1 Evaluate

a $\sqrt{49}$ **b** $\sqrt{121}$ **c** $\sqrt{\frac{1}{9}}$ **d** $\sqrt{\frac{4}{25}}$ **e** $\sqrt{0.01}$ **f** $\sqrt{0.09}$

g $\sqrt[3]{8}$ **h** $\sqrt[3]{1000}$ **i** $\sqrt[4]{81}$ **j** $\sqrt{1\frac{9}{16}}$ **k** $\sqrt[3]{0.125}$ **l** $\sqrt[3]{15\frac{5}{8}}$

2 Simplify

a $\sqrt{7} \times \sqrt{7}$ **b** $4\sqrt{5} \times \sqrt{5}$ **c** $(3\sqrt{3})^2$ **d** $(\sqrt{6})^4$

e $(\sqrt{2})^5$ **f** $(2\sqrt{3})^3$ **g** $\sqrt{2} \times \sqrt{8}$ **h** $2\sqrt{3} \times \sqrt{27}$

i $\dfrac{\sqrt{32}}{\sqrt{2}}$ **j** $\dfrac{\sqrt{3}}{\sqrt{12}}$ **k** $(\sqrt[3]{6})^3$ **l** $(3\sqrt[3]{2})^3$

3 Express in the form $k\sqrt{2}$

a $\sqrt{18}$ **b** $\sqrt{50}$ **c** $\sqrt{8}$ **d** $\sqrt{98}$ **e** $\sqrt{200}$ **f** $\sqrt{162}$

4 Simplify

a $\sqrt{12}$ **b** $\sqrt{28}$ **c** $\sqrt{80}$ **d** $\sqrt{27}$ **e** $\sqrt{24}$ **f** $\sqrt{128}$

g $\sqrt{45}$ **h** $\sqrt{40}$ **i** $\sqrt{75}$ **j** $\sqrt{112}$ **k** $\sqrt{99}$ **l** $\sqrt{147}$

m $\sqrt{216}$ **n** $\sqrt{800}$ **o** $\sqrt{180}$ **p** $\sqrt{60}$ **q** $\sqrt{363}$ **r** $\sqrt{208}$

5 Simplify

a $\sqrt{18} + \sqrt{50}$ **b** $\sqrt{48} - \sqrt{27}$ **c** $2\sqrt{8} + \sqrt{72}$

d $\sqrt{360} - 2\sqrt{40}$ **e** $2\sqrt{5} - \sqrt{45} + 3\sqrt{20}$ **f** $\sqrt{24} + \sqrt{150} - 2\sqrt{96}$

6 Express in the form $a + b\sqrt{3}$

a $\sqrt{3}(2 + \sqrt{3})$ **b** $4 - \sqrt{3} - 2(1 - \sqrt{3})$ **c** $(1 + \sqrt{3})(2 + \sqrt{3})$

d $(4 + \sqrt{3})(1 + 2\sqrt{3})$ **e** $(3\sqrt{3} - 4)^2$ **f** $(3\sqrt{3} + 1)(2 - 5\sqrt{3})$

7 Simplify

a $(\sqrt{5} + 1)(2\sqrt{5} + 3)$ **b** $(1 - \sqrt{2})(4\sqrt{2} - 3)$ **c** $(2\sqrt{7} + 3)^2$

d $(3\sqrt{2} - 1)(2\sqrt{2} + 5)$ **e** $(\sqrt{5} - \sqrt{2})(\sqrt{5} + 2\sqrt{2})$ **f** $(3 - \sqrt{8})(4 + \sqrt{2})$

