ZETA MATHS

CfE Third Level

Maths & Numeracy

Learning Checklist

This checklist covers every skill that learners need for success at Third Level maths and numeracy. Each section of this checklist corresponds to the **Zeta Maths CfE Third Level Maths & Numeracy** textbook (available from www.zetamaths.com or on Amazon). The topic names in this document are linked for easy navigation of the checklist and colour coded to correspond with skills: **numerical**, **algebraic**, **geometric** and **statistical**.

Contents

Section	Topic	Skills			
1	**Rounding**				
1.3	Rounding to 1, 2 and 3 decimal places	When rounding, it is only the number immediately to the right of the number being rounded that we consider. **(a)** 4·269 = 4·3 (1 d.p.) **(b)** 5·393 = 5·39 (2 d.p) **(c)** 8·4996 = 8·500 (3 d.p)			
1.4	Rounding for estimation	**Example:** By rounding to the nearest £10, estimate the total value of £32·84 + £193·25. **Solution:** £32·84 + £193·25 ≈ £30 + £190 = £220			
2	**Whole Numbers**				
2.2	Mental addition and subtraction	**Examples:** **(a)** 45 + 34 = 40 + 30 + 5 + 4 = 70 + 9 = 79 **(b)** 67 – 26 = 67 – 20 – 6 = 47 – 6 = 41 **(c)** 29 + 64 = 30 + 63 = 93 **(d)** 69 – 31 = 69 – 1 – 30 = 68 – 30 = 38			
2.4	Mental multiplication	**Examples:** **(a)** 45 × 6 = 40 × 6 + 5 × 6 = 240 + 30 = 270 **(b)** 39 × 7 = 40 × 7 – 1 × 7= 280 – 7 = 273			
2.6	Mental Division	**Example:** 132 ÷ 6 = 120 ÷ 6 + 12 ÷ 6 = 20 + 2 = 22			
Learners should know and recall multiplication and division facts up to the 10th multiplication table (see website for practice worksheets)					
Learners should be able to use who numbers skills to solve problems (see **Maths in Context 1**)					
3	**Decimal Numbers**				
3.2	Mental addition and subtraction	**Examples:** **(a)** 3·5 + 3·4 = 3 + 3 +0·5 + 0·4 = 6 +0·9 = 6·9 **(b)** 4·5 – 0·9 = 3·6 **(c)** 2·9 + 4·2 = 3·0 + 4·1 = 7·1 **(d)** 6·9 – 3·5 = 7·0 – 3·6 = 7·0 – 3·0 – 0·6 = 3·4			
3.4	Multiplication of a decimal number by a decimal number	**Step 1:** Multiply the numbers together. **Step 2:** Count the number of digits after the decimal point in the calculation. **Step 3:** Write the answer with the number of digits after the point. **Examples:** **(a)** 0·7 × 0·04 = 0·028 **(b)** 3·2 × 0·2 = 0·64			
3.6	Division of a decimal number by a decimal number	To divide decimal fractions, multiply both numbers in the calculation by the **same number**, creating an equivalent fraction which is easier to calculate. **Worked Examples:** **1.** $0{\cdot}4 \div 0{\cdot}2 = \frac{0{\cdot}4}{0{\cdot}2} = \frac{4}{2} = 2$ **2.** $0{\cdot}32 \div 0{\cdot}08 = \frac{0{\cdot}32}{0{\cdot}08} = \frac{32}{8} = 4$			
3.7	Multiplication by Multiples of 10, 100 and 1000	To **multiply** a decimal number by a multiple of **10**, **100** or **1000**, multiply the number by the multiple, then multiply by 10, 100 or 1000. **(a)** 3·4 × 20 = (3·4 × 2) × 10 = 6·8 × 10 = 68 **(b)** 3·5 × 400 = (3·5 × 4) × 100 = 14 × 100 = 1400			

