Year 8 Knowledge Organisers

Bishop walsh
Catholic School

Spring Term 1

Algebraic Techniques

Unit 6: Brackets, Equations & Inequalities

Unit 7: Indices & Standard Form

Algebraic Techniques...

Unit 6: Brackets, Equations & Inequalities

What do I need to be able to do?

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

- Form Expressions
- Expand and factorise single brackets
- Form and solve equations
- Solve equations with brackets
- Represent inequalities
- Form and solve inequalities

Keywords

Expression: A collection of numbers & letters with no = sign
Equation: Two expressions are equal to each other, using =.
Formula: An equation giving instructions how to calculate a value.
Identity: Two expressions are ALWAYS equal to each other.
Product: Multiply
Highest Common Factor (HCF): the biggest factor of both numbers
Factorise: Put into brackets
Inequality: Like an equation but with a <, ≤, > or ≥ sign. It shows if one expression is greater than, less than or equal to another.

Form expressions

For unknown variables, a letter is normally used in its place

More than – ADD
Less than/ difference – SUBTRACT

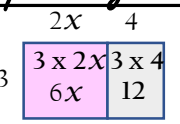
e.g. 4 more than t → t + 4
8 less than k → k - 8

Only like terms can be grouped together

e.g. Find the perimeter of this shape (the distance around the outside of the shape)

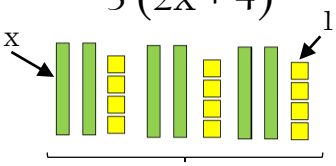
t + 2t + 1 + t + 2t + 1 = 6t + 2

Expand single brackets

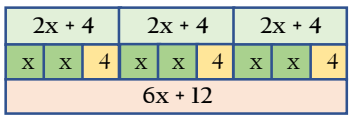


6x + 12

3 (2x + 4)



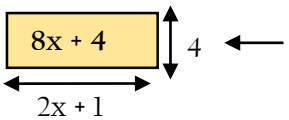
6x + 12



Different representations of 3(2x+4) = 6x + 12

Factorise into a single bracket

8x + 4



This is the **highest common factor**

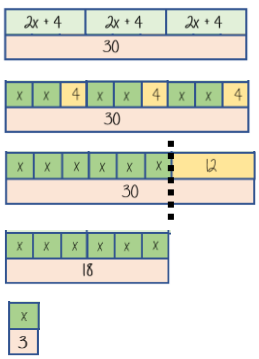
The two values **multiply** together (also the area of the rectangle)

8x + 4 ≡ 4 (2x + 1)

Note: 8x + 4 ≡ 2(4x + 2)
This is not fully factorised as the HCF has not been used

Solve equations with brackets

3 (2x + 4) = 30



3 (2x + 4) = 30

Expand the brackets

6x + 12 = 30

-12 -12

6x = 18

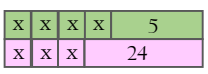
÷ 6 ÷ 6

x = 3

Substitute to check your answer.
2x3+4 = 10
3x10 = 30 ✓

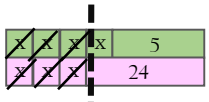
Equations with unknowns on both sides

4x + 5 = 3x + 24



-3x -3x

x + 5 = 24



-5 -5

x = 19

Form and solve simple inequalities

< less than ≤ Less than or equal to
> More than ≥ More than or equal to

e.g. Two more than treble my number is greater than 11

Find the possible range of values

Form x → x3 → +2 → 11

3x + 2 > 11

Solve

3x + 2 > 11
-2 -2
3x > 9
÷3 ÷3
x > 3

Solving inequalities has the same method as equations

Inequalities with unknowns on both sides

5 (x + 4) < 3 (x + 2)

Expand the brackets

5x + 20 < 3x + 6

-3x -3x

2x + 20 < 6

-20 -20

2x < - 14

÷2 ÷2

x < - 7

Algebraic Techniques…

Unit 7: Indices & Standard Form

What do I need to be able to do?

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

- Add/ Subtract expressions with indices
- Multiply expressions with indices
- Divide expressions with indices
- Know the addition law for indices
- Know the subtraction law for indices

Keywords

Integer: Whole number
Base: The number that gets raised to a power
Index: Power (The plural of index is indices)
Coefficient: The number used to multiply by a variable
Product: Multiply
Standard Form: A number written in the form A x 10^n where A is between 1 and 10 and n is an integer.

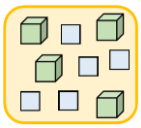
Addition/ Subtraction with indices

Coefficient Power

$5x^2 + 4x^4$

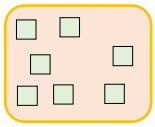
Term Term

Expression



Each square represents x^2 and each cube represents x^4

Only similar terms (like terms) can be simplified
If they have different powers, they are unlike terms

$5x^2 + 2x^2$ →  → $7x^2$

Multiply expressions with indices

$4b \times 3a$
$\equiv 4 \times b \times 3 \times a$
$\equiv 4 \times 3 \times b \times a$
$\equiv 12ab$

$5t^2 \times 9t$
$\equiv 5 \times t \times t \times 9 \times t$
$\equiv 5 \times 9 \times t \times t \times t$
$\equiv 45t^3$

Addition law for indices

$$x^a \times x^b = x^{a+b}$$

If the base number or letter is the same you can ADD the powers

$3^5 \times 3^2 \rightarrow 1.3 \times 10^{-1} 3^7$

$a^7 \times a^3 \rightarrow a^{10}$

$5a^3b^2 \times 3a\,b^4 \rightarrow 15a^4b^6$ Multiply the numbers, add the powers

Standard Form

Any number between 1 and less than 10 → A x 10^n ← Any integer

Non-examples

0.8×10^4

$5.3 \times 10^{0.7}$

Examples

7×10^3	$= 7 \times 10 \times 10 \times 10$	$= 7000$
3.2×10^4	$= 3.2 \times 10 \times 10 \times 10 \times 10$	$= 32000$
6×10^{-3}	$= 6 \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}$	$= 0.006$
5.4×10^{-2}	$= 5.4 \times \frac{1}{10} \times \frac{1}{10}$	$= 0.054$

The power tells you how many times to multiply (for positive powers) or divide (for negative powers) by 10.

A negative power does not mean a negative answer – it means a number closer to 0.

Divide expressions with indices

$\frac{24}{36} \rightarrow \frac{2 \times 2 \times 2 \times 3}{2 \times 3 \times 2 \times 3} \rightarrow \frac{2}{3}$

Cancel the factors

$\frac{5a^3b^2}{15ab^5} \rightarrow \frac{5 \times a \times a \times a \times b \times b}{3 \times 5 \times a \times b \times b \times b \times b \times b} \rightarrow \frac{a^2}{3b^3}$

Subtraction law for indices

$$x^a \div x^b = x^{a-b}$$

$3^5 \div 3^2 \rightarrow 3^3$

$a^7 \div a^3 \rightarrow a^4$

$\frac{50a^7b^5}{10a^2b^3} \rightarrow 5a^5b^2$ Divide the numbers, subtract the powers

Order numbers in standard form

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	3.3	0.13

Look at the power first will the number be = › or ‹ than 1

Use a place value grid to compare the numbers for ordering