3.2 Definition of a Logarithm

The inverse of an exponential function is called a LOGARITHMIC function.

$p = q^r$	$\log_q p = r$

Using the calculator, evaluate:

Log 10 000	Log 10	Log 0.01
Log 1 000	Log 1	Log 0.001
Log 100	Log 0.1	Log 0.0001

A logarithm without a base written is called a "common logarithm" and it's base is 10, i.e.

$\log 100 = \log_{10} 100 =$

Convert from exponential form to logarithmic form:

$10000 = 10^4$ $\log_{10}(10{,}000) = 4$	$243 = 3^5$ $\log_3(243) = 5$
$\left(\frac{1}{8}\right) = 2^{-3}$ $\log_2\left(\frac{1}{8}\right) = -3$	$y = x^n$ $\log_x(y) = n$

Change from logarithmic form to exponential form:

$\log_2 16 = 4$ $2^4 = 16$	$\log_5 125 = 3$ $5^3 = 125$
$\log_{\frac{1}{2}}\left(\frac{1}{8}\right) = 3$ $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$	$\log_{\frac{1}{3}} 27 = -3$ $\left(\frac{1}{3}\right)^{-3} = 27$
$\log_p q = r$	

Evaluate the following logarithms: (NO CALCULATOR!)

$\log_2 64$ $2^x = 64$ $x = 6$	$\log_5 625$ $5^x = 625$ $x = 4$
$\log_3 243$ $3^x = 243$ $x = 5$	$\log_{81} 9$ $81^x = 9$ $x = \frac{1}{2}$
$\log_{\frac{1}{2}} 8$ $\left(\frac{1}{2}\right)^x = 8$ $x = -3$	$\log_{\frac{2}{3}}\left(\frac{9}{4}\right)$ $\left(\frac{2}{3}\right)^x = \frac{9}{4}$ $x = -2$
$\log_{243} 3$ $243^x = 3$ $x = \frac{1}{5}$	$\log_a a^7$ $a^x = a^7$ $x = 7$

Estimate the following logarithms:

$\log 20$ more than 1 way less than 2	$\log_2 9$ little more than 3
$\log_3 30$ little more than 3	$\log 0.23$ negative a bit.
$\log_7 42$ less than 2	$\log_2\left(\frac{1}{10}\right)$ less than -3