Rationalising the Denominator
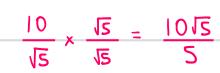
1 Show that $\dfrac{10}{\sqrt{5}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

$$\frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{10\sqrt{5}}{5}$$

$$= 2\sqrt{5}$$

2 Show that $\dfrac{18}{\sqrt{6}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

$$\frac{18}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{18\sqrt{6}}{6}$$

$$= 3\sqrt{6}$$

3 Show that $\dfrac{70}{\sqrt{2}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

$$\frac{70}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{70\sqrt{2}}{2}$$

$$= 35\sqrt{2}$$

4 Show that $\dfrac{20}{\sqrt{10}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

$$\frac{20}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} = \frac{20\sqrt{10}}{10}$$

$$= 2\sqrt{10}$$

For the entire booklet

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5 Show that $\dfrac{24}{\sqrt{15}}$ can be written in the form $\dfrac{a\sqrt{15}}{b}$ where a and b are integers.

[2 marks]

$$\frac{24}{\sqrt{15}} \times \frac{\sqrt{15}}{\sqrt{15}} = \frac{24\sqrt{15}}{15}$$

$$= \frac{8\sqrt{15}}{5}$$

6 Show that $\dfrac{35}{4\sqrt{5}}$ can be written in the form $\dfrac{a\sqrt{5}}{b}$ where a and b are integers.

[2 marks]

$$\frac{35}{4\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{35\sqrt{5}}{20}$$

$$= \frac{7\sqrt{5}}{4}$$

7 Show that $\dfrac{1}{9\sqrt{2}}$ can be written in the form $\dfrac{\sqrt{2}}{a}$ where a and b are integers.

[2 marks]

$$\frac{1}{9\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{18}$$

8 Show that $\dfrac{60}{\sqrt{24}}$ can be written in the form $a\sqrt{b}$ where a and b are integers

[2 marks]

$$\sqrt{24} = \sqrt{4} \times \sqrt{6}$$
$$= 2\sqrt{6}$$

$$\frac{60}{2\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{60\sqrt{6}}{12}$$

$$= 5\sqrt{6}$$

9 Show that $\dfrac{24}{\sqrt{45}}$ can be written in the form $\dfrac{a\sqrt{5}}{b}$ where a and b are integers.

[2 marks]

$$\sqrt{45} = \sqrt{9} \times \sqrt{5}$$
$$= 3\sqrt{5}$$

$$\frac{24}{3\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{24\sqrt{5}}{15}$$

$$= \frac{8\sqrt{5}}{5}$$

10 Show that $\dfrac{10 - \sqrt{32}}{\sqrt{2}}$ can be written in the form $a\sqrt{2} - b$

where a and b are integers.

[3 marks]

$$\frac{10 - \sqrt{32}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}(10 - \sqrt{32})}{2}$$

$$= \frac{10\sqrt{2} - \sqrt{64}}{2}$$

$$= \frac{10\sqrt{2} - 8}{2} \qquad = 5\sqrt{2} - 4$$

11 Show that $\dfrac{\sqrt{12} + 9}{\sqrt{3}}$ can be written in the form $a + b\sqrt{3}$

where a and b are integers.

[3 marks]

$$\frac{\sqrt{12} + 9}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}(\sqrt{12} + 9)}{3}$$

$$= \frac{\sqrt{36} + 9\sqrt{3}}{3}$$

$$= \frac{6 + 9\sqrt{3}}{3} \qquad = 2 + 3\sqrt{3}$$

12 Show that $\dfrac{\sqrt{180} + 40}{\sqrt{20}}$ can be written in the form $a + b\sqrt{5}$

where a and b are integers.

