Unit 1: Number 1 - Red indicates higher tier only -

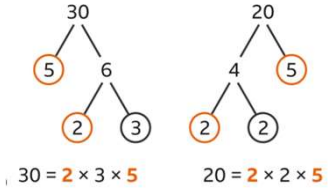
Shaw Education Trust | The Orme Academy

Knowledge Organiser - Mathematics

Key Words

- *Factor*: Integers that multiply together to get another number
- *HCF*: Highest common factor of two or more numbers
- *Indices:* How many times to use a number in a multiplication
- *Integer*: A whole number
- *LCM*: Lowest common multiple of two or more numbers
- *Multiple*: Found by multiplying any number by a positive integer
- *Operation*: A mathematical process (+, -, x, ÷)
- *Prime Number*: A number with exactly two factors, 1 and itself

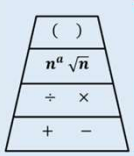
Product of Prime Factors



30 = 2 × 3 × 5 20 = 2 × 2 × 5

Order of Operations

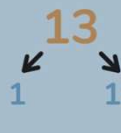
To help us remember the order of operations we use the phrase 'BIDMAS'



B Brackets
I Indices (another name for powers e.g. 3^2)
DM Division and multiplication complete them as they appear from left to right
AS Addition and subtraction complete them as they appear from left to right

Prime Numbers

How do prime numbers work?



13 has **only two factors - itself and 1**. So it is a prime number.

4 has **three factors - itself, 1 and 2**. So it is NOT a prime number.

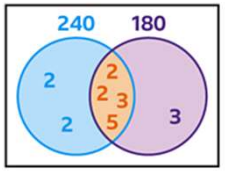
LCMs

LCM of 8, 4 & 6

8, 4, 6

8 → 8, 16, **24**, 32, 40, 48
4 → 4, 8, 12, 16, 20, **24**, 28, 32
6 → 6, 12, 18, **24**, 30, 36

LCM of 240 & 180



LCM of 240 and 180
= 2 × 2 × 3 × 5 × 2 × 2 × 3
= 720

Adding/Subtracting Fractions

$$\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}=\frac{7}{12} \qquad \frac{1}{2}-\frac{1}{5}=\frac{5}{10}-\frac{2}{10}=\frac{3}{10}$$

Multiplying Fractions

STEP 1 STEP 2 STEP 3

$$\frac{3}{4}\times\frac{2}{5}=\frac{3\times2}{4\times5}=\frac{6}{20}$$

Simplify?

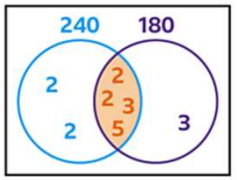
HCFs

HCF of 16 & 24

16 → 1, 2, 4, **8**, 16

24 → 1, 2, 3, 4, 6, **8**, 12, 24

HCF of 240 & 180



HCF of 240 and 180
= 2 × 2 × 3 × 5
= 60

Dividing Fractions

$$\frac{2}{5}\div\frac{2}{3} \rightarrow \frac{2}{5}\times\frac{3}{2}$$

Inequalities

Inequalities compare the size of numbers or expressions.
There are four ways we can compare terms:

< Less than
Example $x < 2$ 'x is less than 2'

> Greater than
Example $x > 2$ 'x is greater than 2'

≤ Less than or equal to
Example $x \leq 2$
'x is less than or equal to 2'

≥ Greater than or equal to
Example $x \geq 2$
'x is greater than or equal to 2'

Dividing Decimals

8.75 ÷ 0.7

×10

$$\frac{8.75}{0.7}=\frac{87.5}{7}$$

×10

$$7\overline{)87.5} = 12.5$$

Product Rule for Counting

To find the total number of outcomes for two or more events, multiply the number of outcomes for each event together.

Unit 2: Algebraic Manipulation - Red indicates higher tier only - Knowledge Organiser - Mathematics

Key Words

- *Binomials* – expressions with two terms (e.g., x + 3)
- *Coefficients* – numbers in front of variables (e.g., the 2 in 2x)
- *Equations* – expressions with equal signs (e.g., x + 3 = 7)
- *Expanding* – to multiply out of brackets
- *Expressions* – mathematical statements
- *Factorising* – to divide expressions into brackets
- *Formulae* – a mathematical rule that uses letters to represent amounts which can be changed (e.g., *b* x *h* for area of a rectangle)
- *Identities* – equations which are always true (e.g., 2 x y = 2y)
- *Inequalities* – expressing terms as unequal to one another, using >, <, ≥, ≤, or ≠
- *Quadratics* – expressions with a square terms as the highest power (e.g., $x^2 - 3x + 1$)
- *Surds* – an expression that includes a square, cube, or other root
- *Terms* – an individual component in an expression (e.g., the x in 2x + 5)
- *Variables* – values which can change, expressed as letters

Collecting Like Terms

$3a$ and $+2a$ are like terms

$+4b$ and $-2b$ are also like terms, but they are different to the terms with the letter a. The plus or minus sign in front of a term belongs to that term.

$$3a + 4b + 2a - 2b = 3a + 2a + 4b - 2b$$
$$= 5a + 2b$$

Expanding Single Brackets

6(x-3) = 6x-18	Use your negative rules
6x(x+5)= $6x^2$+30	Use index laws when multiplying powers
-2 (4+3x) = -8-6x	Take care with signs
y(y^2+9) -3y = y^3+6y	Simplify your answers after you have expanded.

Composite & Inverse Functions

If $h(x) = x^2$ and $f(x) = x - 5$ we can find an expression for $fh(x)$:

$fh(x) = f[h(x)]$

$= f[x^2]$ ← apply the function h first (squaring)

$= x^2 - 5$ ← then apply the function f (subtracting 5)

Example: Find the inverse of $f(x) = 5x + 3$

write the function using a "y" → $5y + 3 = x$ ← set equal to "x"

$5y = x - 3$

$y = \frac{x-3}{5}$ ← rearrange to make y the subject

use f^{-1} notation → $f^{-1} = \frac{x-3}{5}$

Algebraic Notation

$ab = a \times b$

$3y = y + y + y = 3 \times y$

$a^2 = a \times a$ & $a^3 = a \times a \times a$

$a^2b = a \times a \times b$

$a/b = a \div b$

Expanding Double Brackets

$(2x + 2)(x - 6)$

×	$2x$	$+2$
x	$2x^2$	$+2x$
-6	$-12x$	-12

$2x^2 + 2x - 12x - 12$

$2x^2 - 10x - 12$

Index Laws

$x^a \times x^b$	x^{a+b}
$x^a \div x^b$	x^{a-b}
x^{ab}	x^{ab}

Function Machines

input → × 3 → output

input → ÷ 3 → output