# Percentages: Feeding the Nutcracker

## Key Learning Content

This film introduces the idea of a percentage of a number, as well as using basic probability relationships between an event and its complement. It tells the story of a bird which hides thousands of nuts during the summer to eat during the winter. Despite the fact that the bird is not always successful in remembering where it is has hidden all its nuts, it plays the percentage game and will expect to find sufficient nuts to survive the harsh winter. Finding the percentage of a number is shown by dividing by 100 and multiplying by the percentage.

No prior knowledge of percentages or probability is required prior to watching the film.

## Core Outcomes

### Learning Points

- Be able to understand that 'percentage' means 'number of parts per 100'.
- Be able to express a percentage as a fraction.
- Be able to find given percentages of a given number.

### Suggested Activities

- Match up common percentages and their fraction equivalences.
- Learn shortcuts and 'tricks' for finding percentages of a number.
- Use the general method for finding any percentage of any given number.

## Extension Outcomes

### Learning Points

- Be able to understand the language of probability: outcomes, events, complements, likelihood.
- Be able to recognise that $\Sigma Pi = 1$.
- Be able to understand that if $P(A) = p$, then $P(A') = 1 - p$ , where $A'$ is the complement of A.

### Suggested Activities

- Work out the likely geographic distribution of the nuts hidden by the bird assuming random selection of hiding places.
- Assess to what extent the bird's success at finding the nuts is due to chance, or whether it is evidence of using memory.

**Clark's nutcracker must use its incredible memory when storing food and play the percentage game to survive.**

## Related Films

To use before the lesson plan:

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| **Numbers: Animal Maths** | This film speculates as to how much mathematics animals might know and use. |
| **Fractional Reserve Banking** | This film demonstrates the use of fractions or decimals or percentages to keep banks healthy. |

To use after the lesson plan:

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|---|---|
| **Percentages: Tax Breaks** | This film explains why small differences in a few key percentages could be very costly. |
| **Primed for Survival** | This film showcases the a surprisingly sophisticated use of maths in the breeding cycle of an insect. |
| **The Monty Hall Problem** | This film features a simple television game show that challenges ideas about probability. |

## Guide Lesson Plan

### Introduction

Ask students if they always remember where they have put things. How many students have ever forgotten text books, writing books or calculators for their maths lesson? Get students to estimate how many things they have to find during the day and what their percentage success rate is. Collate and compare responses.

### Show Film

**Percentages: Feeding the Nutcracker**

### Main Activity

**Foundation**

Note that in the film 70% and 30% were used, and could be seen as 70/100 = 7/10 and 30/100 = 3/10. Give students other common percentages (multiples of 10, multiples of 25, 33.3…%, 12.5% etc.) and get them to work out the corresponding fractions. Then show them how more complicated percentages, such as 37.5% of 80, could be quickly evaluated by writing 37.5% as 25% + 12.5%, or one-quarter plus one-eighth. Set exercises to find percentages of given numbers using only mental maths.

## Main Activity cont..

**Advanced**

Tell students that you want to work out how good a memory the nutcracker has by estimating the probability that it found nuts randomly, by chance. Work out how many square metres there are in its flying zone (from the film), then how many hiding places it will create, hence find the probability that a randomly chosen square metre will have nuts in it. Then discuss how to refine the model, for example by counting only a small percentage of the land as being suitable for burying nuts; or by considering how many other nutcrackers will also be burying nuts in the same area. Then consider how many square metres a nutcracker could check in a day, in a month, in a whole winter. Compare students' results from their models and come to a conclusion about how good the nutcracker's memory is.

## Extension Activity

**Foundation**

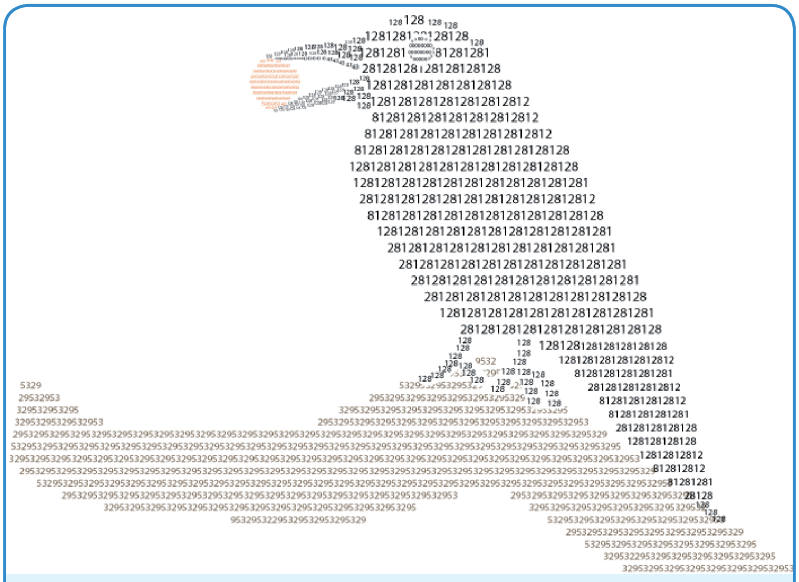
Explain that some percentages are very difficult to work out solely by using mental maths, e.g. 31.7% of 1318.6. Explain that many percentage problems can become very simple if you first work out 1% of the number by dividing by 100, and then multiply by the required percentage, using a calculator. Set exercises to practise the general method. (Note: do not allow students to use a % button on a calculator; insist that they understand the general method.)

**Advanced**

Discuss whether a binomial distribution could be used to assess the number of hiding places the nutcracker is likely to find by chance, using $(p + (1-p))^n$, and the binomial functions built into spreadsheets.

## Optional Extra

Research how the data presented in the film was collected. How did the observers know how many nuts were buried, how many were found, and whether a nutcracker was finding its own or another bird's nuts?



**The nutcracker has a 70% success rate in finding the nut stores under the deep snow.**