

Maths Crucial Knowledge Year 7-9

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Numbers

Chapter 1 - Number

Place Value									
• The 'column values' of numbers									
....	Thousands	Hundreds	Tens	Units	Decimal Point	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

4 Operators

Addition (or **Sum**) +
Subtraction (or **Difference**) -
Multiplication (or **Product**) x
Division ÷

Negative Numbers

+ and + = +
+ and - = -
- and + = -
- and - = +

Multiplying and Dividing by 10, 100, 1000

- When we multiply a number by 10, we move every digit one place value to the left.
- When we multiply a number by 100, we move every digit 2 place values to the left.
- When we multiply a number by 1000, we move every digit 3 places to the left.
- We move each digit the same number of places to the left as there are zeros.
- Remember to fill in any blank spaces with 0 place holders.
- For dividing, we follow the same method but move every digit to the right

Ordering Decimals

- Set up a table with the decimal point in the same place for each number.
- Put in each number.
- Fill in the empty squares with zeros.
- Compare using the first column on the left.
- If the digits are equal move to the next column to the right until one number is higher.
- This number is the bigger one.

Know More, Remember More, Understand and Apply



Crucial Knowledge Directed Numbers



<u>Crucial Knowledge</u>	<u>Remember More</u>		
<p><u>Adding a positive number / Subtracting a negative number</u></p> <p>Count along the number line to the right.</p> <p><u>Subtracting a positive number / Adding a negative number</u></p> <p>Count along the number line to the left.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Start at -3 and ADD 10 $-3 + 10 = 7$</p> </div> <div style="text-align: center;"> <p>Start at -3 and SUBTRACT 6 $-3 - 6 = -9$</p> </div> </div>		
<u>Understand and Apply</u>			
$-8 + 5 =$	$8 - 5 =$	$8 - - 5 =$	$8 + - 5 =$
$-12 + 19 =$	$12 - 19 =$	$12 - - 19 =$	$12 + - 19 =$
$-23 + 16 =$	$-23 - 16 =$	$23 - - 16 =$	$-23 + - 16 =$

1 - Directed Numbers



Crucial Knowledge Highest Common Factor [Listing]



<u>Crucial Knowledge</u>	<u>Remember More</u>
<p>The Highest Common Factor is the biggest number that goes into two or more given numbers.</p> <p>Write down all the factors of each number. →</p> <p>Identify the biggest number they both have in the list. →</p>	<p>Highest Common Factor of 24 and 36:</p> <p>24 – 1, 2, 3, 4, 6, 8, 12, 24</p> <p>36 – 1, 2, 3, 4, 6, 9, 12, 18, 36</p> <p>They both have 1, 2, 3, 4, 6 and 12.</p> <p>12 is the biggest they both have. It is the highest common factor.</p>
<u>Understand and Apply</u>	
<p>Using this listing method, find the highest common factor of...</p> <p>a) 16 and 24 b) 27 and 45 c) 16 and 32</p>	

2 - Highest Common Factor

Chapter 2 – Measures, Area, Perimeter

Length	Area	Capacity and Volume	Mass	Time
1 cm = 10 mm	1 cm ² = 100 mm ²	1 cl = 10 ml	1 kg = 1000 g	1 minute = 60 seconds
1 m = 100 cm	1 m ² = 10 000 cm ²	1 litre = 100 cl	1 tonne = 1000 kg	1 hour = 60 minutes
1 km = 1000 m	1 ha = 10 000 m ²	1 litre = 1000 ml		1 day = 24 hours
	1 km ² = 1 000 000 m ²	1 litre = 1000 cm ³		1 week = 7 days
		1 ml = 1 cm ³		1 year = 365 days

Area and perimeter

Perimeter is distance around shape
 Area is space inside a shape (2D), measure in square units
 Rectangle Area = *base x height*
 Parallelogram Area = *base x height*
 Triangle Area = $\frac{1}{2} (\text{base} \times \text{height})$
 Trapezium Area = $\frac{1}{2} (a+b) \times \text{height}$
 Circle Area = $\pi \times \text{radius}^2$
 Circumference is the perimeter of a circle
 Circumference = $2\pi \times \text{radius}$

Terminology of Shape

Height – Perpendicular height
 Perpendicular – lines meet at 90 degrees
 Parallel – always the same distance apart
 Edge – Where 2 faces meet on a 3D shape
 Vertices – The point where edges meet (corner) on a 3D shape
 Face – side of a 3D shape
 Compound Shapes – two or more shapes together
 Quadrilateral – a 4-sided polygon
 Polygon – a 2d shape with straight sides

Surface Area

The total of the area of all the faces

Volume

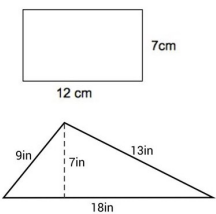
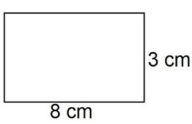
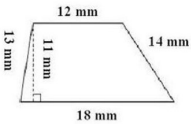
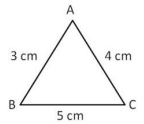
Volume is the space inside a 3D shape
 Volume of a prism = cross sectional area x length

Know More, Remember More, Understand and Apply



Crucial Knowledge Perimeter

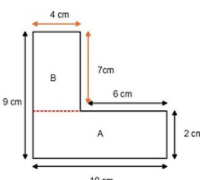


Crucial Knowledge	Remember More
Total distance around the shape. Add up the lengths around the shape. Ignore any extra lengths given.	 <p>Perimeter = $12 + 7 + 12 + 7$ = 38cm</p> <p>Perimeter = $18 + 9 + 13$ = 40in</p>
Understand and Apply	
	
	

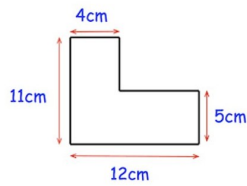


Crucial Knowledge Perimeter of Compound Shapes



Crucial Knowledge	Remember More
<p>Total distance around the shape.</p> <p>Find the missing sides by comparing the heights or the widths.</p>	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Missing Sides Height: $9 - 2 = 7\text{ cm}$ Width: $10 - 6 = 4\text{ cm}$</p> <p>Perimeter = $4\text{ cm} + 7\text{ cm} + 6\text{ cm} + 2\text{ cm} + 10\text{ cm} + 9\text{ cm}$ $= 38\text{ cm}$</p> </div> </div>

