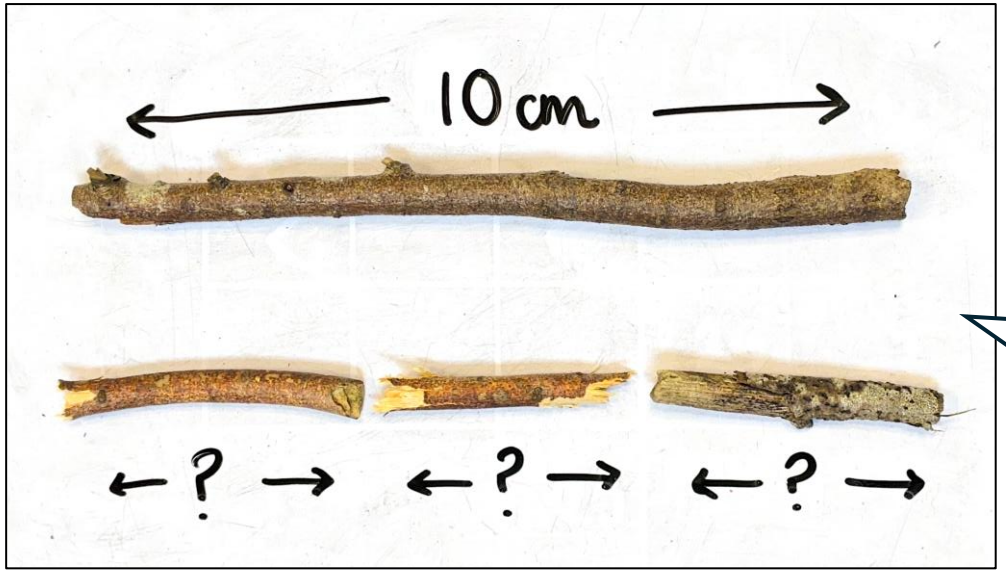
KS4 Outdoor Maths Opportunities

Using and applying numerical structure

Decimal and fractional representations

Use sticks to assess pupils' appreciation 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:

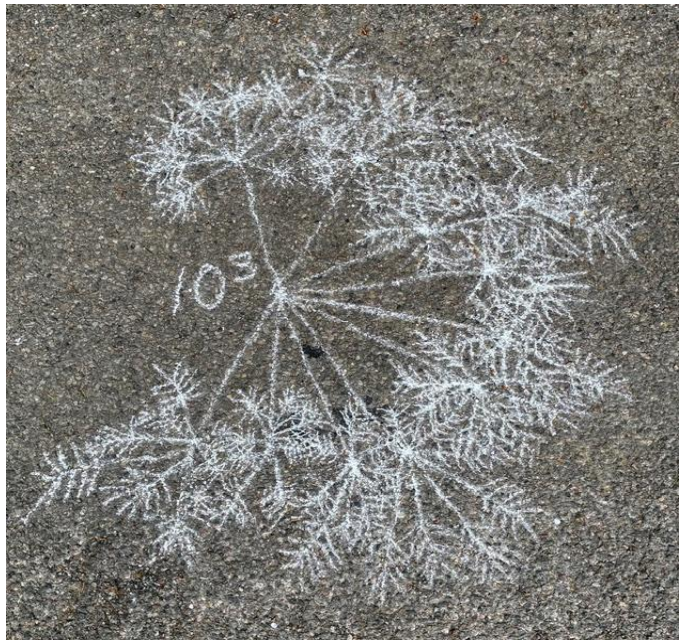
- 3.3 cm long
- $3\frac{3}{3}$ cm long
- 3.33333 cm long
- $3.\dot{3}$ cm

Which do they most agree with and why?

Exploring the structure of indices

A common error when calculating indices is to confuse, for example, 10^3 as 10 x 3.

Pupils could explore the difference in magnitude represented by these two expressions while working outside in a large space with chalk to create multiplication branches. Just the effort taken to create a squared or cubed branching example should help to reinforce the difference!



Pupils could also explore similar looking scenarios, such as: ‘Which is greater, 4^3 or 3^4?’