[3 marks]

$$\sqrt{180} = \sqrt{36} \times \sqrt{5}$$
$$= 6\sqrt{5}$$

$$\sqrt{20} = \sqrt{4} \times \sqrt{5}$$
$$= 2\sqrt{5}$$

$$\frac{6\sqrt{5} + 40}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}(6\sqrt{5} + 40)}{10}$$

$$= \frac{30 + 40\sqrt{5}}{10}$$

$$= 3 + 4\sqrt{5}$$

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Turn over ▶

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13 Show that $\left(\dfrac{1}{\sqrt{2}}\right)^5$ can be written in the form $\dfrac{\sqrt{2}}{a}$ where a is an integer.

[3 marks]

$$\dfrac{1^5}{(\sqrt{2})^5} = \dfrac{1}{4\sqrt{2}} \qquad \dfrac{1}{4\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{\sqrt{2}}{8}$$

14 Show that $\dfrac{24}{\sqrt{6}} + \sqrt{54}$ can be written in the form $k\sqrt{6}$ where k is an integer.

[3 marks]

$$\dfrac{24}{\sqrt{6}} \times \dfrac{\sqrt{6}}{\sqrt{6}} = \dfrac{24\sqrt{6}}{6} \qquad \sqrt{54} = \sqrt{9} \times \sqrt{6}$$
$$= 4\sqrt{6} \qquad\qquad = 3\sqrt{6}$$

$$4\sqrt{6} + 3\sqrt{6} = 7\sqrt{6}$$

15 Show that $\dfrac{42}{\sqrt{18}} + \sqrt{200}$ can be written in the form $k\sqrt{6}$ where k is an integer.

[4 marks]

$$\sqrt{18} = \sqrt{9} \times \sqrt{2} \qquad\qquad \sqrt{200} = \sqrt{100} \times \sqrt{2}$$
$$= 3\sqrt{2} \qquad\qquad\qquad = 10\sqrt{2}$$

$$\dfrac{42}{3\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{42\sqrt{2}}{6}$$
$$\qquad\qquad 7\sqrt{2} + 10\sqrt{2} = 17\sqrt{2}$$
$$= 7\sqrt{2}$$

16 Show that $\dfrac{21}{\sqrt{3}} + \dfrac{12}{\sqrt{48}}$ can be written in the form $k\sqrt{3}$ where k is an integer.

[3 marks]

$$\frac{21}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{21\sqrt{3}}{3} \qquad \frac{12}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{12\sqrt{3}}{12}$$

$$= 7\sqrt{3} \qquad\qquad = \sqrt{3}$$

$$\sqrt{48} = \sqrt{16} \times \sqrt{3} \qquad 7\sqrt{3} + \sqrt{3} = 8\sqrt{3}$$

$$= 4\sqrt{3}$$

17 Show that $20 \times \sqrt{3\tfrac{1}{5}}$ can be written in the form $k\sqrt{5}$ where k is an integer.

[4 marks]

$$20 \times \sqrt{\frac{16}{5}} = 20 \times \frac{\sqrt{16}}{\sqrt{5}} \qquad\qquad = \frac{80}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$= 20 \times \frac{4}{\sqrt{5}} \qquad\qquad = \frac{80\sqrt{5}}{5}$$

$$= \frac{80}{\sqrt{5}} \qquad\qquad = 16\sqrt{5}$$

18 Show that $\dfrac{\sqrt{3} + \sqrt{5}}{\sqrt{2}} - \dfrac{5}{\sqrt{10}}$ can be written in the form $\dfrac{\sqrt{6}}{a}$ where a is an integer.

[4 marks]

$$\frac{\sqrt{3} + \sqrt{5}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6} + \sqrt{10}}{2} \qquad \frac{\sqrt{6} + \sqrt{10}}{2} - \frac{\sqrt{10}}{2}$$

$$\frac{5}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} = \frac{5\sqrt{10}}{10} \qquad = \frac{\sqrt{6} + \sqrt{10} - \sqrt{10}}{2}$$

$$= \frac{\sqrt{10}}{2} \qquad\qquad = \frac{\sqrt{6}}{2}$$

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