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3.8	Division by Multiples of 10, 100 and 1000	To **divide** a decimal number by a multiple of **10**, **100** or **1000**, divide by 10, 100 or 1000, then divide the number by the multiple. **(a)** 1.6 ÷ 20 = (1.6 ÷ 10) ÷ 2 = 0.16 ÷ 2 = 0.08 **(b)** 4.8 ÷ 400 = (4.8 ÷ 100) ÷ 4 = 0.048 ÷ 4 = 0.012			
Learners should be able to use decimal number skills to solve problems (see **Maths in Context 1**)					
4	**Integers (positive and negative whole numbers)**				
Integers are numbers with no fractional part that can be either positive or negative, **e.g.** …,–2, –1, 0, 1, 2,…, etc.					
4.2	Addition and subtraction of negative numbers	When **adding negative numbers**, this is the same as taking away positive numbers. 8 **+ (–9)** = 8 **– 9** = –1 When **subtracting negative numbers**, this is the same as adding positive numbers. 12 **– (–5)** = 12 **+ 5** = **17**			
4.3	Multiplication of a decimal number by a decimal number	When we multiply a **negative** number by a **positive** number, the result is a **negative number**. **3 × (–9)** = **–27** When we multiply or divide two numbers that have the same signs, **i.e.** they are **both positive** or **both negative**, the result is always **positive**. **(–6) × (–8)** = **48**			
Learners should be able to use negative number skills to solve problems (see **Maths in Context 1**)					
5	**Multiples, Factors & Primes**				
5.1	Multiples	A **multiple** of a number is the result of a multiplication of the number by any whole number. The first 6 multiples of 4 are: 4, 8, 12, 16, 20, 24			
5.2	The lowest common multiple (LCM)	The **lowest common multiple (LCM)** of two or more numbers is the lowest multiple that they both/all share. **Example:** The lowest common multiple of 4 and 10. **Multiples of 4:** 4, 8, 12, 16, **20** **Multiples of 10:** 10, **20**, 30, 40, 50 The LCM of 4 and 10 is 20.			
5.3	Factors	A **factor** of a number is a whole number that divides into the number without leaving a remainder. **24:** 1 × 24, 2 × 12, 3 × 8, 4 × 6. The factors of 24: 1, 2, 3, 4, 6, 8, 12, 24			
5.4	The highest common factor (HCF)	The **highest common factor (HCF)** of two or more numbers is the highest factor that each of the numbers share. **Example:** The highest common factor 16 and 28. **16:** 1 × 16 , 2 × 8, 4 × 4 **Factors of 16:** 1, 2, **4**, 8, 16 **28:** 1 × 28, 2 × 14, 4 × 7 **Factors of 28:** 1, 2, **4**, 7, 14, 28 The HCF of 16 and 28 is 4.			
5.5	Prime numbers	A **Prime Number** is a whole number with exactly two distinct factors, **i.e.** 1 and itself.			

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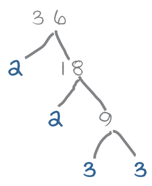
Section	Topic	Skills			
5.6	Prime factorisation	Every positive whole number is either a prime number or it can be expressed as a product of prime numbers.  **Example:** Express 36 as a product of prime factors **Step 1:** Write 36 and divide it by a low prime (2 or 3). **Step 2:** Write the factor pair underneath the 36. **Step 3:** Now pick the non-prime (18) and divide it by a prime (it can be the same prime). **Step 4:** Continue factorising the non-prime numbers until all you are left with is primes. **Step 5:** Write the answer as a product (multiplication). It comes from the end of branches. **Answer:** $36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$			
Learners should be able to solve problems with multiples and factors (see **Maths in Context 1**)					
6	**Powers**				
6.1	Evaluating whole number powers	In the number **5^3**, the **5** is the base and the **3** is the power. We read it as 'five to the power three', or 'five cubed'. It means we multiply **5** by itself **3** times. So, **$5^2 = 5 \times 5 \times 5 = 125$**.			
6.2	Expressing whole numbers in index form	**Examples:** **(a)** 9 $= 3 \times 3$ $= 3^2$ **(b)** $2 \times 9 \times 3 \times 2 \times 2$ $= 2 \times (3 \times 3) \times 3 \times 2 \times 2$ $= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$ $= 2^4 \times 5^2$			
7	**The Order of Operations**				
7.1	Simple operations (SECOND LEVEL)	**BIDMAS** is an acronym which means: **B**rackets, **I**ndices (powers), **D**ivide, **M**ultiply, **A**dd, **S**ubtract. At Second Level, we are only interested in the last four letters which remind us that it is important to remember that we always **multiply** or **divide** *before* we **add** or **subtract**. **Worked Examples:** Evaluate each of the following: **(a)** $5 + 3 \times 2$ $= 5 + 6$ $= 11$ **(b)** $12 - 16 \div 8$ $= 12 - 2$ $= 10$			
8	**Fractions**				
8.3	Converting improper fractions to mixed numbers	An **improper fraction** or a **top-heavy fraction** is a fraction with a larger number on the top (numerator) than the bottom (denominator). A **mixed number** is a number with a whole number part and a fractional part. **(a)** $\frac{14}{3} = 4\frac{2}{3}$ $(14 \div 3 = 4$ remainder $2)$ **(b)** $\frac{32}{5} = 6\frac{2}{5}$ $(32 \div 5 = 6$ remainder $2)$			
8.4	Converting mixed numbers to improper fractions	**Worked Examples:** **(a)** $4\frac{1}{5} = \frac{4 \times 5 + 1}{5} = \frac{21}{5}$ **(b)** $3\frac{2}{7} = \frac{3 \times 7 + 2}{7} = \frac{23}{7}$			
8.5	Finding a fraction of a whole number or quantity	**Worked Examples:** **(a)** Find $\frac{1}{3}$ of 12. $\frac{1}{3} \times 12$ $= 12 \div 3$ $= 4$ **(b)** Find $\frac{3}{4}$ of 36. $\frac{3}{4} \times 36$ $= 36 \div 4 \times 3$ $= 9 \times 3$ $= 27$			