Understand and Apply

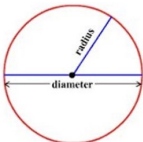




6 - Perimeter of Compound Shapes

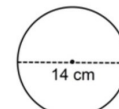
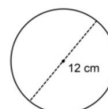
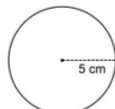
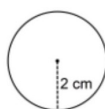


Crucial Knowledge Circumference of a Circle



Crucial Knowledge	Remember More
<p>The distance around a circle.</p> <p>Circumference = $2\pi r$ (r = radius)</p> <p>Radius = diameter \div 2</p> 	<div style="display: flex; flex-direction: column; gap: 10px;"> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Radius = 6 Circumference = $2 \times \pi \times 6$ $= 27.6991 = 27.7\text{ cm}$</p> </div> </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Radius = $8 \div 2 = 4$ Circumference = $2 \times \pi \times 4$ $= 25.1327 = 25.1\text{ cm}$</p> </div> </div> </div>

Understand and Apply



7 - Circumference

Chapter 3 - Expressions

Algebra terminology
 We don't use the multiplication sign in algebra. When multiplying letters and numbers they are placed next to each other.
 We don't use the divide sign in algebra. When dividing letters and numbers they are written as a fraction.

Indices
 If we multiply the indices, we add the powers.
 $y^3 \times y^4 = y^{(3+4)} = y^7$
 If we divide the indices, we subtract the powers.
 $y^{10} \div y^6 = y^{(10-6)} = y^4$
 If we have indices raised to a power, we multiply.
 $(y^2)^3 = y^{(2 \times 3)} = y^6$
 Anything to the power zero is always 1

Simplifying – Adding and Subtracting
 We can only bring 'like terms' together to simplify the expression
 Rewrite to get your 'like terms together'

Simplifying – Multiplying and Dividing
 Multiply or divide the numbers.
 If letters are different, put them together.
 If the letters are the same use power laws.

Expanding
 Remove the brackets by multiplying.

Factorising
 Opposite to expanding. Put back into brackets by dividing by the highest common factor.

Substitution
 We can replace letters with numbers to create an answer.
 You are told $E = \frac{1}{2} mv^2$
 Calculate E when $m = 10$ and $v = 2.5$
 $E = \frac{1}{2} \times 10 \times 2.5^2$
 $E = 31.25$

Know More, Remember More, Understand and Apply



Crucial Knowledge Expanding Single Brackets (Positives)



Crucial Knowledge		Remember More	
Remove the brackets by multiplying			
Multiply the term on the outside of the bracket by the first term inside the bracket	→	$3(x+4)$	$3 \times x = 3x$
Multiply the term on the outside of the bracket by the second term in the bracket	→	$3(x+4)$	$3 \times 4 = +12$
Bring the two multiplied terms together	→		$3x + 12$
Understand and Apply			
Expand the following brackets:			
$5(x+7)$	$x(x+4)$	$3x(x+2)$	
$7(2+y)$	$y(3+y)$	$2y(3+4y)$	
$2(z+5)$	$z(z+6)$	$z^2(z+6z)$	



Crucial Knowledge Expanding Single Brackets (Negatives)



Crucial Knowledge	Remember More	
Remove the brackets by multiplying		
Multiply the term on the outside of the bracket by the first term inside the bracket	$\overbrace{3(x-4)}^{3x} = 3x - 12$	
Multiply the term on the outside of the bracket by the second term in the bracket	$\overbrace{3(x-4)}^{-12} = -12$	
Bring the two multiplied terms together	$3x - 12$	
Understand and Apply		
Expand the following brackets:		
$5(x-7)$	$x(x-4)$	$3x(x-2)$
$7(2-y)$	$y(3-y)$	$2y(3-4y)$
$2(z-5)$	$z(z-6)$	$z^2(z-6z)$

9 - Expanding Single Brackets (Negatives)



Crucial Knowledge Factorising Single Brackets [Positive Terms Only]



Crucial Knowledge	Remember More	
Factorise means to put into brackets.		
Take the highest common factor of each term out of the expression and put outside of the brackets.	$4x + 16$ <p style="text-align: center;">Highest Common Factor = 4</p> $4(\quad)$	
Divide terms by the highest common factor and write these inside of the brackets.	$\begin{array}{cc} 4x + 16 \\ \div 4 \downarrow \quad \downarrow \div 4 \\ 4(\underline{x + 4}) \end{array}$	
Understand and Apply		
Factorise the following:		
a) $3x + 12$	b) $4x + 12$	c) $3x + 15$

10 - Factorising Single Brackets [Positive Terms]



Crucial Knowledge

Factorising Single Brackets [Negative Terms]



Crucial Knowledge	Remember More
<p>Factorise means to put into brackets.</p> <p>Take the highest common factor of each term out of the expression and put outside of the brackets.</p> <p>Divide terms by the HCF and write these inside of the brackets.</p> <p style="color: red; font-size: small;">A negative divided by a positive is a negative. A negative divided by a negative is a positive.</p>	$4x - 16$ <p>Highest Common Factor = 4</p> $4(\quad)$ $\begin{array}{r} 4x - 16 \\ \div 4 \quad \downarrow \div 4 \\ x - 4 \end{array}$ $4(x - 4)$
<u>Understand and Apply</u>	
<p>Factorise the following:</p> <p style="display: flex; justify-content: space-around;"> a) $5x + 20$ b) $5x - 20$ c) $-5x - 20$ </p>	

11 - Factorising Single Brackets [Negative Terms]



Crucial Knowledge

Factorising Single Brackets [Multiple Letters/Squared Terms]



