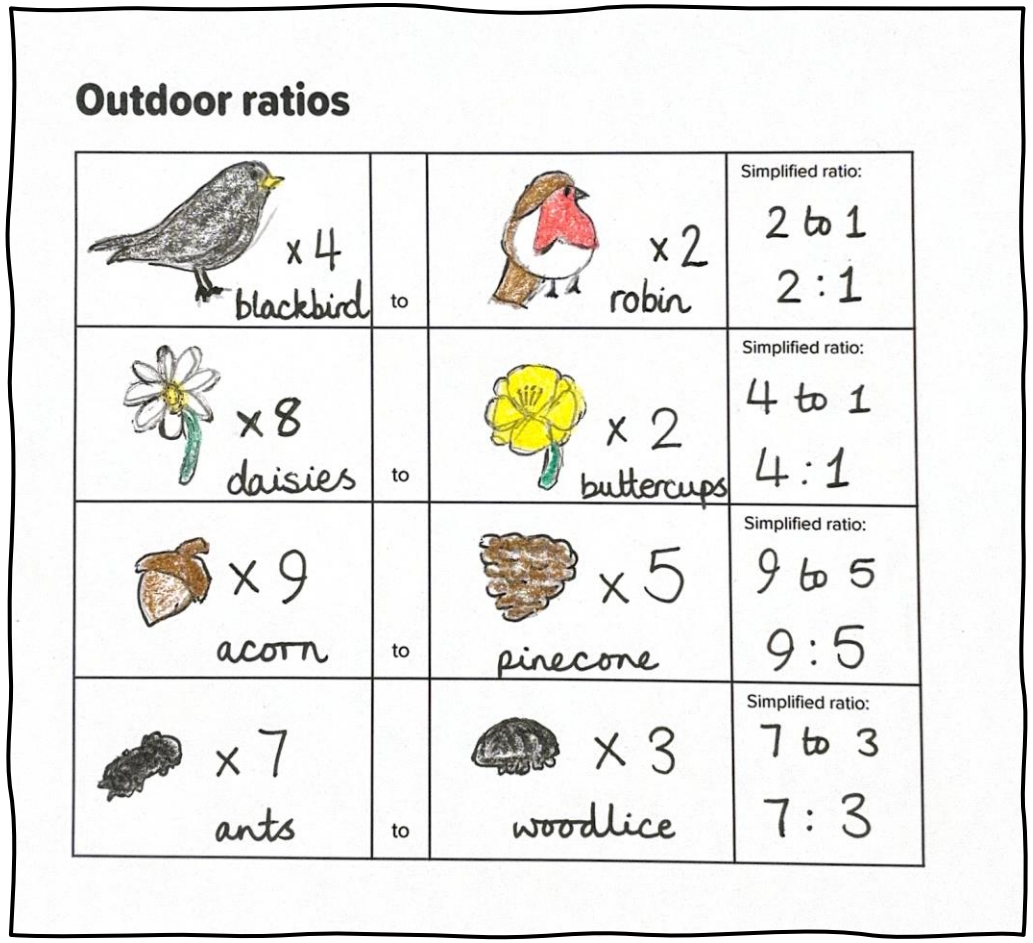
(Year 6)

Observed ratios

Once pupils have an understanding of ratio, what it denotes and how to record this, take them outside to create their own examples, as shown opposite.

Extend the task by challenging pupils to scale up their ratios, for example:

There are four blackbirds for every two robins. If 24 blackbirds fly over the playground, how many robins will there be?



Outdoor ratios

x 4 blackbird	to	x 2 robin	Simplified ratio: 2 to 1 2 : 1
x 8 daisies	to	x 2 buttercups	Simplified ratio: 4 to 1 4 : 1
x 9 acorn	to	x 5 pinecone	Simplified ratio: 9 to 5 9 : 5
x 7 ants	to	x 3 woodlice	Simplified ratio: 7 to 3 7 : 3

Proportional reasoning with sports equipment

Tell pupils you need help planning for a PE lesson.

This is the equipment for a game of kwik cricket:

2 x bats

1 x ball

2 x stump sets

1 x helmet

In the PE cupboard, there are 84 pieces of equipment for kwik cricket sessions.

How many games of kwik cricket could be set up using this equipment?

How many stump sets are there?

Doing this outside with one set of equipment will help pupils to visualise the task and support problem solving ideas.