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8.6	Adding and subtracting fractions	When adding or subtracting two or more fractions, make the denominators of the fractions the same using the **lowest common multiple** of the denominators. Multiply the numerator of the fraction by the same number as the denominator, then add the numerators together. **Worked Examples:** **(a)** $\frac{3}{4} + \frac{4}{5} = \frac{15}{20} + \frac{16}{20} = \frac{31}{20} = 1\frac{11}{20}$ **(b)** $\frac{5}{9} - \frac{1}{2} = \frac{10}{18} - \frac{9}{18} = \frac{1}{18}$			
8.7	Multiplying fractions by whole numbers	To multiply a fraction by a whole number is effectively the same operation as finding a fraction of a quantity, but the other way around. **Worked Example:** $2 \times \frac{6}{7} = \frac{2}{1} \times \frac{6}{7} = \frac{12}{7} = 1\frac{5}{7}$.			
8.8	Expressing fractions as decimals	To express a fraction as a decimal without a calculator, it is best to make the denominator 10, 100, 1000, etc. We can then use our knowledge of place value to write the fraction in decimal form. **Worked Examples:** **(a)** $\frac{1}{5}$ multiply by 2 $= \frac{2}{10}$ $= 0.2$ **(b)** $\frac{1}{8}$ multiply by 12.5 $= \frac{12.5}{100}$ multiply by 10 $= \frac{125}{1000}$ $= 0.125$			
8.9	Expressing decimals as fractions	To express a decimal as a fraction, we can use our knowledge of place value, then simplify. **Worked Examples:** Express the following decimals as fractions: **(a)** 0.05 5 hundredths $= \frac{5}{100}$ divide by 5 $= \frac{1}{20}$ **(b)** 0.14 14 hundredths $= \frac{14}{100}$ divide by 2 $= \frac{7}{50}$			
9	**Percentages**				
9.1	Expressing a percentage as a fraction	To express a percentage as a fraction, write the percentage as a number with a denominator of 100, then simplify. **Worked Examples:** **(a)** $17\% = \frac{17}{100}$ **(b)** $38\% = \frac{38}{100} = \frac{19}{50}$			
9.2	Expressing a fraction as a percentage	To express a fraction as a percentage *without* a calculator, make the denominator 100 using equivalent fractions. We can then write the number as a percentage. **Worked Examples:** **(a)** $\frac{3}{5}$ multiply by $\frac{20}{20}$ $= \frac{60}{100}$ $= 60\%$ **(b)** $\frac{5}{40}$ multiply by $\frac{10}{10}$ $= \frac{50}{400}$ divide by $\frac{4}{4}$ $= 12.5\%$			
9.3	Expressing a percentage as a decimal	To express a percentage as a decimal, divide it by 100. **Worked Examples:** **(a)** 15% = 15 ÷ 100 = 0·15 **(b)** 3% = 3 ÷ 100 = 0·03			