Crucial Knowledge	Remember More
<p>Factorise means to put into brackets.</p> <p>Take the highest common factor of each term out of the expression and put outside of the brackets. Sometimes this highest common factor can be or include a letter.</p> <p>Divide terms by the HCF and write these inside of the brackets.</p>	$3xy + 9x$ <p>Highest Common Factor = 3 AND x</p> $3x(\quad)$ $\begin{array}{r} 3xy + 9x \\ \div 3x \quad \downarrow \div 3x \\ y + 3 \end{array}$ $3x(y + 3)$
<u>Understand and Apply</u>	
<p>Factorise the following:</p> <p style="display: flex; justify-content: space-around;"> a) $xy + 2x$ b) $2xy + 4y$ c) $2x^2 + 6x$ </p>	

12 - Factorising Single Brackets [Multiple Letters]



Crucial Knowledge

Difference of Two Squares [No Coefficient of x^2]



Crucial Knowledge	Remember More
<p>Difference of Two Squares is a method of factorising that can be used when the expression is in the form:</p> $x^2 - c$ <p style="text-align: center;">where 'c' is a square number</p> <p>Factorise into two brackets, with one positive square root and one negative square root of c.</p>	$x^2 - 64$ <p style="color: red;">Square root of 64 is 8...</p> $(x + 8)(x - 8)$
Understand and Apply	
<p>Factorise the following:</p> <p style="text-align: center;">a) $x^2 - 9$ b) $x^2 - 16$ c) $x^2 - 100$</p>	

13 - Factorising [Difference of Two Squares]

Fractions, Decimals, Percentages

Chapter 4 – Fractions, Decimals, Percentages

Fractions

- Bottom term is the denominator
- Top term is the numerator

Fractions of a quantity

- Divide by the denominator
- Multiply by the numerator

Percentages

- An amount out of 100
- With a calculator:**
What is 40% of £50
Percentage ÷ 100 x amount
- Without a calculator:**
1% = divide by 100
10% = divide by 10
25% = divide by 4
50% = divide by 2

Recurring Decimals

A decimal with repeating values
We indicate the repeating numbers with a dot above
 $0.\dot{6} = 0.666666 \dots$
 $0.6\dot{5}6 = 0.656656656 \dots$

Fraction Arithmetic

Multiplying – Multiply top by top and bottom by bottom.
Dividing - 'Keep Change Flip'.
Addition or Subtraction – You need same bottom number (**denominator**). Add or subtract the numerator, keep the denominator the same.

Improper and Mixed Fractions

Improper to mixed: $\frac{5}{3} = 5 \div 3 = 1 \text{ R}2$

Mixed fractions to improper: $2\frac{3}{4} = \frac{(4 \times 2) + 3}{4} = \frac{11}{4}$

Know More, Remember More, Understand and Apply



Crucial Knowledge Decimals and Percentages



Crucial Knowledge	Remember More
<p>Decimals to Percentages: $\times 100$ Move every digit 2 places to the <u>left</u></p>	<p>Express 0.23 as a percentage. $0.23 \times 100 = 23\%$</p>
<p>Percentages to Decimals: $\div 100$ Move every digit 2 places to the <u>right</u></p>	<p>Express 85% as a decimal. $85 \div 100 = 0.85$</p>
Understand and Apply	
<p>How do you change a decimal to a percentage? How do you change a percentage to a decimal?</p>	
<p>Express the following decimals as percentages:</p> <ol style="list-style-type: none"> 0.72 0.8 0.04 	<p>Express the following percentages as decimals:</p> <ol style="list-style-type: none"> 64% 20% 9%

14 - Converting Decimals and Percentages



Crucial Knowledge Decimals and Fractions



Crucial Knowledge	Remember More								
<table border="1" style="width: 100%; text-align: center; font-size: small;"> <tr> <td style="background-color: #c8e6c9;">Thousands</td> <td style="background-color: #bbdefb;">Hundreds</td> <td style="background-color: #fff9c4;">Tens</td> <td style="background-color: #ffe0b2;">Units</td> <td style="background-color: #e1bee7;">Decimal Point</td> <td style="background-color: #e1bee7;">$\frac{1}{10}$</td> <td style="background-color: #e1bee7;">$\frac{1}{100}$</td> <td style="background-color: #e1bee7;">$\frac{1}{1000}$</td> </tr> </table> <p>Decimals to Fractions: The denominator is the place value column</p>	Thousands	Hundreds	Tens	Units	Decimal Point	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	<p>Express 0.24 as a fraction. $\frac{24}{100} = \frac{6}{25}$ The last digit is in the hundredth's column</p>
Thousands	Hundreds	Tens	Units	Decimal Point	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$		
<p>Fractions to Decimals: Numerator \div denominator</p>	<p>Express $\frac{2}{5}$ as a decimal. $2 \div 5 = 0.4$</p>								
<p>Fractions to Decimals: Multiply the fraction to make the denominator a multiple of ten then use the place value</p>	<p>Express $\frac{3}{10}$ as a decimal. This means there is a 3 in the tenth's column. 0.3</p>								
Understand and Apply									
<p>How do you change a decimal to a fraction? How do you change a fraction to a decimal?</p>									
<p>Express the following decimals as fractions:</p> <ol style="list-style-type: none"> 0.72 0.8 	<p>Express the following fractions as decimals:</p> <ol style="list-style-type: none"> $\frac{3}{5}$ $\frac{14}{100}$ 								

15 - Converting Decimals and Fractions



Crucial Knowledge Fractions and Percentages



Crucial Knowledge	Remember More
<p>Fractions to Percentages: Multiply to make the denominator 100. The numerator is the percentage</p> <p>Percentages to Fractions: Write the percentage as the numerator. The denominator is 100. Simplify if possible.</p>	<p>Express $\frac{7}{50}$ as a percentage. Multiply the fraction by 2 = $\frac{14}{100} = 14\%$</p> <p>Express 85% as a fraction. $\frac{85}{100} = \frac{17}{20}$</p>
<u>Understand and Apply</u>	
<p>How do you change a fraction to a percentage? How do you change a percentage to a fraction?</p> <p>Express the following fractions as percentages:</p> <p>1) $\frac{14}{100}$ 2) $\frac{3}{50}$</p> <p>Express the following percentages as fractions:</p> <p>1) 64% 2) 20% 3) 9%</p>	