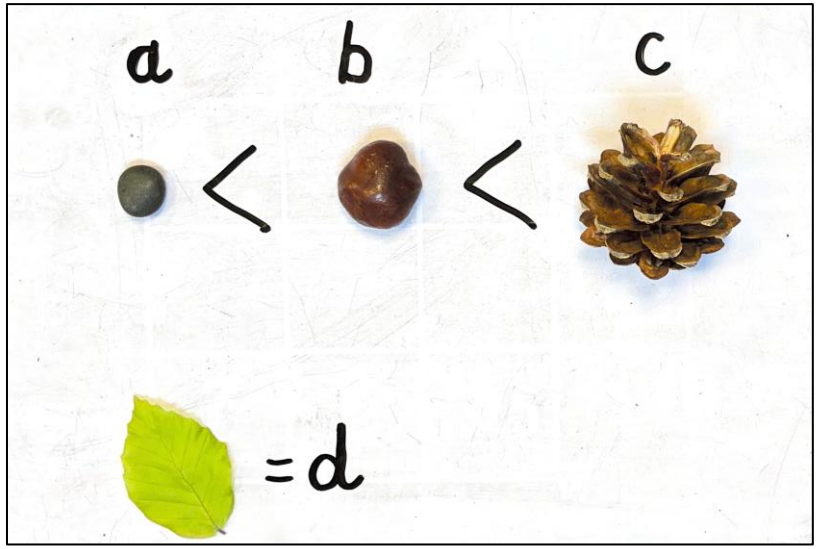
Algebra

Experimenting with increasing or decreasing a value in different calculations

Use natural resources to represent 3 positive numbers (**a, b** and **c**), whereby the rule is **a < b < c** (you may want to use natural objects that follow this pattern in shape or size).Then choose one further item to represent a fourth positive number, **d**.

Ask pupils to decide which of their 3 objects representing **a, b** and **c** should be used to complete these calculations, so that each time it has the biggest possible solution:

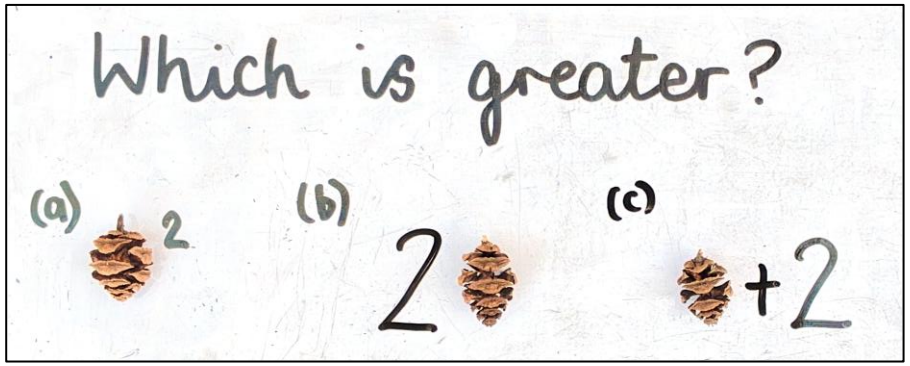
- d – [_]
- d + [_]
- [_] – d
- [_] + d
- [_] x d
- d x [_]
- d ÷ [_]
- [_] ÷ d



Equations taken from NCETM KS4 Materials and guidance - Theme 7.1: Using Structure to calculate and estimate

Algebraic notation with natural resources

Use natural resources to create the following algebraic expressions:



Ask pupils to continue using natural resources to prove which values could make the following rules correct:

a) A value that makes $\mathbf{a^2}$ the greatest total value

b) A value that makes **a + 2** the greatest total value

c) A value that makes **2a** the lowest value

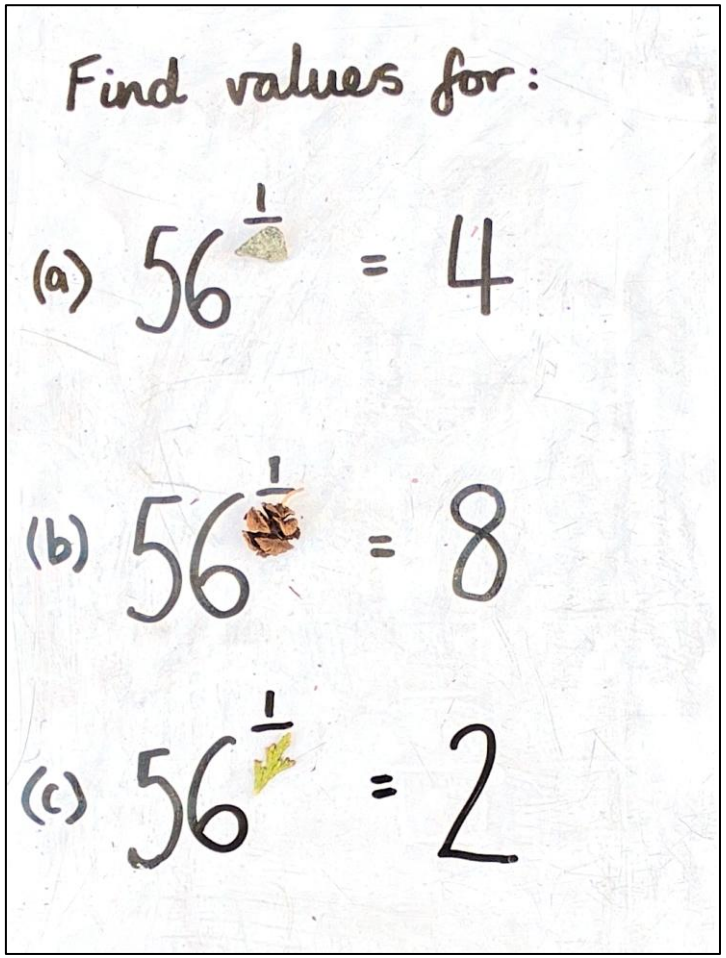
d) A value that makes all three expressions equal in value

Rules taken from NCETM KS4 Materials and guidance - Theme 7.2: Using Structure to transform and evaluate expressions

Exploring fractional indices

Use natural resources to represent denominators in fractional indices. Keeping the base number the same will ensure pupils focus on what changes as the denominator of the indices change.

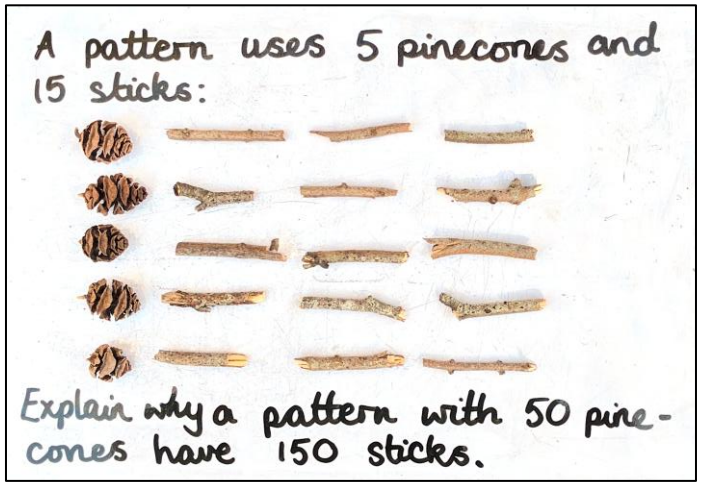
Once pupils have explored a given example, challenge them to create their own equations for a partner or the wider group, using different fractional powers while the base number stays the same.

