Year 10 Summer 1 Knowledge Organiser

HARROW HIGH MATHEMATICS

Unit 28: Sequences

Finding the next term - numbers

When you need to find the next term in the sequence you need to work out what the general rule for the sequence is.

The rule is add 4 because the difference between each number is 4.

1, 5, 9, 13, …. 17

+4 +4 +4

17 is the next number because 13 + 4 = 17.

The rule is subtract 7 because the difference between each number is 7.

14, 7, 0, -7, …. -14

-7 -7 -7

-14 is the next number because -7 – 7 = -14.

Finding the nth term

The nth term is the general rule for a sequence. We can use the nth term to then calculate any term in the sequence.

Here is a sequence: 5, 8, 11, 14, ...

Find the difference between the numbers.

5, 8, 11, 14

+3 +3 +3 = 3n

This means that the nth term starts with 3n and we need to look at the 3 times table.

Remember to calculate how we get from the times table to the original sequence.

3, 6, 9, 12, ...

+ 2

5, 8, 11, 14, ...

The nth term is 3n + 2.

Key Terms:

Term: Each value in a sequence is called a term.

Rule: The value that a sequence increases or decreases by.

Sequence: A number or picture pattern with a specific rule.

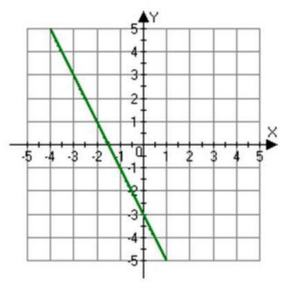
Linear sequence: A sequence that increases or decreases by the same number between each term.

Unit 27: Straight Line Graphs

Straight line graph.

The general equation of a linear graph is y = mx +c where m is the gradient and c is the y intercept.

The equation of a linear graph can contain an x-term, a y-term and a number.



Other examples:

$x = y$

$y = 4$

$x = -2$

$y = 2x - 7$

$y + x = 10$

$2y - 4x = 12$

Key Words

Intercept: Where two graphs cross.

Gradient: This describes the steepness of the line.

y-intercept: Where the graph crosses the y-axis.

Linear: A linear graph is a straight line.

Quadratic: A quadratic graph is curved, u or n shape.

Tip

Parallel lines have the same gradient.

Table of values

In a table of values, the value of *y depends* on the value of *x*. That means that we choose the values for *x* and substitute them into the equation to get the corresponding value for *y*.

The table provides a list of a coordinates the line passes through.

$y = 2x + 5$

To get y double x and add 5

x	–3	–2	–1	0	1	2	3
y	–1	1	3	5	7	9	11
	(–3, –1)	(–2, 1)	(–1, 3)	(0, 5)	(1, 7)	(2, 9)	(3, 11)

Gradient of Straight Lines

The gradient of a line is how steep it is.

Gradient $= \frac{\text{Change in } y}{\text{Change in } x}$

The gradient can be positive (sloping upwards) or negative (sloping downwards)

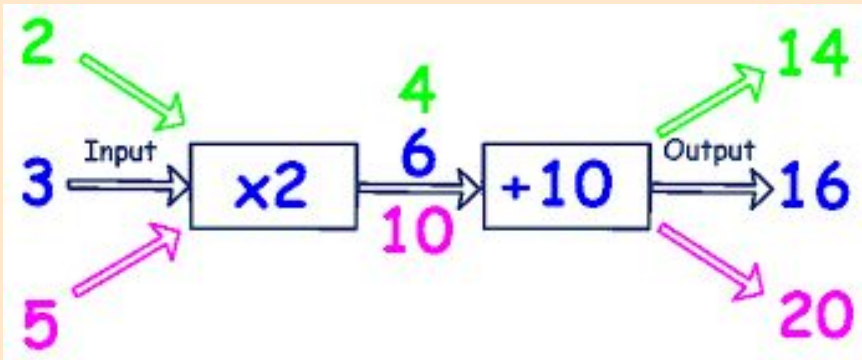
Mathematics Mastery

Year 10 Summer 1 Knowledge Organiser

HARROW HIGH MATHEMATICS

Unit 29: Functions

A function is a relationship between two sets of numbers. We can use function machines to demonstrate the ideas behind Functions. The numbers that go into function machine are called the input. The numbers that come out are called the output.



Composite Functions

You can combine two functions, e.g. f(x) and g(x), such that the output of f(x) becomes the input for g(x).
This is called a composite function.
Composite functions are written fg(x), which means 'do g first, then do f' — you always do the function closest to x first.

EXAMPLE: If $f(x) = 2x - 10$ and $g(x) = -\frac{x}{2}$, find: a) $fg(x)$ and b) $gf(x)$.

a) $fg(x) = f(g(x)) = f(-\frac{x}{2}) = 2(-\frac{x}{2}) - 10 = -x - 10$

b) $gf(x) = g(f(x)) = g(2x - 10) = -\left(\frac{2x - 10}{2}\right) = -(x - 5) = 5 - x$

Inverse Functions

The inverse of a function f(x) is another function, $f^{-1}(x)$, which reverses f(x). The inverse function has the opposite effect and turns all outputs back in to their outputs. You can find an inverse function by x = f(y) and rearranging to find "y = ____"

EXAMPLE: If $f(x) = \frac{12 + x}{3}$, find $f^{-1}(x)$.

1) Write out $x = f(y)$: $x = \frac{12 + y}{3}$

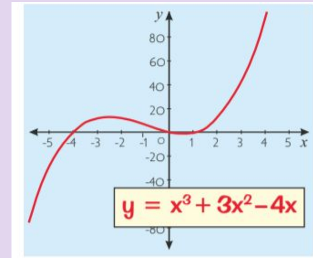
2) Rearrange to make y the subject: $3x = 12 + y$
$y = 3x - 12$

3) Replace y with $f^{-1}(x)$: $f^{-1}(x) = 3x - 12$

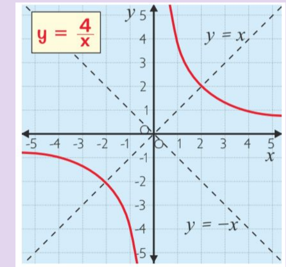
So here you just rewrite the function replacing f(x) with x and x with y.

Unit 30: Non-Linear Graphs

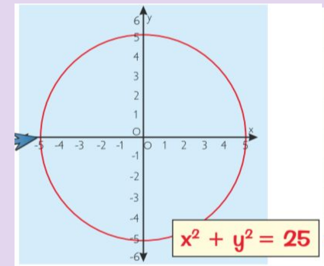
When plotting a relationship between y-ordinates and x-ordinates, patterns appear from the different types of functions we may be given.



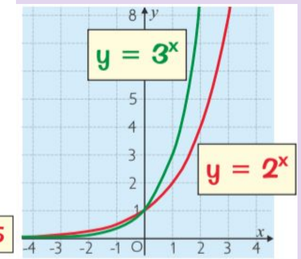
Cubic Graphs



Reciprocal Graphs



Circle Graphs



Exponential Graphs

Unit 31: Transforming Graphs

Transforming the input or output of a given function, or a given plot of a function has a visible effect on the graph. These such translations/reflections can be used to understand why completing the square of a quadratic helps locate the turning point.

	Visual effect on the graph	Effect on co-ordinates
f(x) + a	Translation of ***a*** units upwards	(x , y) □ (x , y + a)
f(x + a)	Translation of ***a*** units to the left	(x , y) □ (x - a , y)
-f(x)	Reflection in the x-axis	(x , y) □ (x , -y)
f(-x)	Reflection in the y-axis	(x , y) □ (-x , y)

Mathematics Mastery