16 - Converting Fractions and Percentages



Crucial Knowledge Fractions of an amount



Crucial Knowledge	Remember More
<p>Divide the amount by the denominator</p> <p>Multiply by the numerator</p>	<p>$\frac{1}{3}$ of 21 = $21 \div 3 = 7$</p> <p>$\frac{2}{3}$ of 21 = $21 \div 3 = 7, 7 \times 2 = 14$</p>
<u>Understand and Apply</u>	
<p>Which part of the fraction do you divide by?</p> <p>Which part of the fraction do you multiply by?</p>	<p>Find:</p> <p>$\frac{1}{4}$ of 24</p> <p>$\frac{2}{3}$ of 18</p> <p>Find:</p> <p>$\frac{3}{5}$ of 45</p> <p>$\frac{4}{7}$ of 49</p>

17 - Fractions of Amounts



Crucial Knowledge Equivalent Fractions



Crucial Knowledge	Remember More
Equivalent fractions are two fractions that are equal. You can multiply or divide. Multiply numerator and denominator by the same number \longrightarrow Divide numerator and denominator by the same number \longrightarrow	$\frac{1}{3} \xrightarrow{\times 2} \frac{2}{6}$ $\frac{9}{24} \xrightarrow{\div 3} \frac{3}{8}$
Understand and Apply	
Fill in the missing numbers: $\frac{2}{5} = \frac{\quad}{15}$ $\frac{3}{8} = \frac{9}{\quad}$ $\frac{2}{7} = \frac{\quad}{35}$	Fill in the missing numbers: $\frac{4}{8} = \frac{\quad}{4}$ $\frac{12}{36} = \frac{4}{\quad}$ $\frac{15}{25} = \frac{\quad}{5}$
Give 2 equivalent fractions to the following: $\frac{1}{4} = \frac{\quad}{\quad}$ $\frac{3}{15} = \frac{\quad}{\quad}$ $\frac{6}{10} = \frac{\quad}{\quad}$	

18 - Equivalent Fractions



Crucial Knowledge Simplifying Fractions



Crucial Knowledge	Remember More
Divide numerator and denominator by the same number. Repeat. Divide numerator and denominator by the highest common factor \longrightarrow	$\frac{10}{30} \xrightarrow{\div 2} \frac{5}{15} \xrightarrow{\div 5} \frac{1}{3}$ $\frac{18}{30} \xrightarrow{\div 6} \frac{3}{5}$
Understand and Apply	
Simplify the following fractions $\frac{3}{15} = \frac{1}{\square}$ $\frac{4}{12} = \frac{\square}{3}$ $\frac{4}{38} = \frac{2}{\square}$	Simplify the following fractions $\frac{3}{35} = \frac{\quad}{\quad}$ $\frac{8}{40} = \frac{\quad}{\quad}$ $\frac{4}{64} = \frac{\quad}{\quad}$

19 - Simplifying Fractions



Crucial Knowledge Adding Fractions



Crucial Knowledge	Remember More
<p>Adding Make sure the bottom numbers (the denominators) are the same</p> <p>Add the top numbers (the numerators), put that answer over the denominator</p>	$\frac{1}{3} + \frac{1}{5}$ <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\begin{array}{c} \times 5 \\ \frac{1}{3} = \frac{5}{15} \\ \times 5 \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{c} \times 3 \\ \frac{1}{5} = \frac{3}{15} \\ \times 3 \end{array}$ </div> </div> $\frac{5}{15} + \frac{3}{15} = \frac{8}{15}$
Understand and Apply	
Add $\frac{2}{7}$ and $\frac{3}{7}$	Add $\frac{1}{4}$ and $\frac{3}{8}$
Add $\frac{1}{8}$ and $\frac{5}{12}$	Add $\frac{8}{15}$ and $\frac{3}{10}$

20 - Adding Fractions



Crucial Knowledge Subtracting Fractions



Crucial Knowledge	Remember More
<p>Subtracting Make sure the bottom numbers (the denominators) are the same</p> <p>Subtract the top numbers (the numerators), put that answer over the denominator</p>	$\frac{3}{16} - \frac{1}{8} = \frac{3}{16} - \frac{2}{16}$ $= \frac{1}{16}$
Understand and Apply	
1) $\frac{3}{6} - \frac{1}{6}$	3) $\frac{2}{5} - \frac{4}{15}$
2) $\frac{3}{4} - \frac{4}{12} =$	4) $\frac{1}{2} - \frac{3}{8} =$

21 - Subtracting Fractions



Crucial Knowledge Multiplying Fractions



Crucial Knowledge	Remember More
<p>Multiplying Multiply the top numbers (the numerators)</p> <p>Multiply the bottom numbers (the denominators)</p>	$\frac{4}{5} \times \frac{3}{7} = \frac{4 \times 3}{5 \times 7} = \frac{12}{35}$
<u>Understand and Apply</u>	
<p>What is $\frac{5}{8} \times \frac{4}{5}$?</p> <p>What is $\frac{3}{7} \times \frac{5}{6}$?</p>	<p>What is $\frac{3}{4} \times \frac{5}{6}$?</p> <p>What is $\frac{5}{14} \times \frac{7}{8}$?</p>

22 - Multiplying Fractions



Crucial Knowledge Dividing Fractions



Crucial Knowledge	Remember More
<p>Dividing Keep the first fraction the same</p> <p>Multiply the numerators and denominators</p> <p>Flip the second fraction</p>	<div style="background-color: #fff9c4; padding: 5px; display: inline-block;"> $\frac{1}{2} \div \frac{1}{6}$ </div> <div style="background-color: #bbdefb; padding: 5px; display: inline-block;"> $\frac{1}{2} \times \frac{6}{1} = \frac{1 \times 6}{2 \times 1} = \frac{6}{2}$ </div> <div style="background-color: #bbdefb; padding: 5px; display: inline-block;"> $\frac{6}{2} = 3$ </div>
<u>Understand and Apply</u>	
<p>What is $\frac{1}{12} \div \frac{1}{4}$?</p> <p>What is $\frac{6}{7} \div \frac{3}{14}$?</p>	<p>What is $\frac{7}{12} \div \frac{2}{3}$?</p> <p>What is $\frac{3}{8} \div \frac{5}{12}$?</p>

