1.6) Rationalising denominators

Worked example	Your turn
Rationalise the denominator:	Rationalise the denominator:
$$\frac{1}{\sqrt{2}}$$	$$\frac{4}{\sqrt{7}}$$
	$$\frac{4\sqrt{7}}{7}$$
$$\frac{2}{\sqrt{3}}$$	
$$\frac{3}{\sqrt{5}}$$	

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{4}{3\sqrt{2}}$$	Rationalise the denominator and simplify: $$\frac{10}{2\sqrt{7}}$$ $$\frac{5\sqrt{7}}{7}$$
$$\frac{6}{5\sqrt{3}}$$	

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{2 - 7\sqrt{3}}{\sqrt{3}}$$ $$\frac{3 - 5\sqrt{11}}{\sqrt{11}}$$	Rationalise the denominator and simplify: $$\frac{9 - 3\sqrt{5}}{\sqrt{5}}$$ $$\frac{9\sqrt{5} - 15}{5}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{3}{5 + \sqrt{2}}$$	Rationalise the denominator and simplify: $$\frac{18}{1 + \sqrt{7}}$$ $$-3 + 3\sqrt{7}$$
$$\frac{4}{1 + \sqrt{3}}$$	

Worked example	Your turn
Rationalise the denominator and simplify: $$\dfrac{3}{5-\sqrt{2}}$$ $$\dfrac{4}{1-\sqrt{3}}$$	Rationalise the denominator and simplify: $$\dfrac{18}{1-\sqrt{7}}$$ $$-3-3\sqrt{7}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\dfrac{3}{\sqrt{2} - 5}$$	Rationalise the denominator and simplify: $$\dfrac{18}{\sqrt{7} - 1}$$ $$3 + 3\sqrt{7}$$
$$\dfrac{4}{-1 + \sqrt{3}}$$	

Worked example	Your turn
Rationalise the denominator and simplify: $$\dfrac{3 + \sqrt{2}}{\sqrt{2} - 5}$$ $$\dfrac{5 - \sqrt{3}}{-1 + \sqrt{3}}$$	Rationalise the denominator and simplify: $$\dfrac{2 - \sqrt{7}}{\sqrt{7} - 1}$$ $$\dfrac{-5 + \sqrt{7}}{6}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{2\sqrt{3}+5}{\sqrt{3}-2}$$	Rationalise the denominator and simplify: $$\frac{2\sqrt{2}+1}{\sqrt{2}-3}$$ $$-1-\sqrt{2}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{3\sqrt{3}-5}{2\sqrt{3}-7}$$	Rationalise the denominator and simplify: $$\frac{5\sqrt{5}-2}{2\sqrt{5}-3}$$ $$4+\sqrt{5}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{11 + 3\sqrt{2}}{3\sqrt{7} + 5}$$	Rationalise: $$\frac{7 + 2\sqrt{3}}{11\sqrt{5} + 2}$$ $$\frac{77\sqrt{5} + 22\sqrt{15} - 4\sqrt{3} - 14}{601}$$

Worked example	Your turn
Rationalise the denominator and simplify: $$\frac{(3 + \sqrt{2})(3 - \sqrt{2})}{\sqrt{7}}$$ $$\frac{(7 + \sqrt{5})(7 - \sqrt{5})}{\sqrt{11}}$$	Rationalise the denominator and simplify: $$\frac{(5 + \sqrt{3})(5 - \sqrt{3})}{\sqrt{22}}$$ $$\sqrt{22}$$

Worked example	Your turn
Simplify, giving your answer in the form $a\sqrt{b}$: $$\frac{\sqrt{54}}{3} + \frac{12}{\sqrt{6}}$$	Simplify, giving your answer in the form $a\sqrt{b}$: $$\frac{\sqrt{63}}{3} + \frac{21}{\sqrt{7}}$$ $4\sqrt{7}$

Worked example	Your turn
Show that $\dfrac{1}{\frac{1}{\sqrt{3}}+1} = \dfrac{3}{2} - \dfrac{1}{2}\sqrt{3}$	Show that $\dfrac{1}{1+\frac{1}{\sqrt{2}}} = 2 - \sqrt{2}$

$$= \frac{\sqrt{2}}{\sqrt{2}+1}$$

$$= \frac{\sqrt{2}}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1}$$

$$= \frac{2-\sqrt{2}}{2+\sqrt{2}-\sqrt{2}-1}$$

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

$$= 2 - \sqrt{2}$$

Worked example	Your turn
A rectangle has an area of $(15 - 6\sqrt{3})\ cm^2$ and a width of $(2\sqrt{3} - 3)\ cm.$ Find the length of the rectangle in the form $a + b\sqrt{3}$	A rectangle has an area of $(2 + \sqrt{2})\ cm^2$ and a width of $(3\sqrt{2} - 4)\ cm.$ Find the length of the rectangle in the form $a + b\sqrt{2}$
	$7 + 5\sqrt{2}\ cm$

Worked example	Your turn
Solve $y(2 + \sqrt{3}) - \sqrt{3} = 4$	Solve $y(1 + \sqrt{2}) - \sqrt{2} = 3$
	$y = 2\sqrt{2} - 1$

Worked example	Your turn
Simplify:	Simplify:
$$\dfrac{\sqrt{a+2} - \sqrt{a}}{\sqrt{a+2} + \sqrt{a}}$$	$$\dfrac{\sqrt{a+1} - \sqrt{a}}{\sqrt{a+1} + \sqrt{a}}$$
	$2a + 1 - 2\sqrt{a}\sqrt{a+1}$

Worked example	Your turn
Solve: $$\frac{\sqrt[5]{8}}{\sqrt[4]{32}} = \sqrt[x]{2}$$	Solve: $$\frac{\sqrt[4]{9}}{\sqrt[5]{27}} = \sqrt[x]{3}$$ $$x = -10$$