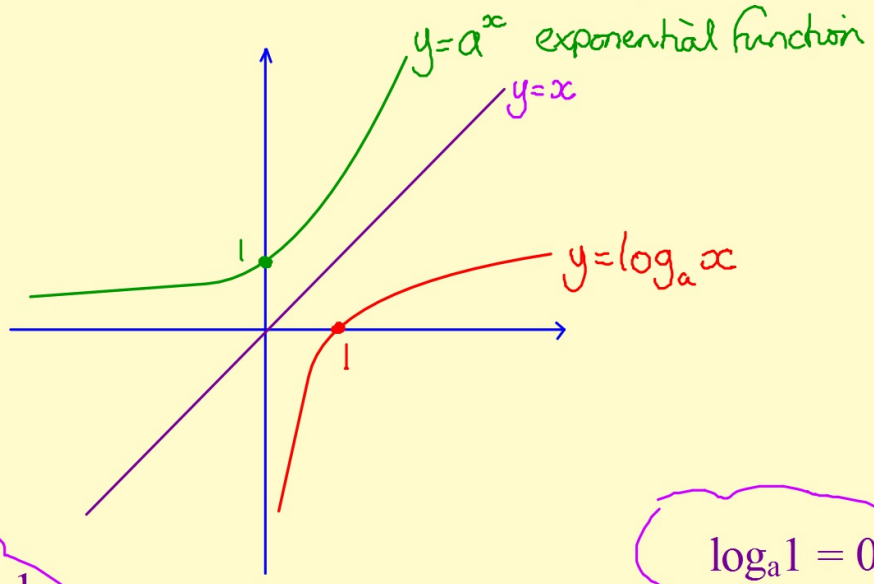
# Logarithmic & Exponential Functions

What you should already know:

The logarithmic function is the inverse of the exponential function.




$\log_a a = 1$
$\log_3 3^1 = 1$

$\log_a 1 = 0$
$\log_3 1 = 0$

Rules of Indices:

$a^0 = 1$ $\quad a^m \times a^n = a^{m+n}$ $\quad \frac{a^m}{a^n} = a^{m-n}$

$a^1 = a$ $\quad (a^p)^q = a^{pq}$

$a^{-1} = \frac{1}{a}$ $\quad a^{\frac{1}{2}} = \sqrt{a}$

$\sqrt{a} \times \sqrt{a} = a^{\frac{1}{2}} \times a^{\frac{1}{2}} = a^{\frac{1}{2}+\frac{1}{2}} = a^1 = a$

$a^{m/n} = \sqrt[n]{a^m}$ $\quad a^{-m/n} = \frac{1}{a^{m/n}} = \frac{1}{\sqrt[n]{a^m}}$

Textbook
Page 6
Ex1B

# Converting Between Log and Exponential

$y = a^x$ $\quad \log_a y = \log_a a^x = x$

$9 = 3^x$ $\quad \log_3 9 = \log_3 3^2 = 2$

$16 = 2^x$ $\quad \log_2 16 = \log_2 2^4 = 4$

$32 = 2^x$ $\quad \log_2 32 = \log_2 2^5 = 5$

$81 = 3^4$ $\quad \log_a 81 = \log_a 3^4 = 4$

$a = 3$

Find the missing values:

$5 = \log_{10} a$ $\quad 10^5 = a = 100000$

$3 = \log_2 a$ $\quad 2^3 = a = 8$

# Rules for Logarithms

$a^0 = 1$ then $\log_a 1 = 0$

$a^1 = a$ then $\log_a a^1 = 1$

$$\log_a x + \log_a y = \log_a (xy)$$

$$\log_a x - \log_a y = \log_a \left(\frac{x}{y}\right)$$

$$\log_a x^n = n \log_a x$$

Textbook
Page 9
Ex1C

## Exercise 1c

**1** **a** $3\log_7 3$
**b** 2
**c** 1
**d** 2
**e** 2
**f** 0
**g** 2
**h** 0

**2** **a** 1
**b** −2
**c** 3
**d** 0
**e** 1

**3** **a** 5
**b** 3
**c** −1
**d** 3
**e** 1
**f** 2
**g** −5
**h** −1
**i** 3
**j** $\frac{3}{2}$
**k** $11\frac{1}{2}$