

# YEAR 7 — APPLICATION OF NUMBER

## Solving problems with addition and subtraction

@whisto\_maths

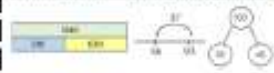
### What do I need to be able to do?

- By the end of this unit you should be able to:
- Understand properties of addition/ subtraction
  - Use mental strategies for addition/subtraction
  - Use formal methods of addition/subtraction for integers
  - Use formal methods of addition/subtraction for decimals
  - Solve problems in context of perimeter
  - Solve problems with finance, tables and timetables
  - Solve problems with frequency trees
  - Solve problems with bar charts and line charts

### Keywords

- Commutative:** changing the order of the operations does not change the result
- Associative:** when you add or multiply you can do so regardless of how the numbers are grouped
- Inverse:** the operation that undoes what was done by the previous operation (The opposite operation)
- Placeholder:** a number that occupies a position to give value
- Perimeter:** the distance/ length around a 2D object
- Polygon:** a 2D shape made with straight lines
- Balance:** in financial questions — the amount of money in a bank account
- Credit:** money that goes into a bank account
- Debit:** money that leaves a bank account

### Addition/ Subtraction with integers



Modelling methods for addition/ subtraction

- Bar models
- Number lines
- Part/ Whole diagrams



Addition is commutative

The order of addition does not change the result

Subtraction the order has to stay the same

$$360 - 147 = 360 - 100 - 40 - 7$$

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction
- Show your relationships by writing fact families

Formal written methods

	H	T	O
+	1	8	7
+	5	4	2
-----			

	H	T	O
-	4	2	7
-	2	4	9
-----			

Remember the place value of each column  
You may need to move 10 ones to the ones column to be able to subtract

### Addition/ Subtraction with decimals

4	.	3	8
7	.	9	0
-----			

0 can be used to fill empty places with value

The decimal place acts as the placeholder and aligns the other values



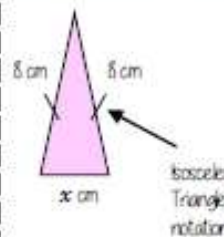
1 represents 1 instead of 100

$$5.43 + \frac{8}{10}$$

Revisit Fraction — Decimal equivalence  
 $5.43 + 0.8$

### Solve problems with perimeter

Perimeter is the length around the outside of a polygon



isosceles Triangle notation

The triangle has a perimeter of 25cm  
Find the length of x

$$8\text{cm} + 8\text{cm} + x\text{cm} = 25\text{cm}$$

$$16\text{cm} + x\text{cm} = 25\text{cm}$$

$$x\text{cm} = 9\text{cm}$$

### Solve problems with finance

Profit = Income - Costs

Credit — Money coming into an account

Debit — Money leaving an account

Money uses a two decimal place system  
14.2 on a calculator represents £14.20

Check the units of currency — work in the same unit

### Tables and timetables

Distance tables

London		Cardiff	Glasgow	Belfast
211	493	177		
556	392			
518				

This shows the distance between Glasgow and London  
It is where their row and column intersects

Bus/ Train timetables

Horton	1005	1045	1130
Bridge	1024	1106	1147
Avilla	1051	1133	1205
Ware	1117	1202	1233

Each column represents a journey each row represents the time the 'bus' arrives at that location

TIME CALCULATIONS — use a number line

Two-way tables

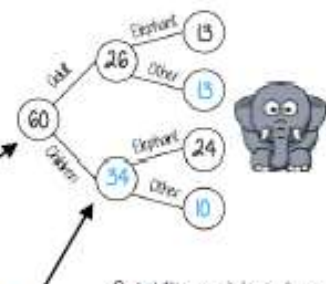
	H	T
H	HH	HT
T	TH	TT

Where rows and columns intersect is the outcome of that action

### Frequency trees

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

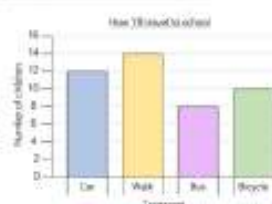
The overall total "60 people"



A frequency tree is made up from part-whole models  
One piece of information leads to another

Probabilities or statements can be taken from the completed trees  
eg. 34 children visited the zoo

### Bar and line charts



Use addition/ subtraction methods to extract information from bar charts

eg. Difference between the number of students who walked and took the bus  
Walk frequency — bus frequency

When describing changes or making predictions:

- Extract information from your data source
- Make comparisons of difference or sum of values
- Put into the context of the scenario