Section	Topic	Skills			
9.4	Expressing a decimal as a percentage	To express a decimal as a percentage, multiply it by 100%. **Worked Examples:** **(a)** 0·3 = 0·3 × 100(%) = 30% **(b)** 0·04 = 0·04 × 100(%) = 4%			
9.5	Finding a percentage of a quantity (non-calculator)	To calculate more complicated percentages of any value *without* using a calculator, we can calculate simple percentages and add them together. The most useful percentage is 10%. From this, we can calculate 1% (divide 10% by 10), 5% (divide 10% by 2), 20% (multiply 10% by 2), 30% (multiply 10% by 3), etc. **Worked Examples:** Find the following percentages without using a calculator: **(a)** 40% of 56 100% = 56 10% = 5·6 **40% = 22·4** **(b)** 15% of 68 100% = 68 **10% = 6·8** **5% = 3·4** **15% = 10·2**			
9.6	Finding a percentage of a quantity (calculator)	To find a percentage of a quantity with a calculator, we can do one of three things: **(a)** use the calculator % button then multiply, **(b)** turn the percentage into a fraction then multiply, or **(c)** turn the percentage into a decimal then multiply. We will use method **(c)**. To turn a percentage into a decimal, we divide by 100% (see **section 9.3**). **Worked Examples:** **(a)** Find 12% of 85. 0·12 × 85 = 10·2 **(b)** Find 28% of 146. 0·28 × 146 = 40·88			
10	**Ratio**				
10.1	Simplifying ratios	Ratios can be simplified in the same way as fractions, by dividing each number by the *same* number, ideally, the **highest common factor** (see **section 5.4**). We should always simplify ratios before sharing. **Worked Examples:** Simplify the following ratios: **(a)** 18 : 30 divide by 6 3 : 5 **(b)** 75 : 120 divide by 15 5 : 8			
10.1	Sharing ratios	A ratio divides a quantity into a certain number of parts that are then shared in the given ratio. If the ratio can be simplified, simplify before sharing. **Worked Example:** Share 90 in the ratio 3 : 2. **Step 1:** Determine the number of parts. 3 + 2 = 5 parts **Step 2:** Calculate the value of one part. 1 part = 90 ÷ 5 = 18 **Step 3:** Share in the given ratio. 3 ×18 : 2 ×18 **54 : 36**			
10.3	Using a ratio to find unknown values	**Worked Example:** A and B are in the ratio **3** : **4**. If A is 420, what is the value of B? **Step 1:** Calculate the value of one part. 1 part = 420 ÷ **3** = 140 **Step 2:** Multiply by 4 to find value of B. 140 × **4** = 560			
11	**Simplifying Expressions**				
11.1	Basic addition and subtraction	**Worked Examples:** **(a)** $x + x = 2x$ **(b)** $x + y + x + y + x = 3x + 2y$			
11.2	Further addition and subtraction	**Worked Examples:** **(a)** $3x + 4x = 7x$ **(b)** $x + 4 + 2y + 5 - x = 2y + 9$			