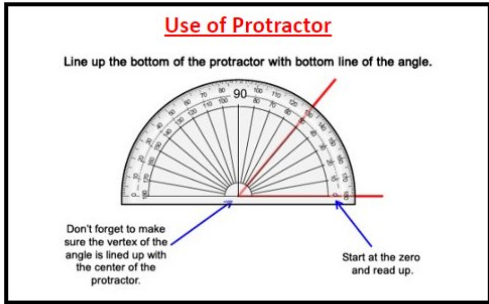
23 - Dividing Fractions

Angles and 2D Shapes

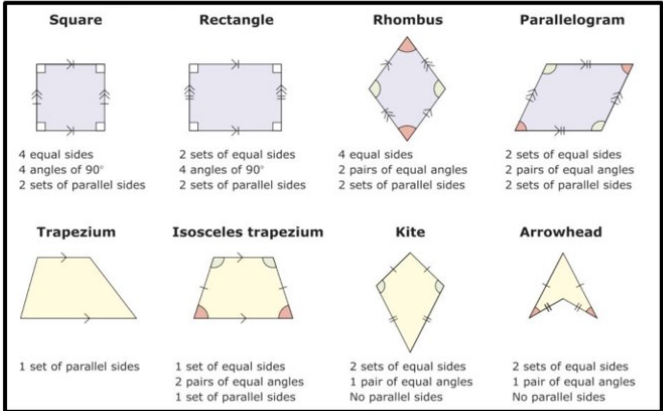
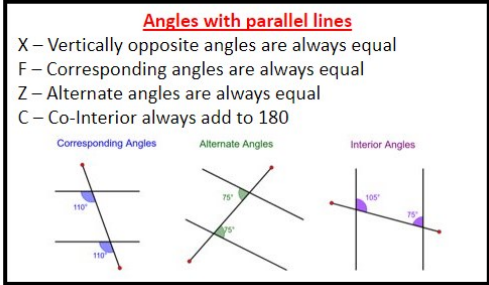
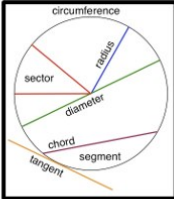
Chapter 5 – Angles and 2D Shapes

Angle Reasoning
 Angles on straight line = 180°
 Angles in a triangle = 180°
 Angles in quadrilateral = 360°
 Angles at a point = 360°

Terminology of a Shape
 Scalene – all sides and angles are different
 Isosceles – 2 sides and angles are the same
 Equilateral – 3 sides and angles are the same
 Right – contains a right angle
 Acute – an angle less than 90 degrees
 Obtuse – an angle between 90 and 180 degrees
 Reflex – an angle more than 180 degrees



Polygons
 A shape with 3 or more straight sides
 Total Interior Angles = $(n-2) \times 180$
 Interior + Exterior = 180°
 Sum of Exterior = 360°



Know More, Remember More, Understand and Apply



Crucial Knowledge Angles at a point

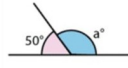
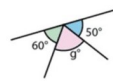
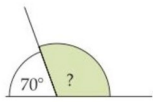
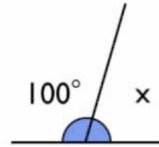



Crucial Knowledge	Remember More
Angles around a point add up to 360°	<p>The square represents 90 degrees</p> <p>$118 + 50 + 90 + x = 360$</p> <p>$x = 360 - 118 - 50 - 90$</p> <p>$x = 102^\circ$</p>
Understand and Apply	
Find the missing angles	
	<p>Find the value of x</p>
	<p>Find the value of x</p>



Crucial Knowledge Angles on a Straight line



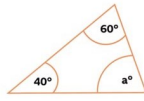
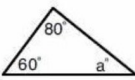
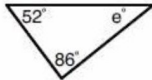
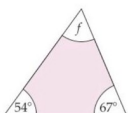
Crucial Knowledge	Remember More
<p>Angles on a straight line add to 180 degrees</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p>Angles on a straight line add up to 180° $a + 50 = 180$ $a = 180 - 50$ $a = 130^\circ$</p> </div> <div style="width: 45%;">  <p>Angles on a straight line add up to 180° $g + 60 + 50 = 180$ $g = 180 - 60 - 50$ $g = 70^\circ$</p> </div> </div>
<u>Understand and Apply</u>	
<p>Find the missing angles</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div>	

25 - Angles on a straight line



Crucial Knowledge Angles in triangles



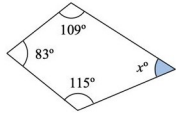
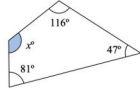
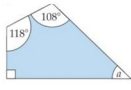
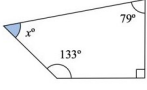
Crucial Knowledge	Remember More
<p>Angles in a triangle add up to 180°</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p>$60 + 40 + a = 180$ $a = 180 - 60 - 40$ $a = 80^\circ$</p> </div> <div style="width: 45%;"></div> </div>
<u>Understand and Apply</u>	
<p>Find the missing angles</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div>	

26 - Angles in a triangle



Crucial Knowledge Angles in a Quadrilateral



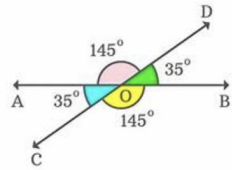
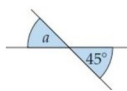
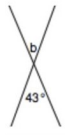
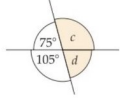
Crucial Knowledge	Remember More
<p>Angles in a quadrilateral add up to 360°</p>	<div style="display: flex; align-items: center;">  <div> <p>Angles in a Quadrilateral add up to 360°</p> <p>$109 + 115 + 83 + x = 360$</p> <p>$x = 360 - 109 - 115 - 83$</p> <p>$x = 53^\circ$</p> </div> </div>
Understand and Apply	
<p>Find the missing angles</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>	

