



Autumn Block 1

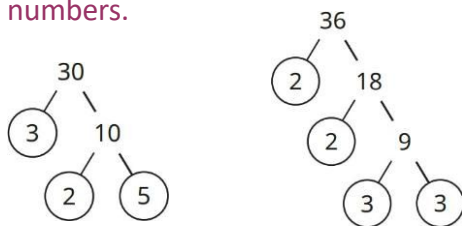
Properties of number

Multiples of 10: 10, 20, 30, 40, ...

Factors of 10: 1, 2, 5, 10

Prime numbers: 2, 3, 5, 7, 11, 13, ...

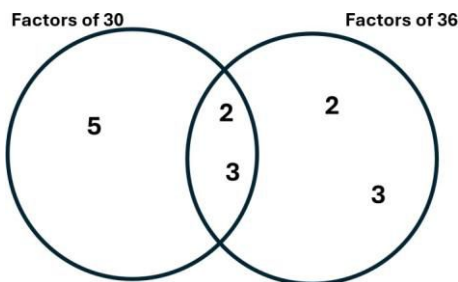
We can write integers as a **product of prime factors** using the method below. Notice how we circle the prime numbers.



$$30 = 2 \times 3 \times 5$$

$$36 = 2^2 \times 3^2$$

If we sort the prime factors of these numbers into a Venn Diagram, we can find their **highest common factor** and **lowest common multiple**.



Only 2 and 3 are in the **intersection**, so the **highest common factor** is $2 \times 3 = 6$.

5, 2, 3, 2, and 3 are in the Venn Diagram, so the lowest common multiple is $5 \times 2 \times 3 \times 2 \times 3 = 180$.

Powers are used to express repeated multiplication of the same number.

Roots are the opposite of powers.

$$5^4 = 5 \times 5 \times 5 \times 5 = 625$$

$$5^3 = 5 \times 5 \times 5 = 125$$

$$5^2 = 5 \times 5 = 25$$

$$\sqrt[4]{625} = 5$$

$$\sqrt[3]{125} = 5$$

$$\sqrt{25} = 5$$

Step 1

Factors, multiples and primes

Step 2

Write a number as a product of prime factors

Step 3

Use prime factors **E**

Step 4

Highest common factor (HCF) and lowest common multiple (LCM)

Step 5

Venn diagrams

Step 6

Use a Venn diagram to calculate HCF and LCM

Step 7

Integers, real numbers and rational numbers

Step 8

Introduction to surds **E**

Key vocabulary

factor

integer that divides exactly into another integer

multiple

result of multiplying a number by an integer

prime number

positive integer that has exactly two factors, 1 and itself

prime factor

factor of a number that is prime

product

result of a multiplication

prime factor decomposition

process of writing a number as the product of its prime factors

index notation

using exponents to show how many times a number (the base) is multiplied by itself

square number

product of a number that has been multiplied by itself

cube number

product of a number that has been multiplied by itself twice

highest common factor

common factor of two or more integers that has the greatest value

lowest common multiple

lowest multiple shared by two or more numbers

Venn diagram

visual diagram used to organise information into sets

set

group of numbers or objects known as members or elements

element

number or object in a set

intersection

intersection of two or more sets represented by the overlapping region between the sets

universal set

set that contains all the relevant objects for a given context



Autumn Block 2

Percentages

Calculate 12% of 40.

A

$$40 \times 0.12$$

B

$$40 \div 100 \times 12$$

Increase £240 by 20%.

A

$$\begin{aligned} 10\% \text{ of } £240 &= £24 \\ 20\% \text{ of } £240 &= £48 \\ £240 + £48 &= £288 \end{aligned}$$

B

$$£240 \times 1.2 = £288$$

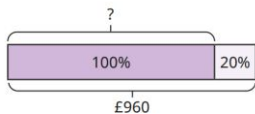
Percentage change = $\frac{\text{change}}{\text{original}} \times 100$

A ticket cost £4 last year. Now it costs £5. Work out the percentage increase in price.

$$5 - 4 = 1$$

$$\frac{1}{4} \times 100 = 25\% \text{ increase}$$

The cost of a laptop has increased by 20% and is now £960
What was the price of the laptop before the price increase?



$$120\% = £960$$

How could we find 1%?