Ratio relationships

Use natural objects to create 1-to-multiple structures (or vice versa) to familiarise pupils with the idea that ratio remains the same regardless of how the objects in a sequence have been arranged.

You may want to start by asking everyone to create the same ratio (not necessarily using the same natural objects), then ask pupils to create their own sequence using the same number of each item. Compare with each other. Has the ratio of objects changed? Why not?

Challenge pupils to also create sequences using more or fewer of each item, but where they must keep the ratio the same, as in the example opposite.

Ratio 1:

Ratio 2:

Language focus: “In each structure, for every 1 leaf, there are 3 stones.”

Inverse proportion

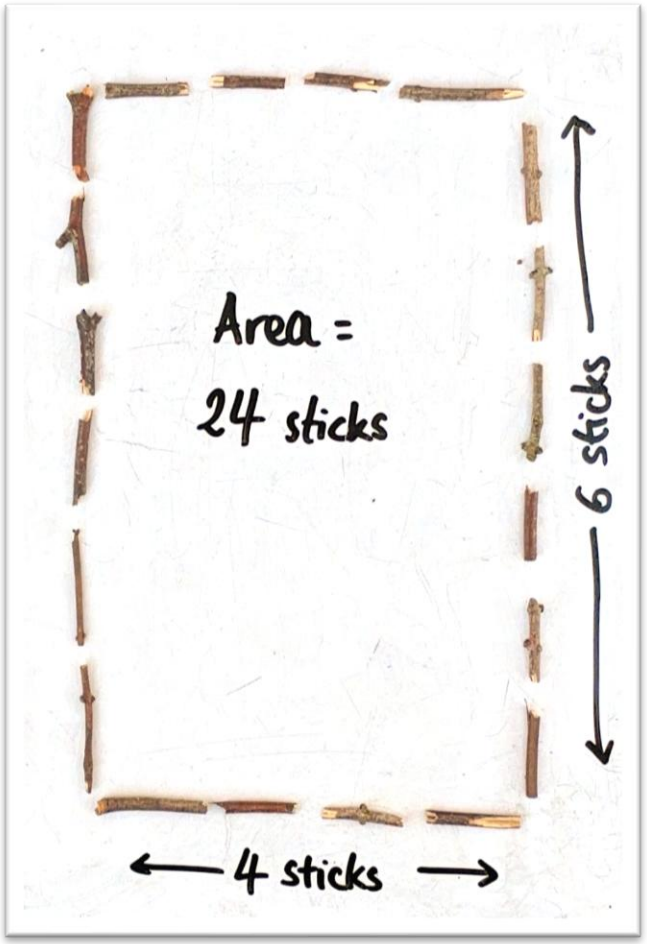
Allow pupils to use natural resources (sticks are most obvious, but you may have an abundance of other objects) to explore what the dimensions could be for a rectangle with the area 24 sticks.

Once they have found several pairs, ask pupils to consider what relationships there are between the different possibilities.

Challenge:

Can we make a generalisation about what happens to the lengths of two pairs, for example, where one rectangle has the sides 12 x 2 and another has 6 x 4?

Can pupils create an algebraic formula to show this where one length is **x** and the other is **y**?

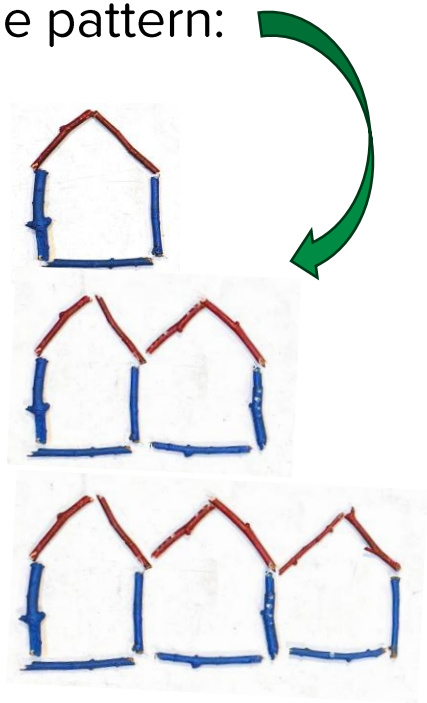


Exploring sequences

This task involves pre-painting sticks two colours of your choice. (Alternatively, you could dip just the ends in paint or put a blob of nail varnish somewhere noticeable.)

Ask pupils to create a pentagon out of the sticks, using one colour for the ‘roof’ and the other colour for the lower part of the shape.

