51. (a) Given that $x > 0$, show that

$$\log_a x^n = n \log_a x.$$ [3]

(b) Express $\frac{1}{2} \log_a 324 \div \log_a 56 - 2\log_a 12$ in the form $\log_a b$, where b is a constant whose value is to be found. [4]

(c) (i) Rewrite the equation

$$3^x = 2^{x+1}$$

in the form

$$c^x = d,$$

where the values of the constants c and d are to be found.

(ii) Hence or otherwise, solve the equation

$$3^x = 2^{x+1},$$

giving your answer correct to two decimal places. [4]

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52. (a) Given that $x > 0$, show that

$$\log_a x^n = n \log_a x.$$ [3]

(b) Solve the equation

$$6^{2y-1} = 4.$$

Show your working and give your answer correct to three decimal places. [3]

(c) Given that $\log_a 4 = \frac{1}{2}$, find the value of a. [2]

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53. Find all values of x satisfying the equation

$$\log_a(6x^2 + 11) - \log_a x = 2\log_a 5.$$ [5]

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(a) Given that $x > 0$, $y > 0$, show that

$$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y.$$ [3]

(b) Express

$$\frac{1}{2}\log_a x^8 - \log_a 4x \div 3\log_a \frac{2}{x}$$

as a single logarithm in its simplest form. [4]

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