How could we find 100%?

Simple interest:

$$I = \frac{nPR}{100} \quad A = P \left(1 + \frac{r}{100} \right)^n$$

Compound interest:

A = amount (the final value)

I = interest earned

n = number of payments (often years)

P = principal (starting value)

R = % rate of interest

Step 1

Percentage increase and decrease

Step 2

Express a change as a percentage

Step 3

Find the original value after a percentage change

Step 4

Solve problems with percentages (non-calculator)

Step 5

Solve problems with percentages (calculator)

Step 6

Repeated percentage change

Step 7

Understand interest

Step 8

Simple interest

Step 9

Compound interest

Key vocabulary

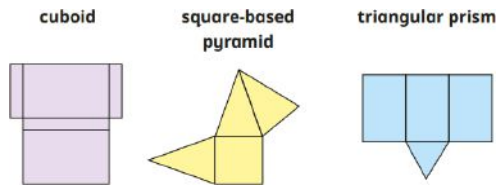
percentage	expressing a part of a whole as a number out of 100
multiplier	number that is multiplied with another number to increase or decrease its value
profit	positive difference between the selling price and the cost price of an item, indicating a financial gain
loss	negative difference between the cost price and the selling price of an item, indicating a financial loss
percentage change	how much a quantity has increased or decreased relative to its original value, calculated as a percentage
depreciate	decrease in value over time
interest	amount of money charged or earned based on a percentage of the original amount over a period of time
interest rate	percentage used to calculate interest on an investment or a loan
balance	amount of money currently available in a bank account
loan	money that is borrowed and must be paid back, typically with interest, over a set period of time
per annum	"per year", used to describe interest rates or payments that occur annually
instalments	regular, smaller payments made over time to pay back a greater amount of money
simple interest	interest calculated on the principal amount and then multiplied by the time period of the investment or loan
annual	something that happens or is calculated once a year
principal amount	original amount of money borrowed or invested before any interest is added
deposit	money placed in a bank account or given as an initial payment for a service or purchase
compound interest	interest calculated on both the principal amount and the accumulated interest from previous periods



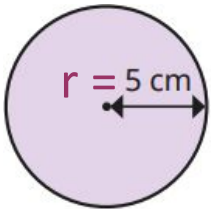
Autumn Block 3

Area and volume

Nets show all of the faces of a shape unfolded flat.

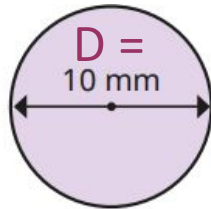


We can calculate the **area** or **circumference** of a circle using these formulae.



$$A = \pi \times r^2$$

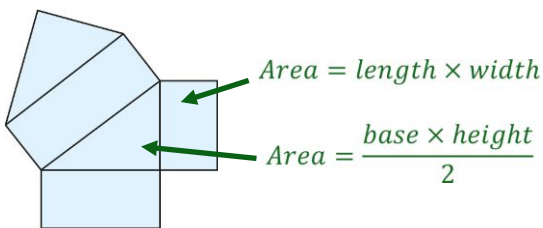
$$A = \pi r^2$$



$$C = \pi \times D$$

$$C = \pi D$$

To find the **surface area** of a 3D shape, we can break the shape down into its faces, then add the areas up.



The **volume** of a prism can be found by multiplying the area of its cross-section by its length. For other shapes, we need to use specific formulae.



