Title : Functions

Key Knowledge/Prior Learning KS2/3 and Retrieval and Suggested Starters

- Solving Equations
- Substitution
- Changing the subject
- Changing the subject where variable appears twice

KS4 National Curriculum – what students will be practicing

- Substituting into functions
- Combining functions (composite functions)
- Inverse Functions
- Problem solving with functions

Specific Ambitious Knowledge

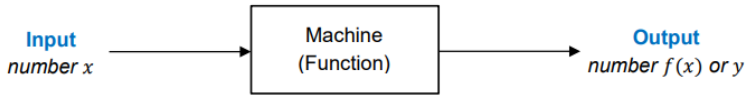
A lot of functions mainly relies on substitution
Composite functions means substituting one function into another
Inverse functions relies on changing the subject

Key Vocabulary/Literacy Opportunities

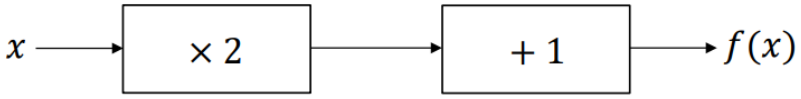
- Function
- Notation f(x), g(x)
- Inverse function
- Subject
- Compound function

Key Formulae/Knowledge

A **function** can be thought of as a machine that takes in a number, performs operations on it and outputs a different number.



Functions are written in the form $f(x)$ which means 'function with an input number x'. A function $f(x)$ is typically written in algebra, for example $f(x) = 2x + 1$. We must be careful to apply the order of operations correctly. To do this, we use **BIDMAS** (Brackets, Indices, Division, Multiplication, Addition, Subtraction).



We could be asked to **replace** x with a specific number to evaluate a function at a certain value.

Lots of **functions** have **inverse functions**. These do the opposite of what a **function** does to a number x. They are written in the form $f^{-1}(x)$.

A common exam question is to find the **inverse function** of a **function**. The following example demonstrates the method required to do that.

We may even be asked to find the value of a **composite function** when x has a specific value. To do this, it is helpful to first write the **composite function** algebraically before then **substituting** in a value of x.

Maths in Context (Historical, Real Life and Student Thinking Points)

- The concept of function was brought to light by mathematicians in the 17th century. In 1637, a mathematician and the first modern philosopher, Rene Descartes, talked about many mathematical relationships in his book *Geometry*. *Still, the* term "function" was officially first used by German mathematician Gottfried Wilhelm Leibniz after about fifty years. He invented a notation y = x to denote a function, dy/dx, to denote a function's derivative. The notation y = f (x) was introduced by a Swiss mathematician Leonhard Euler in 1734.

René Descartes (1596 – 1650) was a French mathematician and philosopher, and one of the key figures in the Scientific Revolution. He refused to accept the authority of previous philosophers, and one of his best-known quotes is "I think, therefore I am".

Descartes is the father of *analytical geometry*, which allows us to describe geometric shapes using algebra. This was one of the prerequisites, which allowed Newton and Leibnitz to invent *calculus* a few decades later.

He is credited with the first use of superscripts for powers or exponents, and the *cartesian coordinate system* is named after him.

Gottfried Wilhelm Leibniz (1646 – 1716) was a German mathematician and philosopher. Among many other achievements, he was one of the inventors of calculus, and created some of the first mechanical calculators.

Leibniz believed that our universe is the "best possible universe" that God could have created, while allowing us to have a free will. He was a great advocate of *rationalism*, and also made contributions to physics, medicine, linguistics, law, history, and many other subjects.

Leonhard Euler (1707 – 1783) was one the greatest mathematicians in history. His work spans all areas of mathematics, and he wrote 80 volumes of research.

Euler was born in Switzerland and studied in Basel, but lived most of his life in Berlin, Prussia, and St. Petersburg, Russia.

Euler invented much of the modern mathematical terminology and notation, and made important discoveries in calculus, analysis, graph theory, physics, astronomy, and many other topics.

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Projects/Enrichment/Investigations
• https://donsteward.blogspot.com/2009/03/periodicity.html •