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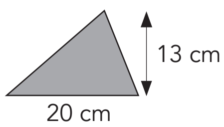
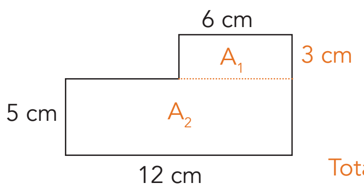
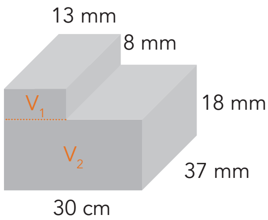
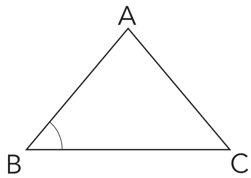
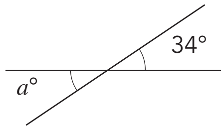
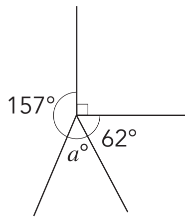
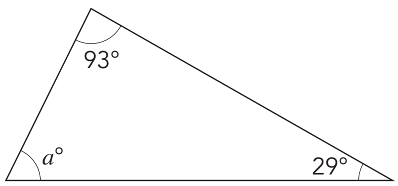
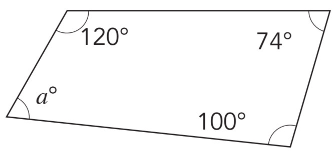
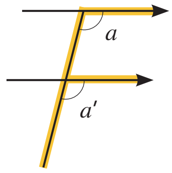
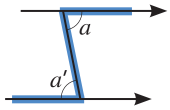
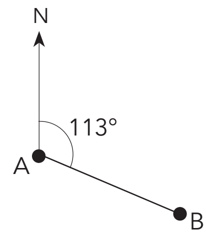
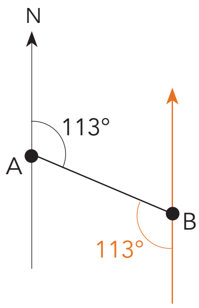
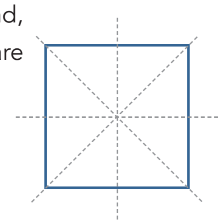
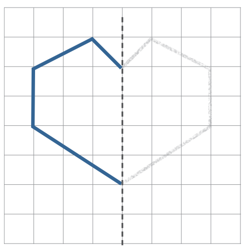
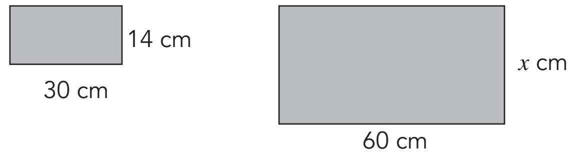
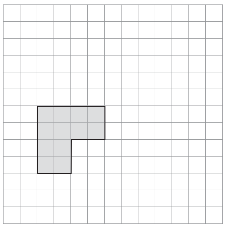
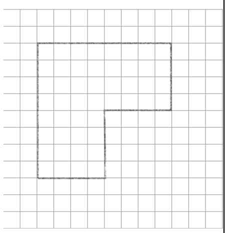
11.3	Multiplication of algebraic terms by letters and numbers	When multiplying algebraic terms together, multiply the **coefficients** together and multiply the **variables** together. **Worked Examples:** **(a)** $5x \times 4y = 20xy$ **(b)** $3x \times 7y \times z = 21xyz$			
11.4	Mixed simplifying – use of BIDMAS	In questions that involve more than one operation, it is necessary to consider the order of operations. Use **BIDMAS** (**B**rackets, **I**ndices, **D**ivision, **M**ultiplication, **A**ddition, **S**ubtraction). **Worked Examples:** **(a)** $4x + 2x \times 5$ $= 4x + 10x$ $= 14x$ **(b)** $5x \times 4y + 3y$ $= 20xy + 3y$			
11.5	Division of algebraic terms by letters and numbers	In these types of questions, divide the coefficients by the coefficients and the variables by the variables. **Worked Examples:** **(a)** $\frac{x}{3x} = \frac{x}{3x} = \frac{1}{3}$ **(b)** $18z \div 3z = \frac{18z}{3z} = 6$			
12	**Substitution**				
11.1	Basic substitution	Substitution is the process of replacing algebraic terms with numerical or equivalent algebraic terms. The skills learned in this chapter will be used again in later chapters. When performing a substitution, always show the original expression and the substitution (lines 1 and 2 below). **Worked Examples:** If $w = -2$, $x = 5$, $y = 4$ and $z = -3$, find: **(a)** $w + y$ $= -2 + 4$ $= -4$ **(b)** $15w + 2z$ $= 15(-2) + 2(-3)$ $= -30 + (-6)$ $= -30 - 6$ $= -36$ **(c)** $\frac{3w + 3z}{5}$ $= \frac{3(-2) + 3(-3)}{5}$ $= \frac{-6 + (-9)}{5}$ $= \frac{-15}{5}$ $= 2$			
13	**Solving Equations**				
13.1	Solving equations: $x \pm a = b$	We have seen in section 11 that an **algebraic expression** is made up of one or more algebraic terms, for example $\mathbf{2x + 1}$. An **equation** is an expression equal to a number or another expression, for example, $\mathbf{2x + 1 = 5}$. To **solve an equation** is to find the value of the unknown which makes the equation true. For example, if $\mathbf{x + 1 = 3}$, then the only value that x can be is **2**, as $\mathbf{2 + 1 = 3}$. So the solution is $\mathbf{x = 2}$. **Worked Examples:** **(a)** $x + 6 = 8$ (-6) (-6) $x = 2$ **(b)** $y - 7 = 9$ $(+7)$ $(+7)$ $y = 16$ **(c)** $12 = 2 + z$ (-2) (-2) $10 = z$ $z = 10$			
13.2	Solving equations: $ax = b$	When solving equations of the form $\mathbf{ax = b}$, always divide by the coefficient of the algebraic term. **Worked Examples:** **(a)** $2w = 8$ $(\div 2)$ $(\div 2)$ $\frac{2w}{2} = \frac{8}{2}$ $w = 4$ **(b)** $3x = -15$ $(\div 3)$ $(\div 3)$ $\frac{3x}{3} = \frac{-15}{3}$ $x = -5$ **(c)** $-y = 9$ $(\div -1)$ $(\div -1)$ $y = -9$			