27 - Angles in a quadrilateral



Crucial Knowledge Vertically Opposite Angles



Crucial Knowledge	Remember More
<p>Vertically opposite angles are equal</p>	
Understand and Apply	
<p>Find the missing angles</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>	

28 - Vertically Opposite

Graphs

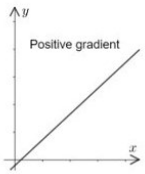
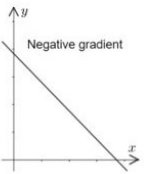
Chapter 6 - Graphs

Coordinates

- Along the corridor then up the stairs
- x and y values should be written on the axes
- There are 4 quadrants

Horizontal, Vertical and Diagonal Lines

- An equation in the form $y = \text{any number}$ always gives a horizontal line.
- An equation in the form $x = \text{any number}$ always gives a vertical line.
- Diagonal lines:

Parallel Lines

- Parallel lines have the same gradient

Linear Lines

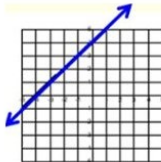
- $y = mx + c$
- $m = \text{gradient}$ (how steep the line is)
- $c = \text{y-intercept}$ (where the line crosses the y axis)
- y is the y coordinate
- x is the x coordinate

Plotting Straight Lines

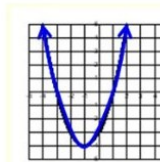
- Always plot at least three coordinates.
- First create a table of values

x				
y				
- Substitute in values to form coordinate points
- Plot the coordinates one at a time

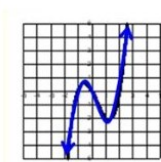
Types of Lines



Linear



Quadratic



Cubic

Calculations

Chapter 7 - Calculations

Getting to Know Your Calculator		Adding & Subtracting Decimals
x^2	Squared (e.g. $3^2 = 3 \times 3 = 9$)	Use the column method Line up the decimal places
SHIFT	Gets the second function of the key	Multiplying Decimals
$\sqrt{\quad}$	Square Root (e.g. $\sqrt{9} = 3$)	Multiply decimal numbers in the question by multiples of 10 to make them into whole numbers. Multiply the whole numbers. Divide your answer by the same multiple of 10 that the question was multiplied by.
$S \leftrightarrow D$	Changes a fraction answer to a decimal	Dividing Decimals
x^3	Cubed (e.g. $2^3 = 2 \times 2 \times 2 = 8$)	Multiply both numbers by 10 or 100 to get the numbers from a decimal to a whole number. Divide using the bus stop method.
"(and ")"	Brackets	
$\sqrt[3]{\quad}$	Cube Root (e.g. $\sqrt[3]{8} = 2$)	
$\frac{\square}{\square}$	Fraction	
Rounding	Negative Numbers	
• Decimal places (column after decimal point)	+ and + = +	
• Significant Figures (highest value column)	+ and - = -	
	- and + = -	
	- and - = +	

Know More, Remember More, Understand and Apply

Crucial Knowledge	Remember More
<p>Multiply each decimal number by 10, 100 or 1000 to make it a whole number.</p> <p>Multiply the whole numbers.</p> <p>Divide your answer by the same number that you multiplied the question by.</p>	<p>0.12×0.5</p> <p>$\begin{array}{r} \times 100 \\ 12 \times 5 \\ = 60 \end{array}$</p> <p>$60 \div 100 \div 10 = 0.06$</p>
Understand and Apply	
<p>Showing each step of the method, calculate...</p> <p>a) 0.6×4 b) 0.6×0.4 c) 0.04×0.6</p>	

29 - Multiplying Decimals

Statistics

Chapter 8 - Statistics

Mean, median, mode and range

You must be able to get measures from a list of values or values in a frequency table

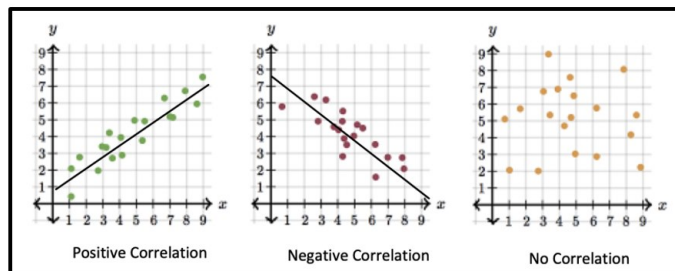
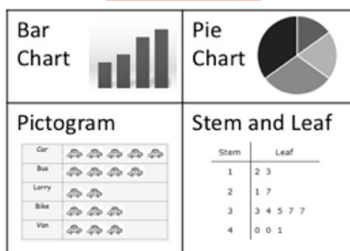
MEAN = Total of values \div Number of values

MEDIAN – The middle value when written in size order

MODE – The value that occurs the most often

RANGE – Maximum value subtract minimum value

Displaying data



Grouped data

- As there is no original data, the mean is an estimate. Use the midpoint of each group.
- You can only find the modal class which is the group with the highest frequency.

Chapter 9 - Transformations

Transformations

- A transformation moves a shape to a new position.

Reflection

- A reflection flips an object over a mirror line.
- You describe a reflection by stating the equation of the mirror line

Rotation

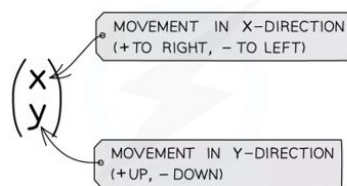
- A rotation turns an object about a point, this is called the centre of rotation.
- You describe a rotation by giving:
 - The centre of rotation
 - The angle of rotation
 - The direction of turn (clockwise or anticlockwise)

Enlargement

- An enlargement changes the size of a shape from a point.
- You describe an enlargement by giving:
 - The scale factor
 - The centre of enlargement.