8 Express each of the following as simply as possible with a rational denominator.

a $\dfrac{1}{\sqrt{5}}$ **b** $\dfrac{2}{\sqrt{3}}$ **c** $\dfrac{1}{\sqrt{8}}$ **d** $\dfrac{14}{\sqrt{7}}$ **e** $\dfrac{3\sqrt{2}}{\sqrt{3}}$ **f** $\dfrac{\sqrt{5}}{\sqrt{15}}$

g $\dfrac{1}{3\sqrt{7}}$ **h** $\dfrac{12}{\sqrt{72}}$ **i** $\dfrac{1}{\sqrt{80}}$ **j** $\dfrac{3}{2\sqrt{54}}$ **k** $\dfrac{4\sqrt{20}}{3\sqrt{18}}$ **l** $\dfrac{3\sqrt{175}}{2\sqrt{27}}$

9 Simplify

a $\sqrt{8} + \frac{6}{\sqrt{2}}$ **b** $\sqrt{48} - \frac{10}{\sqrt{3}}$ **c** $\frac{6-\sqrt{8}}{\sqrt{2}}$

d $\frac{\sqrt{45}-5}{\sqrt{20}}$ **e** $\frac{1}{\sqrt{18}} + \frac{1}{\sqrt{32}}$ **f** $\frac{2}{\sqrt{3}} - \frac{\sqrt{6}}{\sqrt{72}}$

10 Solve each equation, giving your answers as simply as possible in terms of surds.

a $x(x + 4) = 4(x + 8)$ **b** $x - \sqrt{48} = 2\sqrt{3} - 2x$

c $x\sqrt{18} - 4 = \sqrt{8}$ **d** $x\sqrt{5} + 2 = \sqrt{20}\,(x - 1)$

11 **a** Simplify $(2 - \sqrt{3})(2 + \sqrt{3})$.

b Express $\frac{2}{2-\sqrt{3}}$ in the form $a + b\sqrt{3}$.

12 Express each of the following as simply as possible with a rational denominator.

a $\frac{1}{\sqrt{2}+1}$ **b** $\frac{4}{\sqrt{3}-1}$ **c** $\frac{1}{\sqrt{6}-2}$ **d** $\frac{3}{2+\sqrt{3}}$

e $\frac{1}{2+\sqrt{5}}$ **f** $\frac{\sqrt{2}}{\sqrt{2}-1}$ **g** $\frac{6}{\sqrt{7}+3}$ **h** $\frac{1}{3+2\sqrt{2}}$

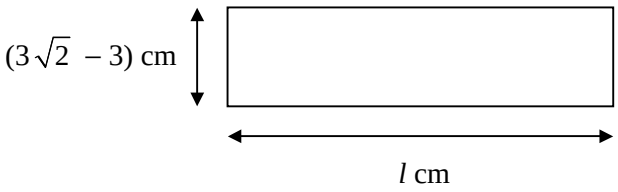
i $\frac{1}{4-2\sqrt{3}}$ **j** $\frac{3}{3\sqrt{2}+4}$ **k** $\frac{2\sqrt{3}}{7-4\sqrt{3}}$ **l** $\frac{6}{\sqrt{5}-\sqrt{3}}$

13 Solve the equation

$$3x = \sqrt{5}\,(x + 2),$$

giving your answer in the form $a + b\sqrt{5}$, where a and b are rational.

14



The diagram shows a rectangle measuring $(3\sqrt{2} - 3)$ cm by l cm.
Given that the area of the rectangle is 6 cm^2, find the exact value of l in its simplest form.

15 Express each of the following as simply as possible with a rational denominator.

a $\frac{\sqrt{2}}{\sqrt{2}+\sqrt{6}}$ **b** $\frac{1+\sqrt{3}}{2+\sqrt{3}}$ **c** $\frac{1+\sqrt{10}}{\sqrt{10}-3}$ **d** $\frac{3-\sqrt{2}}{4+3\sqrt{2}}$

e $\frac{1-\sqrt{2}}{3-\sqrt{8}}$ **f** $\frac{\sqrt{3}-5}{2\sqrt{3}-4}$ **g** $\frac{\sqrt{12}+3}{3-\sqrt{3}}$ **h** $\frac{3\sqrt{7}-2}{2\sqrt{7}-5}$