Edexcel AS and A Level Modular Mathematics
Core 3

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1 Algebraic Fractions

2 Functions

2.1 Function Definition

A function is a mapping such that every element of set A is mapped to exactly one element of set B.
The mapping set is considered to be the domain of the function, and the mapped set is considered to be the range.

Consider the set, A, $\{1, 2, 3, 4, 5\}$ being mapped to set B, $\{1, 4, 16, 25\}$ through the operation of *square*. Set A is the domain and set B is the range.

The function can be defined by:

$$f(x) = x^2,\ \{1 \leq x \leq 5\} \qquad\qquad f : x \to x^2,\ \{1 \leq x \leq 5\}$$

It's range is subsequently defined by

$$1 \leq f(x) \leq 25$$

Consider the function $f : x \to \sqrt{x}$. It can only be considered a function if it's domain is greater than zero. Else it would have values less than zero that are not mapped anywhere as they do not have a real solution.

$$f : x \to \sqrt{x},\ \{x \in \mathbb{R}, x \geq 0\}$$

2.2 Composite Functions

Multiple functions can be combined to make a composite function.

$$\begin{array}{rcl} fg(x) & \Rightarrow & f(g(x)) \\ gf(x) & \Rightarrow & g(f(x)) \\ f^2(x) & \Rightarrow & f(f(x)) \end{array}$$

2.3 Inverse Functions

The inverse function performs the opposite operation in reverse order to get the original input of the function. When graphed, the inverse function is a reflection of the original function in the line $y = x$

An inverse function is noted by $f^{-1}(x)$

$$\begin{array}{rcl} f(x) = x^2 & \Rightarrow & f^{-1}(x) = \sqrt{x} \\ f(x) = 5x + 2 & \Rightarrow & f^{-1}(x) = \dfrac{x-2}{5} \\ f(x) = 2x^2 - 9 & \Rightarrow & f^{-1}(x) = \sqrt{\dfrac{x+9}{2}} \end{array}$$

3 Exponentials and Logarithmic Functions

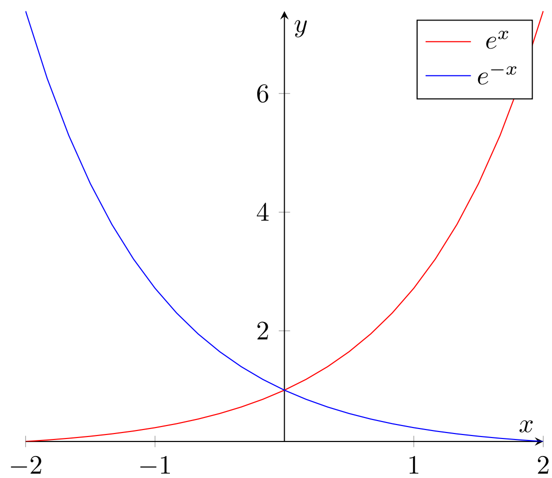
Exponential functions are in the form $y = a^x$ and categories any functions containing exponents.

3.1 The Exponential Function

The exponential function is $y = e^x$, $e \approx 2.718$. At any point, the function is equal to it's gradient, and is therefore refereed to as **the** exponential function. It is used to represent exponential growth, which is how population growth is modeled

$$\frac{d[e^x]}{dy} = e^x$$

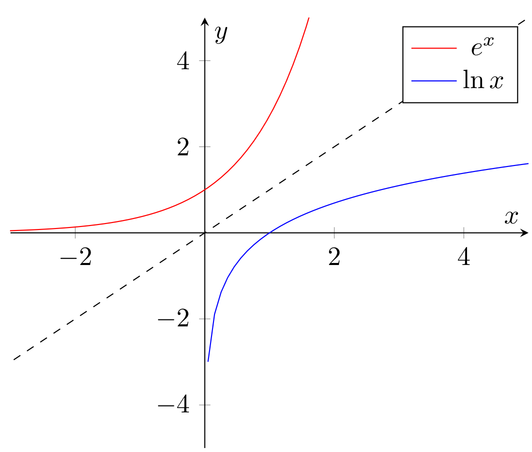
3.2 Graphing Exponential Functions



3.3 The Inverse of the Exponential Function

To understand the inverse of the exponential function, it is necessary to read section 2.3.

The inverse of e^x is $\log_e x$. A log with base e is referred to as the *natural log*, $\ln x$.



4 Numerical Methods

4.1 Finding Approximations Graphically

4.2 Finding Approximations Iteratively and Algebraically

5 Transforming Graphs of Functions

5.1 Sketching the Modulus Function

5.2 Solving Equations Involving Modulus

5.3 Applying Combinations of Transformations

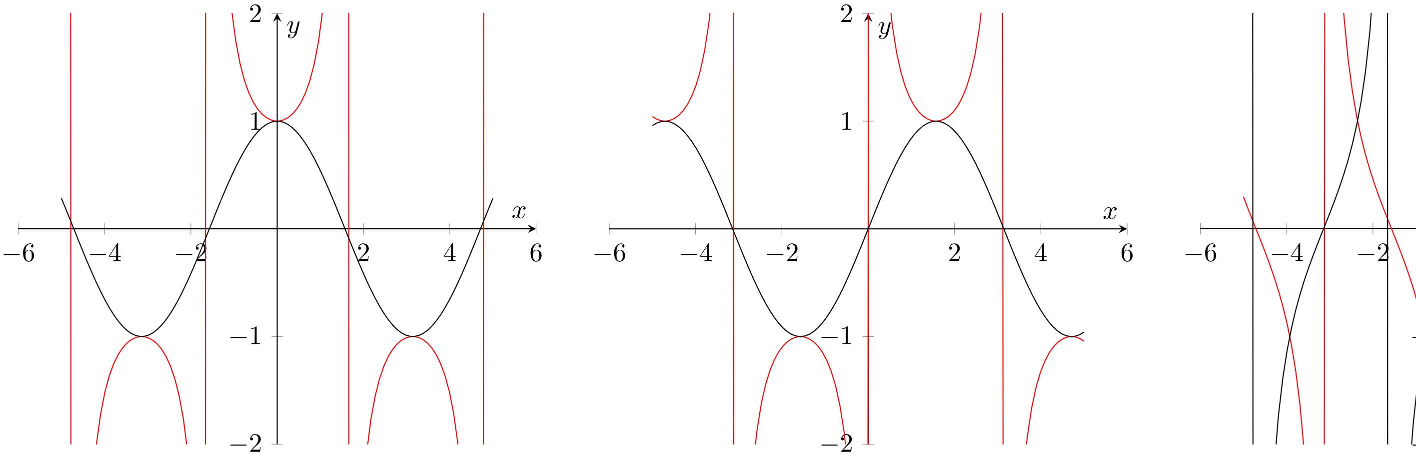
6 Trigonometry

6.1 Introduction of Secant, Co-secant and Cotangent Functions

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$



6.2 Proving Identities

7 Further Trigonometric Identities

7.1 Addition Trigonometrical Formulae

7.2 Double Angle Trigonometrical Formulae

7.3 Expressing $a \cos\theta + b \sin\theta$ In a Single Trigonometric Function

7.4 The Factor Fomulae

8 Differentiation

8.1 Differentiating Using The Chain Rule

8.2 Differentiating Using The Product Rule

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8.5 Differentiating The Logarithmic Function

8.6 Differentiating The Trigonometric and Further Trigonometric Functions

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