# YEAR 7 — APPLICATION OF NUMBER

## Solving problems with multiplication and division

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


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

- Understand and use factors
- Understand and use multiples
- Multiply/ Divide integers and decimals by powers of 10
- Use formal methods to multiply
- Use formal methods to divide
- Understand and use order of operations
- Solve area problems
- Solve problems using the mean

### Keywords

**Array**: an arrangement of items to represent concepts in rows or columns  
**Multiples**: found by multiplying any number by positive integers  
**Factor**: integers that multiply together to get another number  
**Mil**: prefix meaning one thousandth  
**Centi**: prefix meaning one hundredth  
**Kilo**: prefix meaning multiply by 1000  
**Quotient**: the result of a division  
**Dividend**: the number being divided  
**Divisor**: the number we divide by

### Factors

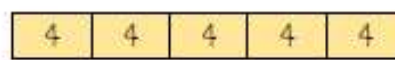
Arrays can help represent factors  
  $5 \times 2$  or  $2 \times 5$   
**Factors of 10**: 1, 2, 5, 10  
 $10 \times 1$  or  $1 \times 10$   
 The number itself is always a factor

Square numbers have an ODD number of factors

**Factors of 4**: 1, 2, 4  
**Factors of 36**: 1, 2, 3, 4, 6, 9, 12, 18, 36

Be strategic:  
 - Lay factors out in pairs can help you not to miss any

### Multiples



Bar models can represent by something is a multiple. Eg 20 is a multiple of 4

#### Lowest Common Multiples

**LCM of 9 and 12**

9: 9, 18, 27, 36, 45, 54  
 12: 12, 24, 36, 48, 60




The first time their multiples match  
**LCM = 36**

### Multiply/ Divide by powers of 10



$$3 \times 100 = 300$$

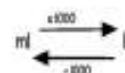
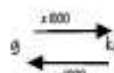
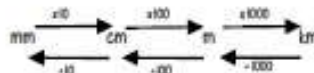


$$0.03 \times 100 = 3$$

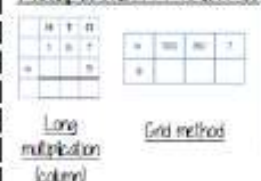
Repeated multiplication and division by powers of 10 is commutative  
 $\div 10$  then  $\div 10 \rightarrow \div 100$

### Metric conversions

Useful Conversions



### Multiplication methods



Less effective method especially for bigger multiplication



#### Multiplication with decimals

Perform multiplications as integers  
 eg  $0.2 \times 0.3 \rightarrow 2 \times 3$

Make adjustments to your answer to match the question  
 $0.2 \times 10 = 2$   
 $0.3 \times 10 = 3$   
 Therefore  $6 \div 100 = 0.06$

Estimation: Using estimations allows a "check" if your answer is reasonable

### Division methods

Short division:  $3584 \div 7 = 512$

Complex division:  $\div 24 = \div 6 \div 4$   
 Break up the divisor using factors

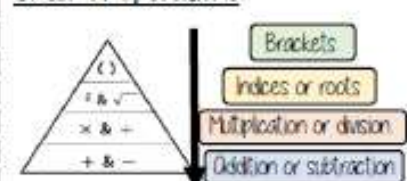
#### Division with decimals

The placeholder in division methods is essential - the decimal lines up on the dividend and the quotient

$$24 \div 0.02 \rightarrow 24 \div 0.2 \rightarrow 240 \div 2$$

All give the same solution as represent the same proportion  
 Multiply the values in proportion until the divisor becomes an integer

### Order of operations



If you have multiple operations from the same tier work from left to right

$$\text{eg } 10 - 3 + 5 \rightarrow 10 - 3 \rightarrow 7 + 5$$

$$6 \times 4 + 8 \times 2$$

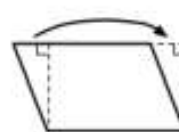
$$24 + 16 = 40$$

### Area problems

Rectangle  
 Base x Perpendicular height



Parallelogram/ Rhombus  
 Base x Perpendicular height



Triangle  
 $\frac{1}{2} \times \text{Base} \times \text{Perpendicular height}$



A triangle is half the size of the rectangle it would fit in

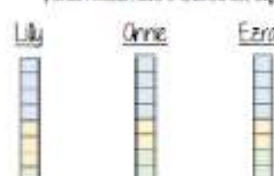
### Mean problems

Mean - a measure of average  
 It gives an idea of the central value

Lilly, Annie and Ezra have the following cubes



Finding the mean amount is the average amount each person would have if shared out equally