Ask them to repeat the pattern, creating an adjoining pentagon following the same pattern:



Ask pupils to discuss or record in groups:

- What is changing?
- What is staying the same?
- What is the ratio of (red) to (blue) sticks each time?
- How many (red) sticks will the next shape in the sequence require?
- How many (X colour) sticks will there be in the n^{th} number of the sequence?

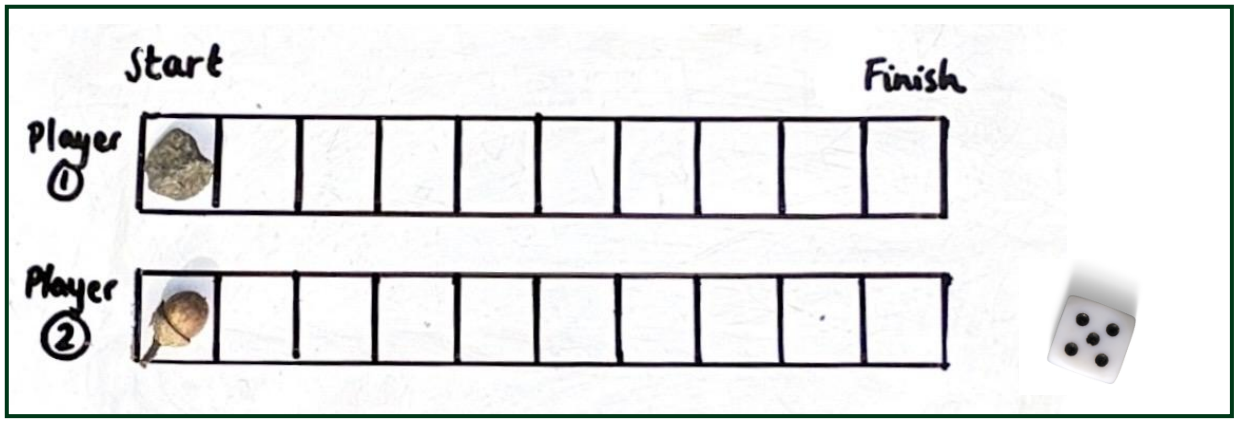
Exploring different likelihoods

Using whiteboards or chalk on paved areas, get pupils to draw a two-sided track with 10 spaces. Each player can choose a natural object to use as a counter, then take it in turns to roll a 6-sided dice.

- **Player 1** can move their counter one space along the track **if a number greater than 4** is rolled.
- **Player 2** can move their counter one space **if a number less than 4** is rolled.
- If the dice lands on a 4, roll again.

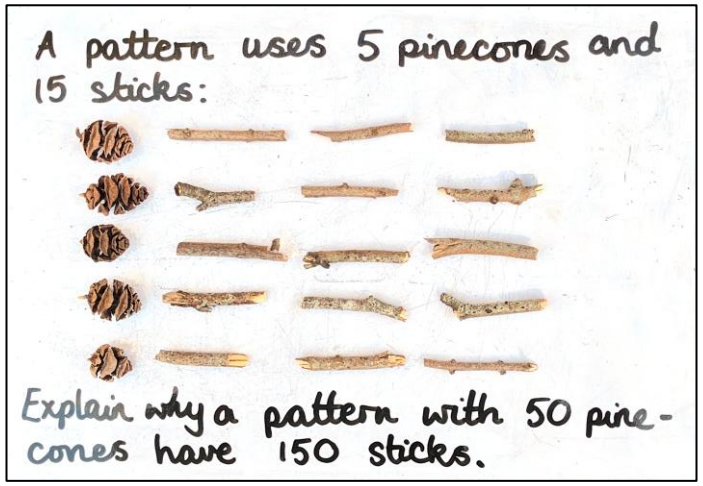
The first player to reach the end of the track is the winner.

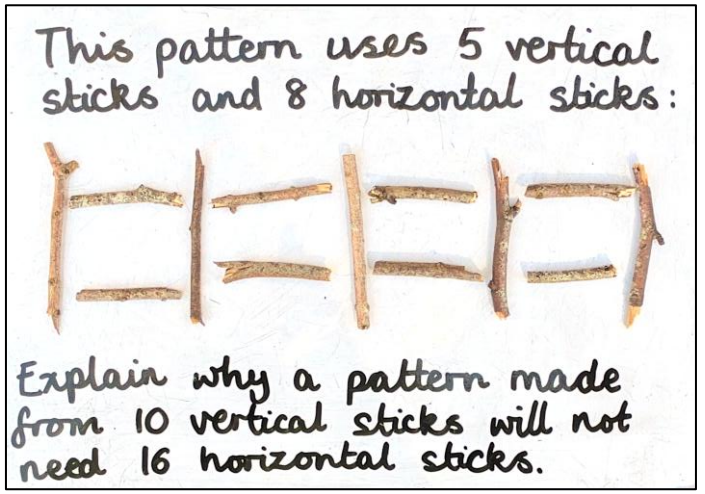
After playing a few times, ask pupils to explain if the game they have played is fair or not and why.



