

# YEAR 10 — PROPORTION...

# Probability

@whisto\_maths

## What do I need to be able to do?

By the end of this unit you should be able to:

- Add, Subtract and multiply fractions
- Find probabilities using likely outcomes
- Use probability that sums to 1
- Estimate probabilities
- Use Venn diagrams and frequency trees
- Use sample space diagrams
- Calculate probability for independent events
- Use tree diagrams

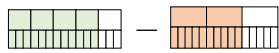
## Keywords

- Event:** one or more outcomes from an experiment
- Outcome:** the result of an experiment
- Intersection:** elements (parts) that are common to both sets
- Union:** the combination of elements in two sets
- Expected Value:** the value/ outcome that a prediction would suggest you will get
- Universal Set:** the set that has all the elements
- Systematic:** ordering values or outcomes with a strategy and sequence
- Product:** the answer when two or more values are multiplied together.

## Add, Subtract and multiply fractions

Addition and Subtraction

$$\frac{4}{5} - \frac{2}{3}$$



$$\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$$

Use equivalent fractions to find a common multiple for both denominators

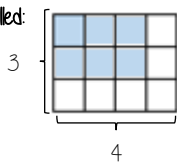
Multiplication

$$\frac{3}{4} \times \frac{2}{3}$$

$$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$$

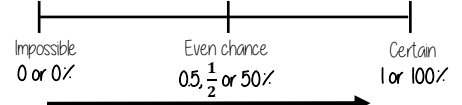
Parts shaded

Modelled:



Total number of parts in the diagram

## Likelihood of a probability



The more likely an event the further up the probability it will be in comparison to another event (it will have a probability closer to 1)

## Sum to 1

Probability is always a value between 0 and 1

The probability of getting a blue ball is  $\frac{1}{5}$   
 $\therefore$  The probability of NOT getting a blue ball is  $\frac{4}{5}$



The sum of the probabilities is 1

## Experimental data

- Theoretical probability** What we expect to happen
- Experimental probability** What actually happens when we try it out

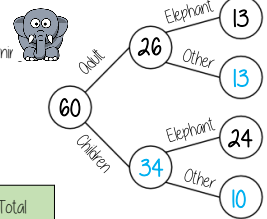
The more trials that are completed the closer experimental probability and theoretical probability become

The probability becomes more accurate with more trials.  
 Theoretical probability is proportional

## Tables, Venn diagrams, Frequency trees

### Frequency trees

60 people visited the zoo one Saturday morning. 26 of them were adults. 13 of the adults's favourite animal was an elephant. 24 of the children's favourite animal was an elephant.



Frequency trees and two-way tables can show the same information

The total columns on two-way tables show the possible denominators

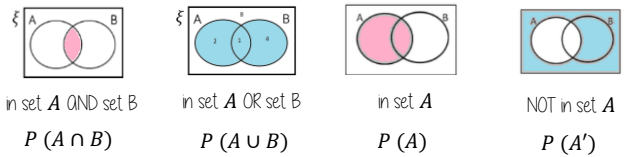
### Two-way table

	Adult	Child	Total
Elephant	13	24	37
Other	13	10	23
Total	26	34	60

$$P(\text{adult}) = \frac{26}{60}$$

$$P(\text{Child with favourite animal as elephant}) = \frac{13}{37}$$

### Venn diagram



## Sample space

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

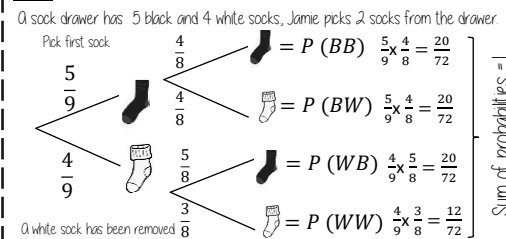
	1	2	3	4	5	6
H	1H	2H	3H	4H	5H	6H
T	1T	2T	3T	4T	5T	6T

$$P(\text{Even number and tails}) = \frac{3}{12}$$

## Dependent events

Tree diagram for dependent event

The outcome of the first event has an impact on the second event



NOTE: as 'socks' are removed from the drawer the number of items in that drawer is also reduced  $\therefore$  the denominator is also reduced for the second pick

## Independent events

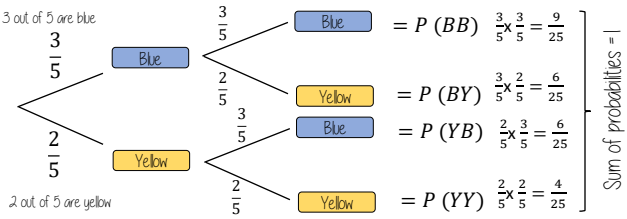
The outcome of two events happening. The outcome of the first event has no bearing on the outcome of the other

$$P(A \text{ and } B) = P(A) \times P(B)$$

### Tree diagram for independent event

Isobel has a bag with 3 blue counters and 2 yellow. She picks a counter and replaces it before the second pick.

Because they are replaced the second pick has the same probability



# YEAR 10 — PROPORTION...

# Percentages and Interest

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## What do I need to be able to do?