The mean number of blocks would be 14.67 each

# YEAR 7 — APPLICATION OF NUMBER

## Fractions and percentages of amounts

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

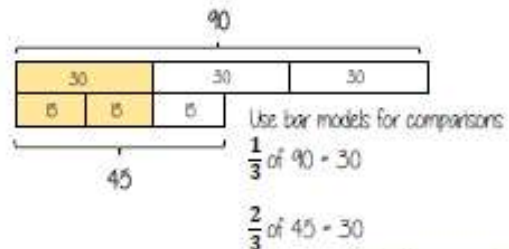
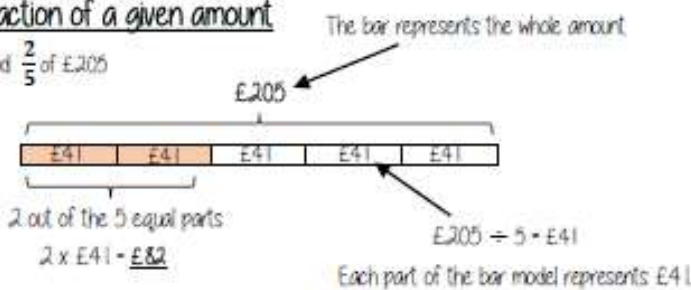
- By the end of this unit you should be able to:
- Find a fraction of a given amount
  - Use a given fraction to find the whole or other fractions
  - Find the percentage of an amount using mental methods
  - Find the percentage of a given amount using a calculator

### Keywords

- Fraction:** how many parts of a whole we have.  
**Equivalent:** of equal value.  
**Whole:** a number with no fractional or decimal part.  
**Percentage:** parts per 100 (uses the % symbol).  
**Place Value:** the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right.  
**Convert:** change into an equivalent representation, often fraction to decimal to a percentage cycle.

### Fraction of a given amount

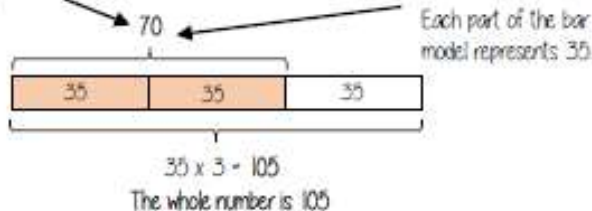
Find  $\frac{2}{5}$  of £205



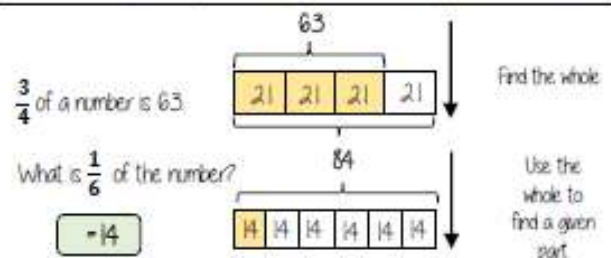
$\therefore \frac{1}{3}$  of 90 =  $\frac{2}{3}$  of 45

### Use a fraction of amount

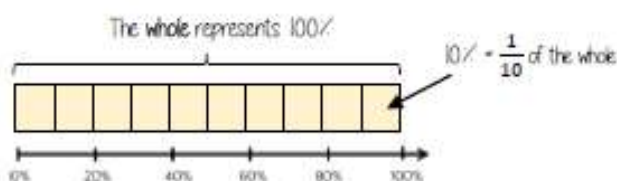
$\frac{2}{3}$  of a value is 70. What is the whole number?



The wording of the question is important to setting up the bar model

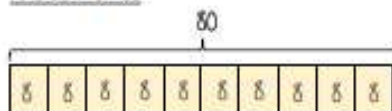


### Find the percentage of an amount (Mental methods)



$10\% = \frac{1}{10}$  of the whole       $50\% = \frac{5}{10} = \frac{1}{2}$  of the whole  
 $20\% = \frac{2}{10} = \frac{1}{5}$  of the whole       $5\% = \frac{1}{20}$  of the whole

Find 65% of 80



For bigger percentages it's sometimes easier to take away from 100%

- Method 1  
 $65\% = 10\% \times 6 + 5\%$   
 $= (8 \times 6) + 4$   
 $= 52$
- Method 2  
 $65\% = 50\% + 10\% + 5\%$   
 $= 40 + 8 + 4$   
 $= 52$