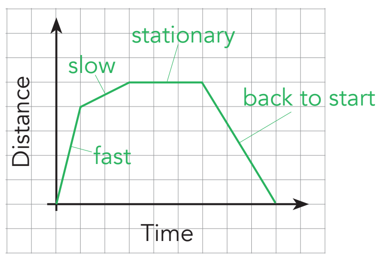
Section	Topic	Skills			
13.3	Solving equations: $ax \pm b = c$	When solving equations of the form ax + b = c, add or subtract, then divide or multiply. **Worked Examples:** **(a)** $2w + 3 = 9$ (–3) (–3) $2w = 6$ (÷2) (÷2) $w = 3$ **(b)** $4x - 5 = 3$ (+5) (+5) $4x = 8$ (÷4) (÷4) $x = 2$ **(c)** $15 - 3y = 3$ (–15) (–15) $-3y = -12$ (÷–3) (÷–3) $y = 4$			
13.5	Solving equations with rational/fractional solutions	A **rational number** is any number that can be expressed as a division of two integers, or more simply, a number that can be expressed as a fraction. Solutions to equations are often fractions. **Worked Examples:** **(a)** $3x = 7$ (÷3) (÷3) $x = \frac{7}{3}$ **(b)** $6x + 2 = 5$ (–2) (–2) $6x = 3$ (÷6) (÷6) $x = \frac{3}{6} = \frac{1}{2}$ **(c)** $9 = 3 - 5z$ (+5z) (+5z) $5z + 9 = 3$ (–9) (–9) $5z = -6$ (÷5) (÷5) $z = -\frac{6}{5}$			
14	**Measurement**				
14.2	Converting units	**Larger to Smaller Unit (Multiply)** Kilometres to metres (×1000) Metres to centimetres (×100) Centimetres to millimetres (×10) Metres to millimetres (×1000) Kilograms to grams (×1000) Litres to millilitres (×1000) **Smaller to Larger Unit (Divide)** Metres to kilometres (÷1000) Centimetres to metres (÷100) Millimetres to centimetres (÷10) Millimetres to metres (÷1000) Grams to kilograms (÷1000) Millilitres to litres (÷1000)			
15	**Area & Volume**				
15.3	The area of any triangle	We can find the area of any triangle using the formula $A = \frac{1}{2} \times b \times h$, where b is the base and h is the vertical height at right angles to the base. **Worked Example:** Find the area of the triangle.  $A = \frac{1}{2} \times b \times h$ $A = \frac{1}{2} \times 20 \times 13$ $A = 10 \times 13$ $A = 130\text{ cm}^2$			
15.4	The area of composite shapes	**Worked Example:** Find the area of the shape.  **Solution:** $A_1 = l \times b$ $A_1 = 6 \times 3$ $A_1 = 18\text{ cm}^2$ $A_2 = l \times b$ $A_2 = 2 \times 5$ $A_2 = 60\text{ cm}^2$ Total Area = $A_1 + A_2 = 18 + 60 = 78\text{ cm}^2$			

Section	Topic	Skills			
15.6	The volume of composite objects	**Worked Example:** **Solution:** Find the volume of the object.  $V_1 = l \times b \times h$ $V_1 = 13 \times 37 \times 8$ $V_1 = 3848$ cm^3 $V_2 = l \times b \times h$ $V_2 = 30 \times 37 \times 18$ $V_2 = 19\,980$ cm^3 Total Volume = $V_1 + V_2 = 23\,828$ cm^3			
17	**Angle Properties**				
17.2	Naming angles	If an angle is formed by three points, the angle can be named using the letters of each of the three points. When naming an angle, we must use an angle sign, such as **∠ABC** or **$A\hat{B}C$**, ensuring that the **middle** letter of the name is the **vertex** of the angle. 			
17.4	Vertically opposite angles	When two lines intersect, the angles on the opposite side of the point of intersection are equal. **Worked Example:** Write down angle $a°$. $a° = 34°$ 			
17.5	Angles around a point	Angles around a point add up to 360°. To find an unknown angle around a point, sum all the other angles and take them away from 360°. **Worked Example:** Calculate angle $a°$. $a° = 360 – (157 + 90 + 62)$ $a° = 360 – 309$ $a° = 51°$ 			
17.6	Angles in a triangle	The angles in any triangle add up to 180°. **Worked Example:** Calculate angle $a°$ from the triangle opposite. $93 + 29 = 122$ $a° = 180 – 122$ $a° = 58°$ 			
17.7	Angles in a quadrilateral	A **quadrilateral** is a shape with four sides. We are already familiar with several quadrilaterals: squares, rectangles, parallelograms, rhombi, kites and trapezia. The internal angles in any quadrilateral add up to 360°. **Worked Example:** Calculate angle $a°$ in the quadrilateral. $120 + 74 + 100 = 294$ $a° = 360 – 294$ $a° = 66°$ 			