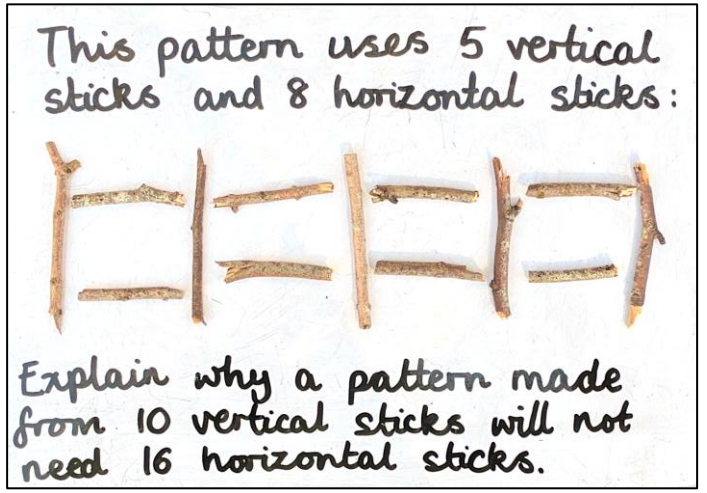


Ratio, proportion and rates of change

Proportional and non-proportional contexts

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.

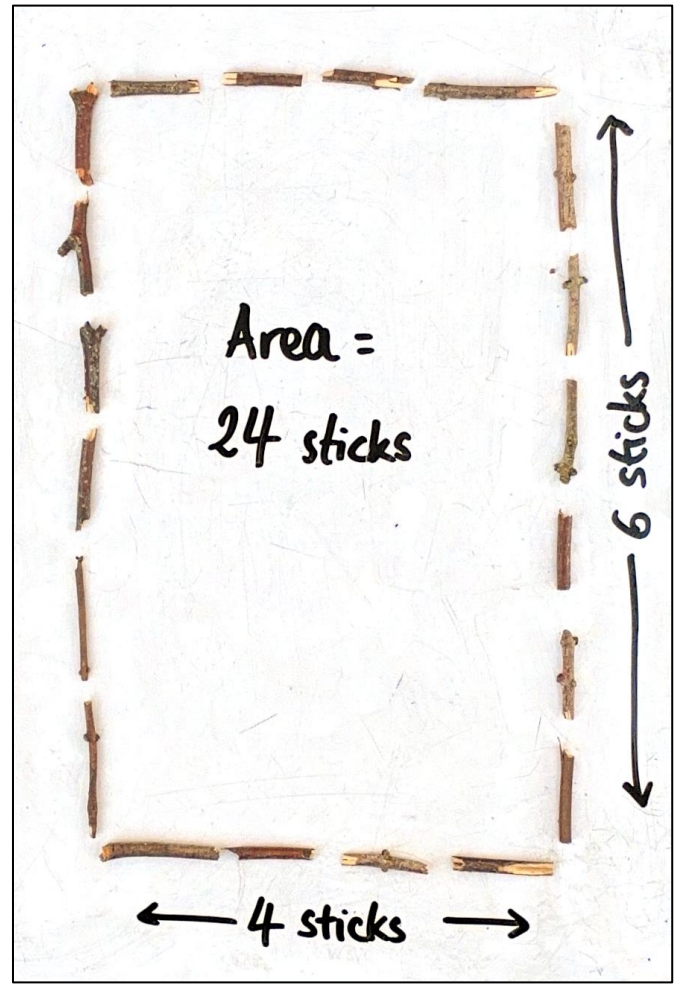
Inverse proportion

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.

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**?



Algebraic stones

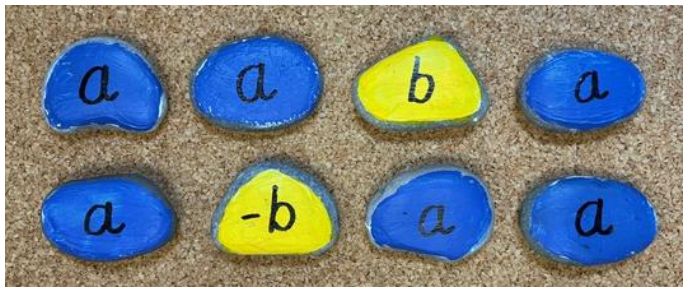
Using stones with algebraic notations can help pupils gain familiarity with adding and subtracting formal algebraic equations. Using algebraic stones to manipulate variables will help to develop and embed an understanding of zero pairs.