### Find the percentage of an amount (Calculator methods)



Using a multiplier

Find 65% of 80

Fraction, decimal, percentage conversion

$65\% = \frac{65}{100} = 0.65$  ← The multiplier

$0.65 \times 80 = 52$

Using the percent button

Find 65% of 80

This brings up the % button on screen. You will see 65%

Type 65

Press **SHIFT** **(%)**

Press **×** 80 and then press =

You can also use the calculator to support non-calculator methods and find  $\frac{1}{10}$  or  $\frac{10}{100}$  then add percentages together

\*of can represent 'x' in calculator methods

# YEAR 7 — DIRECTED NUMBER

## Operations with equations and directed numbers

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

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

- Perform calculations that cross zero
- Add/ Subtract directed numbers
- Multiply/ Divide directed numbers
- Evaluate algebraic expressions
- Solve two-step equations
- Use order of operations with directed number

### Keywords

- Subtract:** taking away one number from another.  
**Negative:** a value less than zero.  
**Commutative:** changing the order of the operations does not change the result.  
**Product:** multiply terms.  
**Inverse:** the opposite function.  
**Square root:** a square root of a number is a number when multiplied by itself gives the value (symbol  $\sqrt{\quad}$ )  
**Square:** a term multiplied by itself.  
**Expression:** a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

### Perform calculations that cross zero

Number lines are useful to help you visualise the calculation crossing 0

$4 - 6 = -2$  Use the number line to guide subtraction of 6  
 Start at 4  
 Find the difference between 6 and -4  
 From 6 to 0: 6  
 From 0 to -4: 4  
 10 beads between them

Rearrangements of the same equation:  $-5 + 5 = 0$  and  $5 - 5 = 0$

### Add directed numbers

$2 + -4 = -2$   
 Zero pair  $(-1 + 1 = 0)$   
 Two  $-1$ 's left  $= -2$

$8 + -3 = 5$   
 Partitioning:  $8 + -3 = 5$  and  $5 + 3 + -3 = 5$   
 Partition the value to create a zero pair calculation

Representations:  $\bullet = -1$ ,  $\circ = 1$

### Subtract directed numbers

"Subtract" - means take away or remove

$2 - -1 = 3$   
 Take away one

$2 - -3 = 5$

Generators:  $+$ ,  $-$ ,  $-$ ,  $+$

### Multiply/ Divide directed numbers

Two representations of the same calculation:  $2 \times -3 = -6$

Negative, Negative calculation:  $-2 \times -3 = 6$   
 This is the negative of  $2 \times -3$

The act of making counters into their negative is turning them over

Divisors are the inverse operations

### Evaluate algebraic expressions

$a = 5$ ,  $b = -4$   
 $a^2 = 5^2 = 25$ ,  $b^2 = (-4)^2 = 16$

With negative numbers the brackets are important so that it performs  $-4 \times -4$

Brackets around negative substitutions helps remove calculation errors

$2a - b = 2 \times 5 - (-4) = 10 + 4 = 14$   
 $3b - 2a = 3(-4) - 2(5) = -12 - 10 = -22$

### Two-step equations

Bar Model:  $4x + 2 = 10$  and  $10 - 4x = 2$   
 Representing the same question (use fact families)

Function machine:  $x \rightarrow x^4 \rightarrow +2 \rightarrow 10$   
 Inverse operations to find x

### Use order of operations

Brackets  
 Indices or roots  
 Multiplication or division  
 Addition or subtraction

Remember square roots have a positive and negative value

Brackets around negative substitutions helps remove calculation errors

# YEAR 7 — FRACTIONAL THINKING

## Addition and subtraction of fractions

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

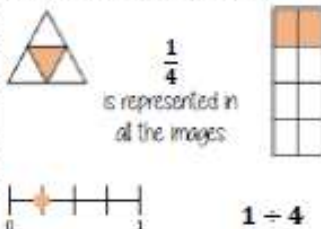
By the end of this unit you should be able to:

- Convert between mixed numbers and fractions
- Add/Subtract unit fractions (same denominator)
- Add/Subtract fractions (same denominator)
- Add/Subtract fractions from integers
- Use equivalent fractions
- Add/Subtract any fractions
- Add/Subtract improper fractions and mixed numbers
- Use fractions in algebraic contexts

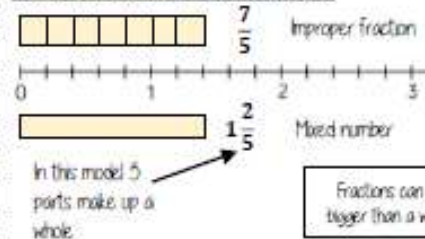
### Keywords

**Numerator:** the number above the line on a fraction. The top number. Represents how many parts are taken.  
**Denominator:** the number below the line on a fraction. The number represents the total number of parts.  
**Equivalent:** of equal value.  
**Mixed numbers:** a number with an integer and a proper fraction.  
**Improper fractions:** a fraction with a bigger numerator than denominator.  
**Substitute:** replace a variable with a numerical value.  
**Place value:** the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right.

