Year 8 Spring 1 Knowledge Organiser

HARROW HIGH MATHEMATICS

Unit 5: Sequences

Number grids

Using a number grid, we can describe different sequences. This grid has six columns and one of the columns contains the **multiples** of six.

1	2	3	4	5	**6**
7	8	9	10	11	**12**
13	14	15	16	17	**18**
19	20	21	22	23	**24**
25	26	27	28	29	**30**

This grid uses **tracking calculations** to show a rule between the row number and value in the cell.

Row 1	1	2	3	$6 \times 1 - 2$	5	6×1
Row 2	7	8	9	$6 \times 2 - 2$	11	6×2
Row 3	13	14	15	$6 \times 3 - 2$	17	6×3
Row 4	19	20	21	…	23	…

A **'linear' or 'arithmetic' sequence** is any sequence where the **difference** between the **terms** is constant.

E.g. 9, 15, 21, 27, 33, …
+3 +3 +3 +3 …

The columns in number grids are examples of linear sequences.

Some sequences decrease. As long as they decrease by a constant amount they are still linear sequences.
E.g.: 5, 2, -1, -4, -7 …

Describing sequences

A sequence is made up of **terms.** The first term is said to be in the first '**position**'.

A **position-to-term rule** uses the position to help us work out any **term** in a linear sequence.

A term-to-term rules can describe how we move from one term of a sequence to the next.

Position	1	2	3	4	n
Tracking calculation	$6 \times 1 + 3$	$6 \times 2 + 3$	$6 \times 3 + 3$	$6 \times 4 + 3$	$6 \times n + 3$
Term	**9**	**15**	**21**	**27**	$\mathbf{6n + 3}$
Term to term:	+6	+6	+6	+6	+6

Not all sequences are arithmetic sequences.
Here are some examples:

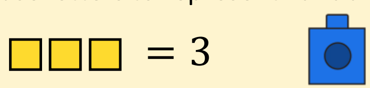
Sequence	1, 4, 9, …	2, 4, 8, 16 …	1, 3, 6, 10 …
Position to term rule	n^2	2^n	$\frac{1}{2}n(n+1)$
Term to term rule	$+(2n-1)$	$\times 2$	$+n$

Unit 6: Forming and solving equations

Expressions

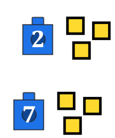
A **constant** is a number whose value is always the same.

A **variable** is a number whose value can change.
We use letters to represent variables.


$= 3$ $= n$

An **expression** is a way of writing a single number using algebra.
The value of the expression is **dependent** on the value of the **variable**.

For example:
When $n = 2$ then $n + 3 = 5$
When $n = 7$ then $n + 3 = 10$

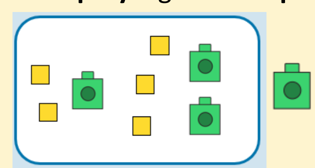


$= 5$
$= 10$

When using variables or brackets we don't always use the '×' symbol.

$2 \times n + 3 = 2n + 3$
$2(1 + a) = 2 \times (1 + a)$

We can **collect** together **like terms** of variables and constants in order to **simplify** algebraic **expressions**.


$= a$

$2 + a + 3 + 2a = 3a + 5$

Mathematics Mastery

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Unit 6: Forming and solving equations

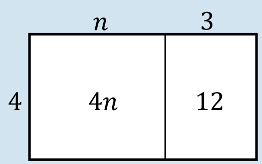
Equations and identities

- Two expressions are **equal** if they have the same **value.**
- We use the equals sign = to write an **equation**.
- Equations can be true or false.

The **value** of "2 + 3" is 5
So we can write $2 + 3 = 5$

$1 + 2 = 6 - 3$ **True**
$2 + 3 = 5 + 5$ **False**

Equations are only true for certain values.
Identities are true for all values and have different notation.



$4(n + 3) \equiv 4n + 12$

This symbol means 'identical to.' It means the expressions are **always** equal.

Bar models are good representations for **equations**. The bars represent **expressions**, and the numbers below show what the **expressions** have been **equated** to.

$3g = 12$ $2g + r = 16$

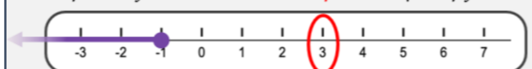
Unit 7: Forming and solving inequalities

Inequalities

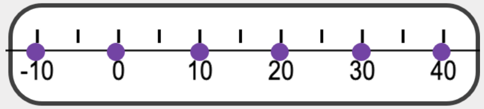
- When two expressions may not be equal, we can write an **inequality.**
- We use the inequality symbols <, >, ≤ and ≥ to write an inequality. These are the same ones we use to compare numbers.
- Like equations, inequalities can be true or false.

It is **TRUE** that $3 < 5$.
We say that "$x = 3$ satisfies the inequality $x < 5$".

It is **FALSE** that $3 < -1$.
We say that "$y = 3$ does not satisfy the inequality $y \leq -1$".

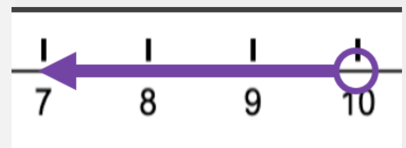


We can represent sets of numbers on number lines.



This number line represents the 'multiples of 12.' Each multiple is represented by a purple dot.

We can use this number line to represent the numbers less than 10.



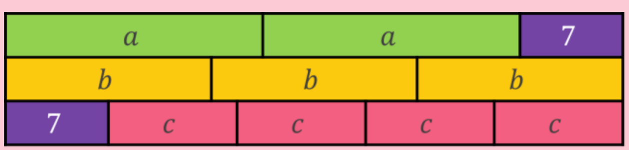
10 itself is not filled in with a circle because 10 is not less than 10.
This is the inequality $n < 10$.

We can use existing inequalities to find new related ones.

Solving an inequality means finding the range of values that satisfy the inequality.

Inequalities with two variables

Just like equations, inequalities can relate two or more variables together.



Unlike equations, multiplying both sides by a number less than 0 does not lead to a true related inequality.

$a < b$ does **not** mean $-a < -b$
If $a < b$ then $-a > -b$

Inequality	Divide both sides by:	New Inequality	Is new inequality true or false?
$4 < 8$	4	$1 < 2$	true
$12 \geq -15$	3	$4 \geq -5$	true
$-16 \leq 12$	−4	$4 \leq -3$	false
$15 > 5$	−5	$-3 > -1$	false

Mathematics Mastery

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Week 1 – Introduction to sequences (clips 33, 198, 264, 261)

Quiz 1	Quiz 2
Quiz 3	Quiz 4

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Week 2 – Further sequences (clips 196, 197, 263, 247)

Quiz 1	Quiz 2
Quiz 3	Quiz 4

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Week 3 – Expressions and equations (clip xxxx)

Quiz 1	**Quiz 2**
Quiz 3	**Quiz 4**

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Week 4 – Forming and solving equations (clip xxxx)

Quiz 1	**Quiz 2**
Quiz 3	**Quiz 4**

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Week 5 – Solutions to inequalities (clip xxxx)

Quiz 1	Quiz 2
Quiz 3	Quiz 4

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Week 6 – Forming and solving inequalities (clip xxxx)

Quiz 1	Quiz 2
Quiz 3	**Quiz 4**