By the end of this unit you should be able to:

- Convert and compare FDP
- Work out percentages of amounts
- Increase/ decrease by a given percentage
- Express one number as a percentage
- Calculate simple and compound interest
- Calculate repeated percentage change
- Find the original value
- Solve problems with growth and decay

## Keywords

**Exponent:** how many times we use a number in multiplication It is written as a power

**Compound interest:** calculating interest on both the amount plus previous interest

**Depreciation:** a decrease in the value of something over time.

**Growth:** where a value increases in proportion to its current value such as doubling

**Decay:** the process of reducing an amount by a consistent percentage rate over time.

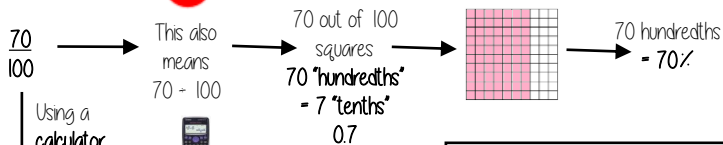
**Multiplier:** the number you are multiplying by

**Equivalent:** of equal value.

## Compare FDP



Comparisons are easier in the same format.



Using a calculator



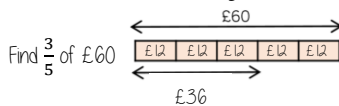
Convert to a decimal

This will give you the answer in the simplest form

× 100 converts to a percentage

Be careful of recurring decimals  
e.g.  $\frac{1}{3} = 0.3333333$   
 $\frac{2}{3} = 0.\dot{6}$   
The dot above the 3

## Fraction/ Percentage of amount



Remember

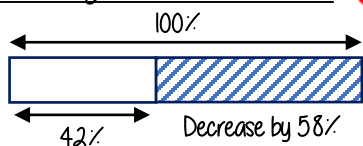
$$\frac{3}{5} = 60\%$$

$$\begin{aligned} 10\% \text{ of } £60 &= £6 \\ 50\% \text{ of } £60 &= £30 \\ 60\% \text{ of } £60 &= £36 \end{aligned}$$



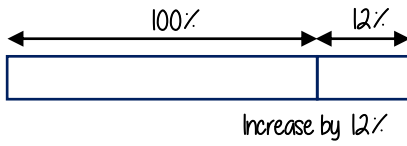
Remember  
 $\frac{3}{5} = 60\% = 0.6$   
60% of £60 =  $0.6 \times 60 = £36$

## Percentage increase/decrease



$$\begin{aligned} 100\% - 58\% &= 42\% \\ 100 - 0.58 &= 0.42 \end{aligned}$$

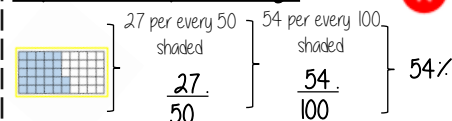
Multiplier  
Less than 1



$$\begin{aligned} 100\% + 12\% &= 112\% \\ 100 + 0.12 &= 112 \end{aligned}$$

Multiplier  
More than 1

## Express as a percentage



$$\frac{13}{30} \rightarrow \frac{13}{30} \rightarrow \times 100$$



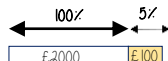
43.3333...%  
→ 43%

Can't use equivalence easily to find 'per hundred'

Decimal percentages are still a percentage.

## Simple and compound interest

### Simple Interest

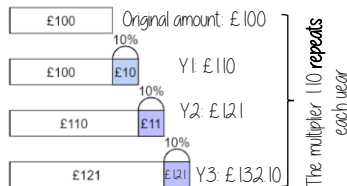


James invests £2,000 at 5% simple interest

The original value increases by this amount every year

### Compound Interest

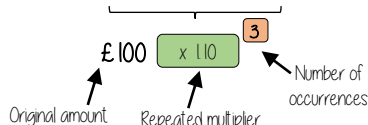
Tess invests £100 at 10% compound interest for 3 years



## Repeated percentage change



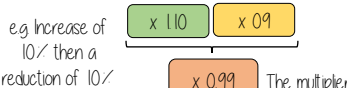
Tess invests £100 at 10% compound interest for 3 years



### Depreciation

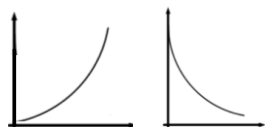
Depreciation calculations use multipliers less than 1

Multipliers are commutative — an overall multiplier effect can be calculated by combining the multipliers separately.



## Growth and decay

Compound growth    Compound decay



Compound growth and compound decay are exponential graphs

**Decay** — the values get closer to 0  
The constant multiplier is less than one

**Growth** — the values increase exponentially  
The constant multiplier is more than one

## Find the original value

Percentage calculations

$$\text{Original amount} \times \text{Multiplier} = \text{Final Value}$$

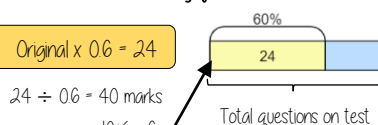
In a test Lucy scored 60% of her questions correctly. Her score was 24. How many questions were on the test?

$$\text{Original} \times 0.6 = 24$$

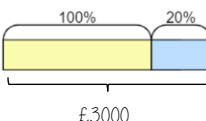
$$24 \div 0.6 = 40 \text{ marks}$$

$$\begin{aligned} 10\% &= 6 \\ 100\% &= 40 \end{aligned}$$

Total questions on test



A car sold for a profit of £3000 with a profit of 20%. How much was the car originally?



$$\text{Original} \times 1.2 = 3000$$

$$\begin{aligned} 120\% &= £3000 \\ 10\% &= £250 \\ 100\% &= £2500 \end{aligned}$$