$$\pi r^2 h$$



$$\frac{1}{3} \pi r^2 h$$



$$\frac{4}{3} \pi r^3$$



$$\frac{1}{3} b^2 h$$

Step 1

Nets

Step 2

Area of a 2-D shape

Step 3

Area and circumference of a circle

Step 4

Surface area of cubes and cuboids

Step 5

Surface area of a triangular prism **E**

Step 6

Surface area of a cylinder **E**

Step 7

Volume of a prism

Step 8

Volume of a cylinder

Step 9

Volume of cones, pyramids and spheres **E**

Step 10

Convert metric units of area and volume **E**

Key vocabulary

face	flat surface on a 3-D shape
edge	where two faces of a shape meet
vertex	point at which two or more edges (3-D) or sides (2-D) meet
net	2-D layout of a 3-D shape's faces that can be folded to create the 3-D shape
dimensions	measurements, such as length, width and height, that describe the size and extent of an object
area	amount of space taken up by a shape or surface, measured in square units
perpendicular height	height of a shape, measured at a right angle from the base to a vertex or edge
radius	distance from the centre of a circle to any point of the circumference
diameter	straight line passing through the centre of a circle from one point on the circumference to another
perimeter	total distance along the boundary of a 2-D shape
circumference	perimeter of a circle
pi (π)	mathematical constant representing the ratio of a circle's circumference to its diameter
surface area	area that covers the outside of a 3-D shape, calculated by finding the total area of all its surfaces
prism	3-D shape with a constant polygon cross-section
cylinder	3-D shape with two parallel and identical circular faces connected by a curved surface
volume	amount of space a 3-D object takes up, measured in cubic units



Autumn Block 4

Equations, inequalities and formulae

$$\begin{array}{rcl} 2m - 1 = 19 & & \\ + 1 & & + 1 \\ \hline 2m = 20 & & \\ \div 2 & & \div 2 \\ \hline m = 10 & & \end{array}$$

$$\begin{array}{rcl} 2m - 1 > 19 & & \\ + 1 & & + 1 \\ \hline 2m > 20 & & \\ \div 2 & & \div 2 \\ \hline m > 10 & & \end{array}$$

We can **solve an equation or inequality** using inverse operations. In the examples above, we +1 to cancel out the -1 then $\div 2$ to cancel out the $\times 2$.

$$\begin{array}{rcl} 2(m + 5) = 30 & & \\ \div 2 & & \div 2 \\ \hline m + 5 = 15 & & \\ - 5 & & - 5 \\ \hline m = 10 & & \end{array}$$

$$\begin{array}{rcl} 3x + 4 = x + 18 & & \\ - x & & - x \\ \hline 2x + 4 = 18 & & \\ - 4 & & - 4 \\ \hline 2x = 14 & & \\ \div 2 & & \div 2 \\ \hline x = 7 & & \end{array}$$

Equations can get more complicated. For equations with brackets, we can divide by the term outside the bracket to cancel it out. For equations with x on both sides, we should cancel the smaller x term first. Other variables (letters) work the same way.

$$\begin{aligned} c &= 35 + 15t \\ c &= 35 + 15 \times 6 \\ c &= 35 + 90 \\ c &= 125 \end{aligned}$$

A plumber charges a call-out fee, plus £15 per hour worked.

$$C = 35 + 15t$$

How much would a 6-hour job cost?

A 6-hour job would cost £125.

A

$$\begin{aligned} t &= 2(p + 4) \\ t &= 2p + 8 \\ t - 8 &= 2p \\ \frac{t - 8}{2} &= p \end{aligned}$$

B

$$\begin{aligned} t &= 2(p + 4) \\ \frac{t}{2} &= p + 4 \\ \frac{t}{2} - 4 &= p \end{aligned}$$

Changing the subject of a formula works a lot like solving an equation. We use inverse operations to **isolate** the subject of the formula. The key difference is that our answer will still contain lots of variables (letters).

Step 1

Solve equations and inequalities

Step 2

Solve equations and inequalities with brackets

Step 3

Inequalities with negative numbers **E**

Step 4

Solve equations and inequalities with unknowns on both sides

Step 5

Solve problems with equations and inequalities

Step 6

Substitute into formulae and equations

Step 7

Change the subject of a formula (one step)

Step 8

Change the subject of a formula (two steps)

Step 9

Change the subject of a complex formula **E**

Key vocabulary

equation

statement to show that two expressions are equal

inequality

statement that shows the relationship between two expressions where one is greater than, less than or not equal to the other

solution

value of an unknown that satisfies an equation or inequality

coefficient

number in front of a variable indicating the multiple of the variable

inverse operation

"opposite" of a given mathematical operation that reverses the effect of the first operation

expand

multiply each term inside a bracket by the expression outside the bracket

expression

collection of terms involving variables and numbers

formula

mathematical rule or equation that shows the relationship between different variables or quantities

substitute

replace letters with numerical values

subject

variable that is isolated on one side of a formula

rearrange

adjust a formula to isolate a specific variable or simplify an expression

























