Example 4

Evaluate the following number correct to two significant figures:

$\log_8 11 - \log_6 4$

use calculator

$\log_8 11 - \log_6 4 = 0.37943825$

≈ 0.38 (2 s.f.)

2. Solving logarithmic equations

Example 5

Solve the equation $2\log_3 x - \log_3(18 - x) = 1$.

$2\log_3 x - \log_3(18-x) = 1$

$\log_3 x^2 - \log_3(18-x) = 1$

$\log_3 x^2 - \log_3(18-x) = \log_3 3$

$\log_3\left[\frac{x^2}{18-x}\right] = \log_3 3$

$\Rightarrow \frac{x^2}{18-x} = 3$

$x^2 = 3(18-x)$

$x^2 = 54 - 3x$

$x^2 + 3x - 54 = 0$

$(x - 6)(x + 9) = 0$

$x = 6$ ✓, $x = -9$ ✗

$n\log a = \log a^n$

Consider

$1 = \log_3 3$

$x^n = y \Leftrightarrow n = \log_x y$

check :

$2\log_3 6 - \log_3(18-6) = 1$

$2\log_3(-9) - \log_3(18-(-9)) =$ Error

Solve the following log equations:

27. $\log_{10}(17 - 3x) + \log_{10} x = 1$ **28.** $\log_{10}(x^2 - 4x - 11) = 0.$

① use rules of logs to create equation
log [something] = log [something]

$\log a + \log b = \log ab$

$\log_{10} 10 = 1$

② Solve quadratic

$\log_{10}(17-3x) + \log_{10} x = 1$

$\log[(17-3x)(x)] = \log 10$

$\Rightarrow \quad 17x - 3x^2 = 10$

$3x^2 - 17x + 10 = 0$

$(3x - 2)(x - 5) = 0$

$x = 2/3, \quad x = 5$

29. Given that $2\log_2 x = y$ and $\log_2(2x) = y + 4$, find the value of x.

we wish to create equation:
log [something] = log [something]
using rules of logs

$4 = \log_2 16$

$2^4 = 16$

Solve equation

$\log_2(2x) = \underbrace{2\log_2 x}_{y} + 4$

$\log_2(2x) = \log_2 x^2 + \log_2 16$

$\log_2(2x) = \log_2((x^2)(16))$

$\Rightarrow \quad 2x = 16x^2$ (CAREFUL 2 SOLNS!)

$16x^2 - 2x = 0$

$8x^2 - x = 0$

$x(8x-1) = 0$

$x = 0$ ✗, $8x - 1 = 0$, $x = 1/8$ ✓

check: $\log_2(2(0)) \neq 2\log_2 2 + 4$ ✗