Section	Topic	Skills			
17.8	Angles and parallel lines	When parallel lines are intersected by another line, **corresponding angles** are formed. These angles are commonly known as ***F*–angles**, as the corresponding angles make an 'F' shape. In the diagram opposite, $a = a'$.  When parallel lines are intersected by another line, **alternate angles** are also formed. These angles are commonly known as ***Z*–angles**, as the corresponding angles make a 'Z' shape. In the diagram opposite, $a = a'$.  			
17.9	Angle chasing	We can use all the angle properties that we have covered in this chapter to find unknown angles in more complicated diagrams. Remember to look out for parallel lines, vertically opposite angles, supplementary angles, and triangles.			
17.10	Bearings	**Bearings** are angles that are measured from **North** in a **clockwise** direction that are always written with **three figures**. **Worked Example:** The bearing of point B from point A is 113°. Calculate the bearing of A from B.   Bearing from B to A = 113 + 180 = 293°			
18	**Reflection Symmetry**				
18.1	Identifying reflection symmetry	In reflection symmetry, parts of a shape correspond, or are reflected along a given line or axis. A square has four lines of symmetry. 			
18.2	Using reflection symmetry	**Step 1:** Start at one end of the design. **Step 2:** For each vertex, count the number of boxes from the symmetry line and count the **same number** of boxes in the **opposite direction**, then mark the new vertex. **Step 3:** Draw a line joining each of the vertices. 			
19	**Scale Factors & Scale Drawing**				
19.1	Calculating scale factors	We can calculate the **scale factor** by dividing the enlarged or reduced length by its corresponding original length. We can use the formula: $\text{Scale Factor} = \dfrac{\text{New Length}}{\text{Original Length}}$			

Section	Topic	Skills			
19.2	Using scale factors	**Worked Example:** The shape on the right is an enlargement of the shape on the left. Calculate the value of x, the unknown side.  **Step 1:** Calculate the scale factor. $SF = \frac{\text{New Length}}{\text{Original Length}} = \frac{60}{30} = 2$ **Step 2:** Use the scale factor. $x = 2 \times 14 = 28$ cm **NB:** Scale can also be used in maps to calculate real life distances from one place to another. Map scales can take several forms. For example, 1:10 000 means that every 1 unit measured is equivalent to 10 000 in real life. Or the scale could say 1 cm = 1 km, etc.			
19.3	Using scale factors for drawing	**Worked Examples:** Draw an enlargement of the given shape using a scale factor of 2.  **Step 1:** Start with any line and multiply multiply the length of the line by 2. **Step 2:** Move round the shape, one side at a time, calculating the new length and drawing the new line. **Step 3:** Complete the shape.  **NB:** We can use scale with our knowledge of bearings to produce accurate scale drawings of places.			
20	**Drawing 2D Shapes**				
20.1	Drawing squares and rectangles	We can draw squares and rectangles, given the length of the sides.			
20.2	Drawing triangles	We can draw triangles in a variety of ways, given: (a) the length of one side and two of the angles (b) the length of two sides and one of the angles. (c) the length of all sides.			
20.3	Drawing regular polygons	We can draw regular polygons if we know the size of the interior angle and the length of the sides.			
21	**Money**				
21.1	Currency conversions	**Worked Example:** The exchange rate from pounds sterling (GBP) to Japanese yen (JPY) is 1 GBP = 160·4973 JPY. To the nearest yen, how many Japanese yen would be exchanged for £750? **Solution:** 750 × 160·4973 = 120 372·975 = 120 373 JPY			

