chapter

7   Algebra 3

Section 7.9 Logarithmic function

PROJECT MATHS
Text & Tests 6

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Example 1

Evaluate   (i) $\log_9 27$ (ii) $\log_{\frac{1}{3}} 9$ (iii) $\log_{\sqrt{2}} 8$.

The **logarithm** of a number is the **power** to which the base number must be raised to get that number.

$a^x = y$ is equivalent to $\log_a y = x$

$9^? = 27$

$\left(\frac{1}{3}\right)^? = 9$

$\left(\sqrt{2}\right)^? = 8$

(i) $\log_9 27 = \frac{3}{2}$

(ii) $\log_{\frac{1}{3}} 9 = -2$

(iii) $\log_{\sqrt{2}} 8 = 6$

RULES

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

$$\log_e x = \ln x \qquad \text{NATURAL LOG}$$

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① $\log a + \log b = \log ab$

② $\log a - \log b = \log \dfrac{a}{b}$

③ $\log a^n = n \log a$

NOTE: $\log 0$ is ERROR AND $\log 1 = 0$

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1. The laws of logarithms

Example 2

Without using a calculator, simplify the following number:

$$2\log_{10}3 + \log_{10}16 - 2\log_{10}\left(\frac{6}{5}\right)$$

POWER/MULTIPLYING RULE

$2\log 3 = \log 3^2$

$2\log\left(\frac{6}{5}\right) = \log\left(\frac{6}{5}\right)^2$

ADDITION & SUBTRACTION RULES

$10^? = 100$

$\log 3^2 + \log 16 - \log\left(\frac{6}{5}\right)^2$

$= \log 9 + \log 16 - \log\left(\frac{36}{25}\right)$

$= \log(9)(16) - \log\left(\frac{36}{25}\right)$

$= \log(144) - \log(36/25)$

$= \log \dfrac{144}{\left(\frac{36}{25}\right)}$

$= \log \left(\overset{4}{\cancel{144}}\right)\left(\frac{25}{\underset{1}{\cancel{36}}}\right)$

$= \log_{10} 100$

$= 2$