Allow pupils the opportunity to experiment with writing algebraic equations for given sets of stones and also the chance to create their own, perhaps for a partner to solve.

The value is 21:

The value is 6:

What is the value of the following?



- **What algebraic expression could you write for each representation?**
- **What is the value of one of the 'a' stones?**
- **What is the value of 'b'?**

Geometry and measures

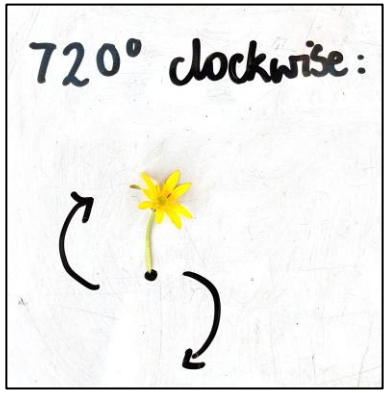
Turns greater than an angle of 360°

Use objects (or the pupils themselves!) in your outdoor area to practice making turns greater than 360° to help with visualisation of this concept.

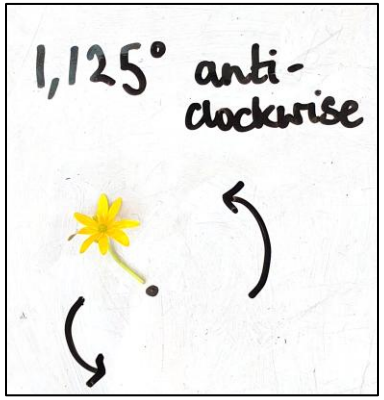
Start by giving pupils turns that are multiples of or close to multiples of 360° to embed the concept.

For example:

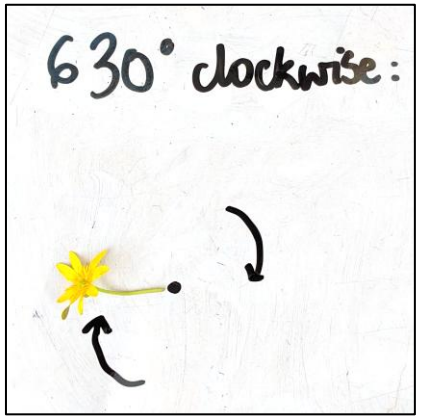
- Move your object 720° clockwise. What is its position now?
- Move your object 630° clockwise. What is its position now?
- Move your object 1,125° anti-clockwise. What is its position now?



2 x 360°



3 x 360° + 45°



2 x 360° - 90°

Probability

Germination probability

Provide a real-life probability context by cultivating plants – you may want to make your choice of seeds based on ease of being able to count the seeds and growing/seasonal requirements.

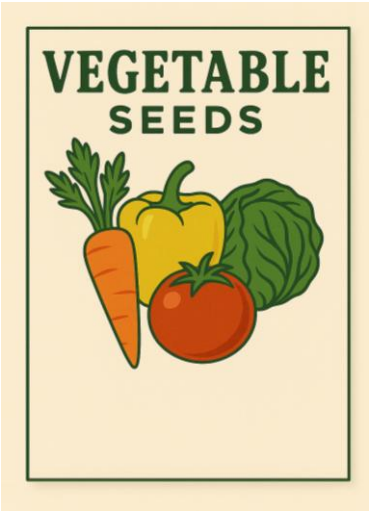
Start by just planting one set of seeds and seeing how many successfully grow into seedlings. From these results, tell pupils this proves that there is an X% chance that this type of seed will germinate. Do they agree with your assessment? This encourages them to consider whether reliable conclusions can be drawn from a single trial.

Repeat the activity, planting a varied number of seeds in different trays or plots and once again recording the number that successfully germinate, e.g.:

Planted	13	15	12	14	12
Germinated	11	15	9	13	12

Pupils can use this range of data to estimate the probability that a seed will germinate and consider whether this is a better estimate than your original that was based on only one set of data.

You could then use the estimate from the range of data to ask questions about how many plants may grow from a certain number of seeds, or how many seeds you should plant if you want to cultivate a particular number of flowers.



Statistics

Coming Soon