

## Special Functions

### Aim

To introduce some special functions (often referred to as standard functions) and show how to differentiate them.

### Learning Outcomes

At the end of this section you will be able to:

- Find the derivative of a special function in your log tables,
- Differentiate the special functions.

This section will show how to differentiate *special functions*. Examples of special functions are  $\ln x$ ,  $e^x$ ,  $\sin x$  and  $\cos x$ . These functions are considered special because they are not covered by the previous rules of differentiation. The results achieved from differentiating these functions shall be presented here and can be used directly as these results are given to you already in your log tables (pg 41 and 42).

### Logarithmic and Exponential Functions

These results are given on page 41 of your log tables. The letter  $a$  is used in the following to represent a constant.

The function $f(x)$	The derivative $\frac{df}{dx}$
$\ln x$	$\frac{1}{x}$
$e^x$	$e^x$
$e^{ax}$	$ae^{ax}$
$a^x$	$a^x \ln a$
$\log_a x$	$\frac{1}{x \ln a}$

## Trigonometric Functions

These results are also presented in your log tables on page 41. The function  $\csc$  represents the cosecant and can also be represented by  $\operatorname{cosec}$ .

The function $f(x)$	The derivative $\frac{df}{dx}$
$\cos x$	$-\sin x$
$\sin x$	$\cos x$
$\tan x$	$\sec^2 x$
$\sec x$	$\sec x \tan x$
$\csc x$	$-\csc x \cot x$
$\cot x$	$-\csc^2 x$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$

## Related Reading

Stroud, K.A. 2001. *Engineering Mathematics*. 5<sup>th</sup> Edition. PALGRAVE.

Morris, O.D., P. Cooke. 1992. *Text & Tests 4*. The Celtic Press.