Translation

- A translation slides an object.
- You describe a translation by giving the distance moved left or right and then up or down.
- Translations can be described using column vectors:



Symmetry

- A line of symmetry divides a shape into two identical mirror images. If a shape has at least one line of symmetry it is said to have **reflectional symmetry**.
- A shape has **rotational symmetry** if it rotates onto itself more than once in a full turn. The number of times is called the **order of rotation**.

Equations

Chapter 10 - Equations

Solving equations

- To get a numerical answer for a letter
- You must do the same to both sides of the equation
- When moving terms across the equal sign, you must use the inverse operations:

Operation	Inverse Operation
+	-
-	+
x	÷
÷	x
Square	Square root
Square root	Square

Method

Equations with unknowns on both sides.

- Expand any brackets
- Move all of the unknowns to one side
- Move all of the numbers to the other side
- Divide by the of unknowns to find what one unknown equals.

Simultaneous Equations

- Equations solved at the same time to find more than one unknown.

Algebraic Method

- Multiply or divide the equations to make the same number of one of the unknowns. Add or subtract the equations to eliminate one variable.
- Solve this new equation for the unknown.
- Substitute back in and solve for the other unknown.

Graphical Method

- Plot the lines
- The solution is the point of intersection (where the lines cross).

Inequalities

- Mathematic statements containing:
 - $<$ less than
 - $>$ greater than
 - \leq less than or equal to
 - \geq greater than or equal to
- Inequalities can be expressed on a number line:
 - Closed dot = equal to
 - Open dot = not equal to

Chapter 11 – Powers and Roots

Factors and Multiples

- A factor divides into a number without leaving any remainder
- A multiple of a number is any number in its times table

Prime Numbers

Have **exactly two factors**
 No other whole numbers, except **1** and **itself** divide into them
 The first 5 prime numbers are 2, 3, 5, 7, 11,

Highest Common Factor (HCF)

Write down all the factors from the numbers and find the biggest value on both lists – This is the **Highest Common Factor**

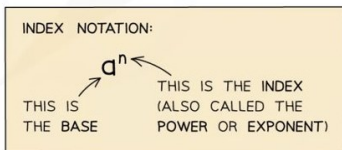
Lowest Common Multiple (LCM)

Write down all the multiples of the two numbers and find the smallest on both lists – This is the **Lowest Common Multiple**

Indices

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $(ab)^n = a^n b^n$
- $a^1 = a$
- $a^0 = 1$

- $a^{\frac{1}{m}} = \sqrt[m]{a}$
- $a^{\frac{m}{n}} = \sqrt[n]{a^m}$
- $a^{-m} = \frac{1}{a^m}$



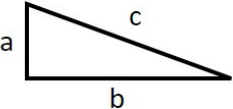
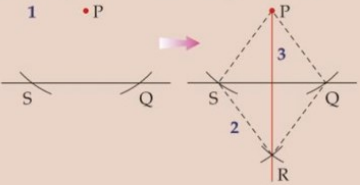
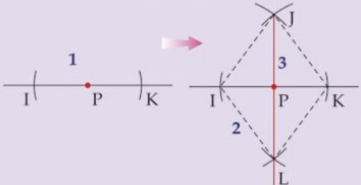
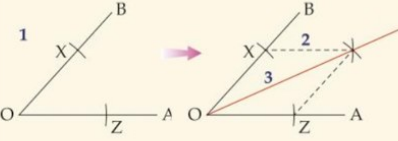
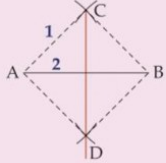
Standard Form

- A way of writing very big numbers (distances between planets) or very small numbers (measuring the size of atoms)
- Big numbers have a positive power
- Small numbers have a negative power



Constructions and Triangles

Chapter 12 – Constructions and Triangles

<p>Pythagoras</p>  <ul style="list-style-type: none"> • $a^2 + b^2 = c^2$ Square root c^2 to find Hypotenuse • $c^2 + a^2 = b^2$ Square root b^2 to find shorter side 	<p>► A perpendicular from a point to a line</p>  <ol style="list-style-type: none"> 1 Draw arcs equidistant from P cutting the line at Q and S. 2 Using Q and S as centres, draw arcs below the line that cross at R. 3 Draw the line PR. 	<p>► A perpendicular from a point on a line</p>  <ol style="list-style-type: none"> 1 Draw arcs equidistant from P cutting the line at I and K. 2 Using I and K as centres, draw arcs above and below the line that cross at J and L. 3 Draw the line JL.
<p>Congruent and Similar Triangles</p> <ul style="list-style-type: none"> • Congruent triangles have the same size and shape. • Similar triangles have been enlarged by a scale factor, but the angles have stayed the same. 	<p>► An angle bisector</p>  <ol style="list-style-type: none"> 1 Draw arcs equidistant from O cutting OA and OB at Z and X. 2 Using X and Z as centres, draw arcs that cross at Y. 3 Draw the line OY. 	<p>► A perpendicular bisector of a line</p>  <ol style="list-style-type: none"> 1 Using A and B as centres, draw arcs above and below the line that cross at C and D. 2 Draw the line CD.

Sequences

Chapter 13 – Sequences

Sequences Definitions

- Each value in a sequence is called a term
 - The term-to-term rule is a rule (often in words) used to find the next term
 - The nth term is a general rule used to find any term in the sequence
- A sequence is linear if the first difference is constant, and quadratic if the second difference is constant.

