1 Express each of the following in the form $a\sqrt{2} + b\sqrt{3}$, where a and b are integers.

a $\sqrt{27} + 2\sqrt{50}$

b $\sqrt{6}(\sqrt{3} - \sqrt{8})$

2 Given that $x > 0$, find in the form $k\sqrt{3}$ the value of x such that

$$x(x - 2) = 2(6 - x).$$

3 Solve the equation

$$25^x = 5^{4x+1}.$$

4 **a** Express $\sqrt[3]{24}$ in the form $k\sqrt[3]{3}$.

b Find the integer n such that

$$\sqrt[3]{24} + \sqrt[3]{81} = \sqrt[3]{n}.$$

5 Show that

$$\frac{10\sqrt{3}}{\sqrt{15}} + \frac{4}{\sqrt{5} - \sqrt{7}}$$

can be written in the form $k\sqrt{7}$, where k is an integer to be found.

6 Showing your method clearly,

a express $\sqrt{37.5}$ in the form $a\sqrt{6}$,

b express $\sqrt{9\frac{3}{5}} - \sqrt{6\frac{2}{3}}$ in the form $b\sqrt{15}$.

7 Given that $x = 2^{t-1}$ and $y = 2^{3t}$,

a find expressions in terms of t for

i xy **ii** $2y^2$

b Hence, or otherwise, find the value of t for which

$$2y^2 - xy = 0.$$

8 Solve the equation

$$\sqrt{2}(3x - 1) = 2(2x + 3),$$

giving your answer in the form $a + b\sqrt{2}$, where a and b are integers.

9 Given that $6^{y+1} = 36^{x-2}$,

a express y in the form $ax + b$,

b find the value of $4^{x - \frac{1}{2}y}$.

10 Express each of the following in the form $a + b\sqrt{2}$, where a and b are integers.

a $(3 - \sqrt{2})(1 + \sqrt{2})$

b $\frac{\sqrt{2}}{\sqrt{2} - 1}$

11 Solve the equation

$$16^{x+1} = 8^{2x+1}.$$

12 Given that

$$(a - 2\sqrt{3})^2 = b - 20\sqrt{3},$$

find the values of the integers a and b.

13 **a** Find the value of t such that

$$(\tfrac{1}{4})^{t-3} = 8.$$

b Solve the equation

$$(\tfrac{1}{3})^{y} = 27^{y+1}.$$

14 Express each of the following in the form $a + b\sqrt{5}$, where a and b are integers.

a $\sqrt{20}\,(\sqrt{5} - 3)$

b $(1 - \sqrt{5})(3 + 2\sqrt{5})$

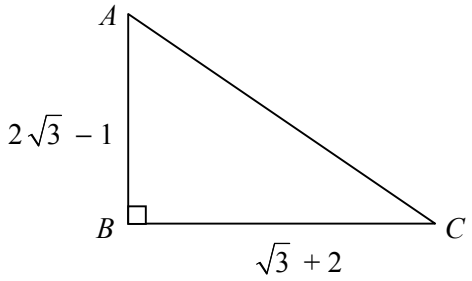
c $\dfrac{1+\sqrt{5}}{\sqrt{5}-2}$

15 Given that $a^{\frac{1}{3}} = b^{\frac{3}{4}}$, and that $a > 0$ and $b > 0$,

a find an expression for $a^{\frac{1}{2}}$ in terms of b,

b find an expression for $b^{\frac{1}{2}}$ in terms of a.

16



In triangle ABC, $AB = 2\sqrt{3} - 1$, $BC = \sqrt{3} + 2$ and $\angle ABC = 90°$.

a Find the exact area of triangle ABC in its simplest form.

b Show that $AC = 2\sqrt{5}$.

c Show that $\tan(\angle ACB) = 5\sqrt{3} - 8$.

17 **a** Given that $y = 2^x$, express each of the following in terms of y.

i 2^{x+2} **ii** 4^x

b Hence, or otherwise, find the value of x for which

$$4^x - 2^{x+2} = 0.$$

18 Given that the point with coordinates $(1 + \sqrt{3}, 5\sqrt{3})$ lies on the curve with the equation

$$y = 2x^2 + px + q,$$

find the values of the rational constants p and q.