Proportional and non-proportional reasoning

Below is one example of proportional reasoning and one non-example :





Use these examples (and/or similar) to question pupils about why doubling the 5th item in one sequence give the 10th item in some situations but not others?

For pupils who are less secure with proportional and non-proportional contexts, allowing them to continue building the sequence further will provide opportunity to see these patterns emerge and deepen their understanding of the key differences in both contexts.

Algebra

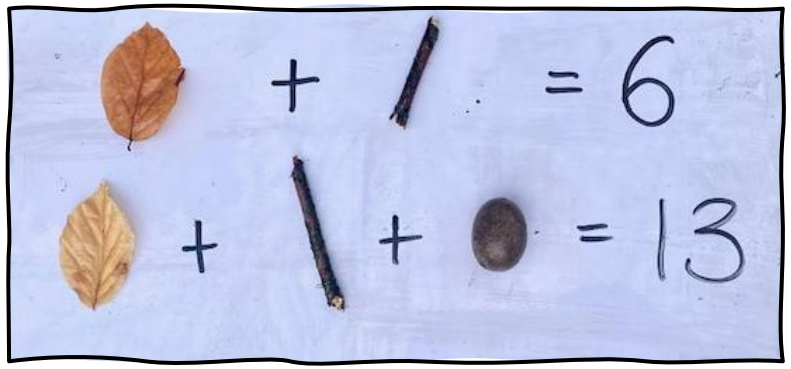
(Year 6)

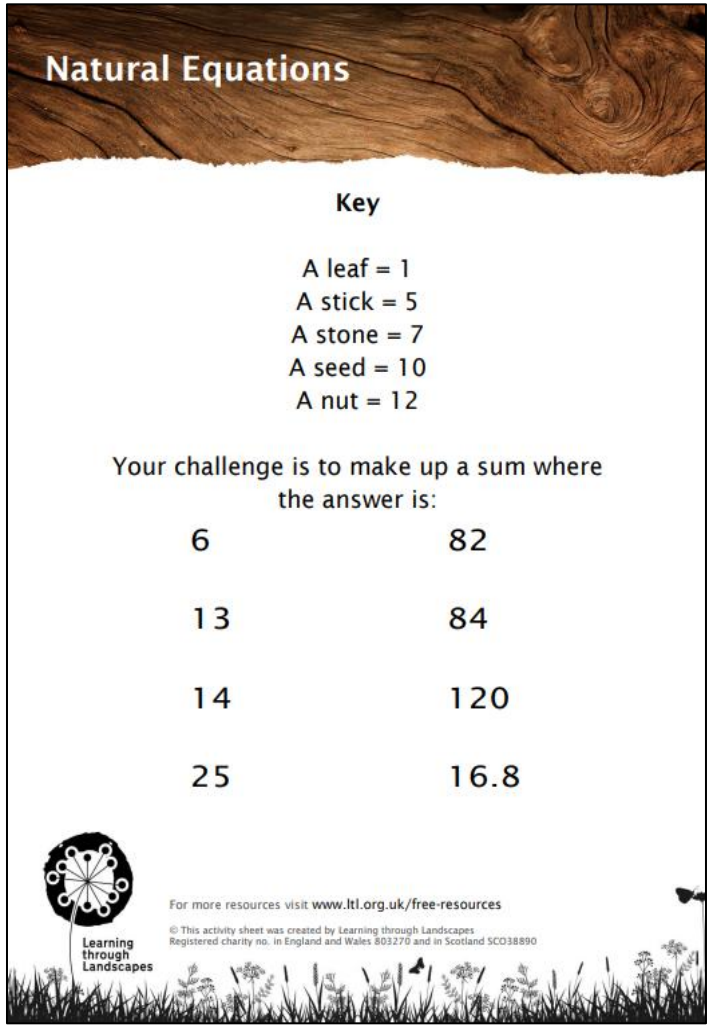
Natural equations

Using the ‘Natural Equations’ value sheet opposite from **Learning through Landscapes** – linked **here** – or creating your own value key for your pupils based on the objects in your outdoor area, demonstrate to pupils how to use this information to create a series of equations.