Linear sequence

A number pattern with a common difference

Quadratic sequence

The nth term contains a square

Chapter 14 – 3D shapes and Trigonometry

Terminology Shape

- Edge – Where 2 faces meet
- Vertices – Where 3 or more faces meet
- Face – side of a 3d shape
- Quadrilateral – a 4-sided polygon
- Polygon – a 2d shape with straight sides
- Cross-section – 2d shape of a prism
- Acute – an angle less than 90°
- Obtuse – an angle between 90° and 180°
- Reflex – an angle more than 180°

Surface Area

Total area of each face of the 3D shape

Volume of Prisms

Volume is the space inside a 3D shape

Volume of Prism = cross sectional area x length

Bearings

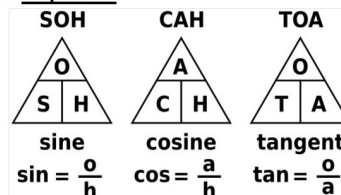
Used to give a direction from one point to another

A three-figure bearing is the angle:

- Measured from North
- Measured clockwise

Right Angled Trigonometry

- The side opposite the right angle is called the hypotenuse
- The side opposite the given angle is called the opposite
- The side next to the given angle is called the adjacent



- Use the normal function for finding unknown sides
- Use the inverse function (Sin^{-1}) for finding unknown angles

Plans

The view from above

Elevations

The view from the front or side

Chapter 15 – Ratio and proportion

Ratio as a measure

A ratio is a comparison of parts
Use a colon (:) to separate parts of a ratio
Units must be the same

Dividing a given ratio

Find the total number of parts in the ratio
Divide the amount to be shared by the total parts
Multiply by each part of the ratio

Cancelling ratios

Divide the ratio by the highest common factor

Ratios to Fractions

If you and a friend share a pie in the ratio 1:3 you get $\frac{1}{4}$ of the pie.

1:n

Divide both values by the first value
Often used to compare different ratios

Inverse Proportionality

Values that have a relationship with each other
As one variable goes up, the other one goes down at the same rate

Direct Proportionality

Values that have a relationship with each other
As one variable goes up so does the other one, at the same rate

Know More, Remember More, Understand and Apply



Crucial Knowledge Simplifying a Ratio



<u>Crucial Knowledge</u>	<u>Remember More</u>
<p>Many ratios can be simplified by finding the largest number that divides into the numbers in the ratio</p>	<p>The ratio of red to blue dinosaurs is 12:18. This ratio can be simplified. Both 12 and 18 can be divided by 6. $12 \div 6 = 2$ $18 \div 6 = 3$ <u>So</u> a simpler way to write 12:18 is 2:3</p>
<u>Understand and Apply</u>	
<p>Simplify the following ratios:</p> <p>a) 12:15 b) 25:20 c) 35:21 d) 18:30 e) 18:26</p>	



Crucial Knowledge Sharing in a Ratio



<u>Crucial Knowledge</u>	<u>Remember More</u>
<p>Amounts can be shared in a ratio.</p> <p>£250 is shared in the ratio 3:2</p> <p>This means that the money is split into 5 parts (3 parts for one person and 2 parts for the other)</p>	<p>Each part will be worth £50 ($£250 \div 5$ parts)</p> <p>The person that receives 3 parts will get $3 \times £50 =$ £150</p> <p>The person that receives 2 parts will get $2 \times £50 =$ £100</p>
<u>Understand and Apply</u>	
<p>1) Share £350 in the ratio 2:5</p> <p>2) Share £450 in the ratio 5:4</p>	



Crucial Knowledge Dividing In A Given Ratio



<u>Crucial Knowledge</u>	<u>Remember More</u>
<p>The simple method of dividing <u>in a given ratio</u> is to:</p> <p>a) Add the ratios</p> <p>b) Divide the amount by the added ratios.</p> <p>c) Multiply each ratio part by step (b)</p> <p>d) Check your answers add to the original amount.</p>	<p>Share £400 in ratio 5:3</p> <p>a) $5 + 3 = 8$</p> <p>b) $400 \div 8 = £50$</p> <p>c) $5 \times £50 =$ £250 $4 \times £50 =$ £200</p> <p>d) $£250 + £200$ does make £450</p>
<u>Understand and Apply</u>	
<p>1) Share £450 in the ratio 3:2</p> <p>2) Share £270 in the ratio 4:5</p> <p>3) Share £560 in the ratio 5: 3</p>	



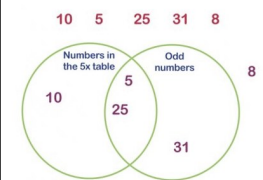
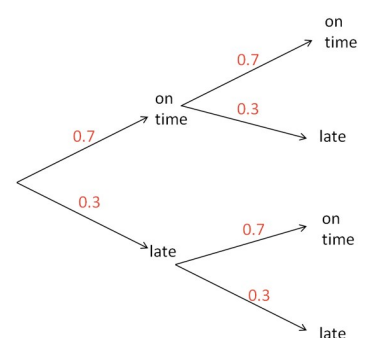
Crucial Knowledge Writing a Ratio



<u>Crucial Knowledge</u>	<u>Remember More</u>
<p>A ratio shows how much of one thing there is compared to another.</p> <p>Ratios are usually written in the form a:b</p>	<p>If you are making orange squash and you mix one part orange to four parts water:</p> <p>the ratio of orange to water will be <u>1:4</u> (1 to 4)</p>
<u>Understand and Apply</u>	
<p>If I want to make pink paint, I need to mix 3 cans of red paint with 2 cans of white paint. How will this be written as a ratio?</p>	

Probability

Chapter 16 - Probability

<p style="text-align: center; color: #c00000;"><u>Probability Definitions</u></p> <p>Outcome – A possible result of an experiment</p> <p>Event – A set of outcomes</p> <p>Impossible – An outcome that cannot happen</p> <p>Certain – An event that must happen</p> <p>Independent – If the outcome of one event does not affect what happens in another event</p> <p>Mutually Exclusive – events that cannot happen at the same time</p>	<p style="text-align: center; color: #c00000;"><u>Venn Diagrams</u></p> <p>Sorts data into groups</p> 	<p style="text-align: center; color: #c00000;"><u>Probability Trees</u></p> <ul style="list-style-type: none"> Splits in branches add to 1 Multiply probabilities along the branches Add multiple route probabilities <div style="text-align: center;"> <p>Monday Tuesday</p>  </div> <p>On time both days = $0.7 \times 0.7 = 0.49$</p>
<p style="text-align: center; color: #c00000;"><u>Probability and relative frequency</u></p> <p>A list of all probabilities adds up to 1</p> <p>Probabilities can be fractions, decimals or percentages</p> <p>Relative frequency = $\frac{\text{How often event happens}}{\text{Total outcomes}}$</p>		