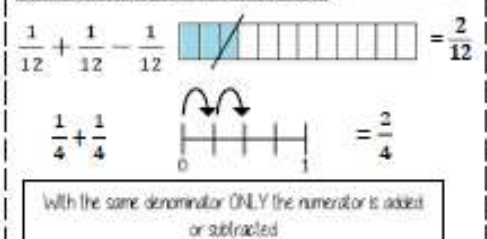
### Representing Fractions



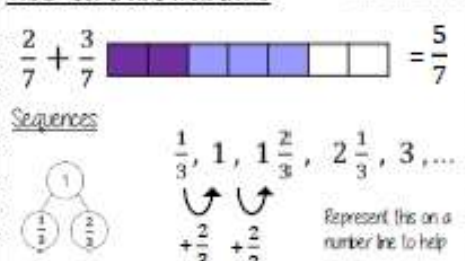
### Mixed numbers and fractions



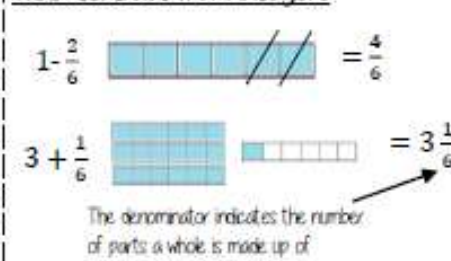
### Add/Subtract unit fractions



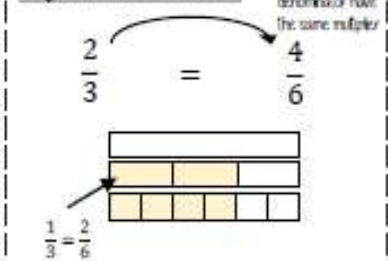
### Add/Subtract fractions



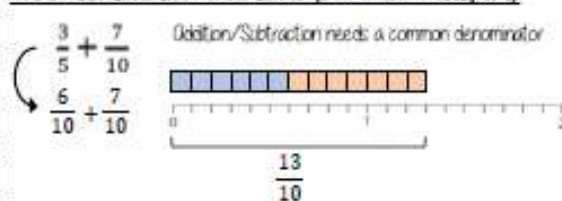
### Add/Subtract from integers



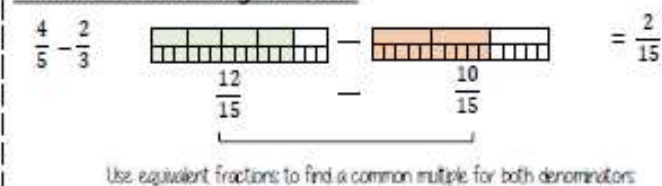
### Equivalent fractions



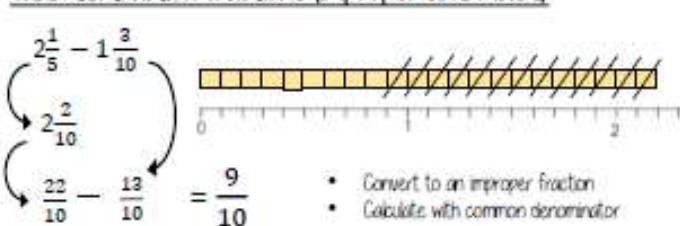
### Add/Subtraction fractions (common multiples)



### Add/Subtraction any fractions



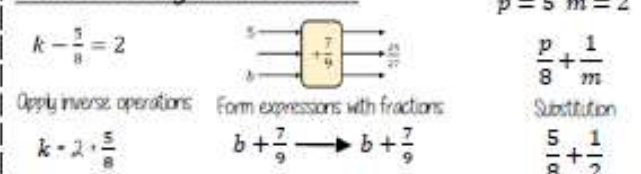
### Add/Subtraction fractions (improper and mixed)



### Partitioning method

$2\frac{1}{5} - 1\frac{3}{10} = 2\frac{2}{10} - 1\frac{3}{10} = 2\frac{2}{10} - 1 - \frac{3}{10} = 1\frac{2}{10} - \frac{3}{10} = \frac{9}{10}$

### Fractions in algebraic contexts



### Fractions and decimals