Extension 1: Is there more than one possible solution for any of the answers?

Extension 2: Can pupils create their own keys and answers that a partner has to create the equations for?



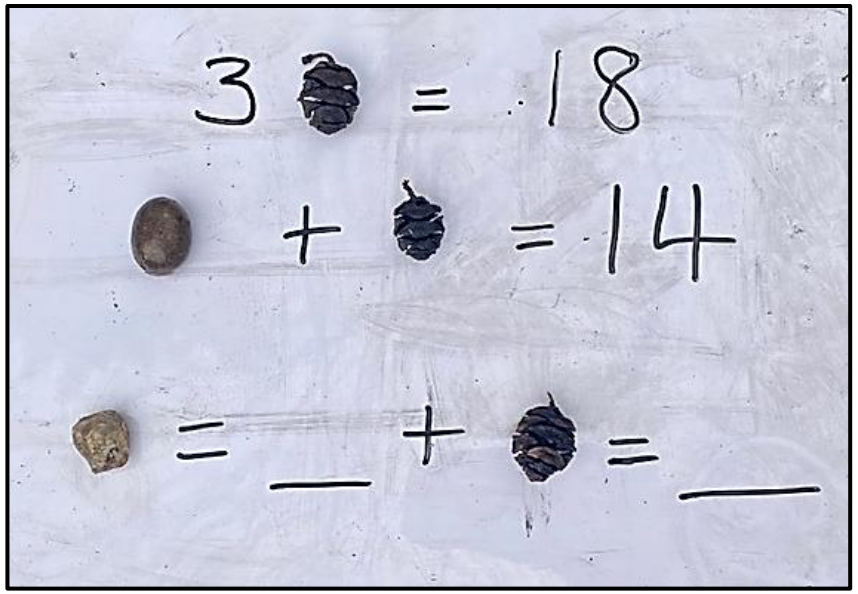


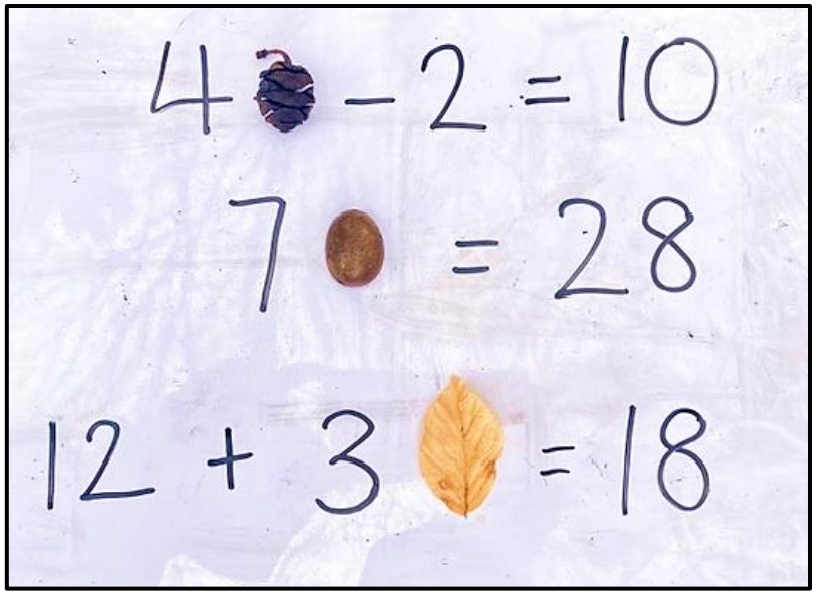
Missing value equations

Challenge pupils to find the value of different natural objects in the same way they would work out an algebraic value.

Can they explain what helped them to solve each equation?

Pupils could also create their own natural object algebra equations for a partner to solve.





n^{th} term in a sequence

Ask pupils to create a square out of sticks:

Then create an adjoining square using 3 more sticks:

Continue this pattern until there is a row of four squares:

Ask pupils:

- What is the sequence of numbers? (i.e. the number of sticks)
- What would the number of sticks be in the 15^{th} diagram? Can you think of a calculation you could perform to find this?

Pupils can then prove/check their reasoning by building the 15^{th} diagram.