<table>
<tr><th>Section</th><th>Topic</th><th>Skills</th><th></th><th></th><th></th></tr>
<tr><td>21.2</td><td>Choosing best value</td><td>Worked Example:
In the supermarket, a bag of six Braeburn apples costs £1·80, another bag of 10 costs £2·79. Which bag offers the best value? Justify your answer by calculation.
Solution:
Step 1: Find the cost of 1 apple in each bag. The cheaper apple offers better value.
1·80 ÷ 6 = £0·30 and 2·79 ÷ 10 = £0·279
Step 2: Compare prices. 27·9p < 30p
Step 3: Answer question. The bag of ten apples is better value.</td><td></td><td></td><td></td></tr>
<tr><td>21.2</td><td>Choosing best value contracts</td><td>The easiest way to compare deals is to compare like–for–like. The best way to do this calculation is to find the total cost of each contract.</td><td></td><td></td><td></td></tr>
<tr><td>22</td><td colspan="5">Patterns & Sequences</td></tr>
<tr><td>22.1</td><td>Finding numbers and describing a rule</td><td>Worked Example:
(a) Find the next three numbers for the following sequence of numbers:
5, 8, 11, 14,…
17, 20, 23.
(b) Describe the rule relating the numbers.
From one number to the next we are adding three.</td><td></td><td></td><td></td></tr>
<tr><td>22.3</td><td>Using the formula for the nth term</td><td>We can describe the nth term of a sequence in the form $an \pm b$. To find the value of a term within the sequence, we substitute the number of that term into the formula.
Worked Example:
Find the 7th term in the sequence $3n - 2$.
To find the 7th term, substitute 7 for n into the formula.
When n is 7,
$3(7) - 2 = 21 - 2 = 19$.</td><td></td><td></td><td></td></tr>
<tr><td>22.4</td><td>Finding a formula connecting two related terms</td><td>Worked Example:
The table below shows two related variables.
<table><tr><td>C</td><td>1</td><td>2</td><td>3</td><td>4</td><td></td><td>12</td></tr><tr><td>D</td><td>5</td><td>8</td><td>11</td><td>14</td><td></td><td></td></tr></table>
(a) Find the formula relating the two variables.
(b) Use the formula to calculate the unknown value to complete the table.
Solution:
(a) In the linear relationship D = aC+b, we find a by looking at the difference in each of the numbers. The numbers go up by 3 each time, which means the sequence involves multiplication by 3.
So D = 3C + b.
When C = 1, D = 5, so 5 = 3 + b, b = 2.
The formula is D = 3C + 2
(b) Substitute 12 into the formula.
D = 3(12) + 2 = 36 + 2 = 38</td><td></td><td></td><td></td></tr>
</table>

Section	Topic	Skills			
23	**Speed, Distance & Time**				
23.1	Time intervals	**Worked Example:** **(a)** How long is the time interval between 10.35 am and 4.12 pm on the same day? +25 mins +5 hours +12 mins 10.35am 11.00am 4pm 4.12pm Duration 5 hours and 37 minutes. **(b)** An event starts at 0840 and lasts 4 hours and 28 minutes; when does it finish? +28 mins +4 hours 0840 0908 1308 The event finishes at 1308.			
23.2	Calculating speed	We can calculate the average speed of an object by dividing the distance travelled by the time taken, **i.e.** $\text{speed} = \frac{\text{distance}}{\text{time}}$ or $S = \frac{D}{T}$.			
23.3	Calculating distance	We can calculate the distance travelled by an object by multiplying the speed travelled by the time taken, **i.e.** **distance = speed × time** or **D = ST**.			
23.4	Calculating time	We can calculate the time travelled by an object by dividing the distance travelled by the speed, **i.e.** $\text{time} = \frac{\text{distance}}{\text{speed}}$ or $T = \frac{D}{S}$.			
23.6	Distance-time graphs	We can graph distance travelled against time to produce a distance-time graph. The steepness of the line in the graph is an indication of the speed of the object. 			
24	**Information Handling**				
24.1	Data interpretation	Three areas of information handling that can produce inaccurate or misleading information: **the sample**, **the survey** and **the graph**.			
24.2	Comparative bar graphs	Comparative bar graphs or charts allow us to compare like-for-like data with two or more categories. These graphs have two or more sets of data side by side on the graph.			
24.3	Comparative line graphs	A comparative line graph allows us to compare two sets of data over the same length of time. These graphs have two or more sets of data plotted on the same graph.			

Section	Topic	Skills			
24.4	Pie charts	Pie charts are a method of displaying information graphically, represented by pieces of a pie. Pie charts give a very clear indication of the proportions of the data belonging to each category, but they do not necessarily provide any other specific numerical information relating to the data.			
25	**Probability**				
25.1	Stating probability using words	In describing probability, we will limit ourselves to seven descriptions: **impossible**, **highly unlikely**, **unlikely**, **even chance**, **likely**, **highly likely** and **certainty**. These descriptions may vary.			
25.2	Stating probability using a scale from 0 to 1	We often use words to describe probability, but probability is also measurable and can be expressed as a **fraction** a **percentage** or a **decimal**. This measure is always on a scale from 0 to 1. This scale goes from 0, impossible, to 1, which is a certainty. The middle would be 0·5, even chance, 50% or fifty-fifty.			
25.3	Calculating simple probability	We can calculate probability using the formula: $$\text{P(event)} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$ **Worked Examples:** ***1.*** What is the probability that when a die is rolled, the number is 2? $$\text{P}(2) = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{1}{6}$$ There is one 2 on a die, so one favourable outcome and there are six numbers, so six possible outcomes.			
25.4	Using probability	We can use that skill to make decisions based on the likelihood of events.			

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