1 **(a)** Use the substitution $u = 5^x$ to solve the equation $5^{x+1} = 8 + 4(5^{-x})$. [5]

(b) Given that $\log(p - q) = \log p - \log q$, express p in terms of q. [3]

2 **(i)** Express $\frac{1}{\sqrt{32}}$ as a power of 2. [1]

(ii) Express $(64)^{\frac{1}{x}}$ as a power of 2. [1]

(iii) Hence solve the equation $\frac{(64)^{\frac{1}{x}}}{2^x} = \frac{1}{\sqrt{32}}$. [3]

3 Given that $p = \frac{\sqrt{3}+1}{\sqrt{3}-1}$, express in its simplest surd form,

(i) p, [3]

(ii) $p - \frac{1}{p}$. [2]

4 **(i)** Use the substitution $u = 2^x$ to solve the equation $2^{2x} = 2^{x+2} + 5$. [5]

(ii) Solve the equation $2\log_9 3 + \log_5(7y - 3) = \log_2 8$. [4]

5 **(i)** Express 9^{x+1} as a power of 3. [1]

(ii) Express $\sqrt[3]{27^{2x}}$ as a power of 3. [1]

(iii) Express $\frac{54 \times \sqrt[3]{27^{2x}}}{9^{x+1} + 216(3^{2x-1})}$ as a fraction in its simplest form. [3]

6 Express $\frac{8 - 3\sqrt{2}}{4 + 3\sqrt{2}}$ in the form $a + b\sqrt{2}$, where a and b are integers. [3]

7 **(i)** Given that $\log_9 x = a\log_3 x$, find a. [1]

(ii) Given that $\log_{27} y = b\log_3 y$, find b. [1]

(iii) Hence solve, for x and y, the simultaneous equations

$$6\log_9 x + 3\log_{27}\ y = 8,$$
$$\log_3 x + 2\log_9 y = 2.$$

[4]

8 Solve the equation

(i) $2^{2x+1} = 20$, [3]

(ii) $\dfrac{5^{4y-1}}{25^y} = \dfrac{125^{y+3}}{25^{2-y}}$. [4]

9 Solve the equation

(i) $\dfrac{4^x}{2^{5-x}} = \dfrac{2^{4x}}{8^{x-3}}$, [3]

(ii) $\lg(2y+10) + \lg y = 2$. [3]

10 **(a)** Solve the equation $9^{2x-1} = 27^x$. [3]

(b) Given that $\dfrac{a^{-\frac{1}{2}}b^{\frac{2}{3}}}{\sqrt{a^3 b^{-\frac{2}{3}}}} = a^p b^q$, find the value of p and of q. [2]

11 Given that $\log_p X = 9$ and $\log_p Y = 6$, find

(i) $\log_p \sqrt{X}$, [1]

(ii) $\log_p \left(\dfrac{1}{X}\right)$, [1]

(iii) $\log_p (XY)$, [2]

(iv) $\log_Y X$. [2]

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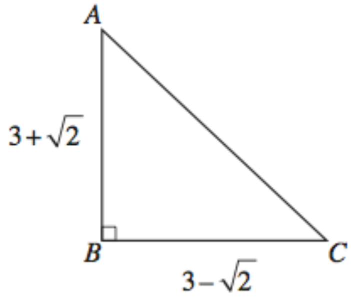

The diagram shows a triangle ABC, where angle B is a right angle, the length of $AB = 3 + \sqrt{2}$ and the length of $BC = 3 - \sqrt{2}$.

(i) Find the length of AC in the form $\sqrt{k}$, where k is an integer. [2]

13 **(a)** Solve $\lg(7x - 3) + 2\lg 5 = 2 + \lg(x + 3)$. [4]

(b) Use the substitution $u = 3^x$ to solve the equation $3^{x+1} + 3^{2-x} = 28$. [5]

14 Given that $\log_8 p = x$ and $\log_8 q = y$, express in terms of x and/or y

(i) $\log_8 \sqrt{p} + \log_8 q^2$, [2]

(ii) $\log_8 \left(\frac{q}{8}\right)$, [2]

(iii) $\log_2 (64p)$. [3]

15 **(a)** Solve the equation $(2^{3-4x})(4^{x+4}) = 2$. [3]

(b) **(i)** Simplify $\sqrt{108} - \frac{12}{\sqrt{3}}$, giving your answer in the form $k\sqrt{3}$, where k is an integer. [2]

(ii) Simplify $\frac{\sqrt{5}+3}{\sqrt{5}-2}$, giving your answer in the form $a\sqrt{5} + b$, where a and b are integers. [3]