Surds - Lesson 4

Rationalising the Denominator 1

LI

- Rationalise a denominator.

SC

- Simplifying fractions fully.

(- Simplifying surds.)

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Rationalising the Denominator means to write a fraction with the denominator not involving a root

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Important Reminders

Multiplying numerator and denominator of a fraction by the same number does not change the fraction

How to rationalise a denominator

Multiply top and bottom of the original fraction by the root in the denominator of the original fraction; simplify if possible

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Example 1

Rationalise the denominator :

$$\frac{2}{\sqrt{3}} \quad \begin{matrix} \times \sqrt{3} \\ \times \sqrt{3} \end{matrix}$$

$$= \boxed{\frac{2\sqrt{3}}{3}}$$

Example 2

Rationalise the denominator :

$$\frac{6}{\sqrt{2}} \quad \begin{matrix} \times \sqrt{2} \\ \times \sqrt{2} \end{matrix}$$

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

$$= \boxed{3\sqrt{2}}$$

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Example 3

Rationalise the denominator :

$$\frac{7}{9\sqrt{5}} \quad \begin{matrix} \times \sqrt{5} \\ \times \sqrt{5} \end{matrix}$$

$$= \frac{7\sqrt{5}}{9 \times 5}$$

$$= \boxed{\frac{7\sqrt{5}}{45}}$$

Example 4

Rationalise the denominator :

$$\frac{\sqrt{7}}{\sqrt{3}} \quad \begin{matrix} \times \sqrt{3} \\ \times \sqrt{3} \end{matrix}$$

$$= \frac{\sqrt{7}\,\sqrt{3}}{3}$$

Example 5

Rationalise the denominator (and simplify fully) :

$$\frac{6}{\sqrt{12}} \times \frac{\sqrt{12}}{\sqrt{12}}$$

$$= \frac{6\sqrt{12}}{12}$$

$$= \frac{\sqrt{12}}{2}$$

$$= \frac{\sqrt{4}\,\sqrt{3}}{2}$$

$$= \boxed{\sqrt{3}}$$

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Example 6

Express in simplest form with a rational denominator :

$$\frac{4}{\sqrt{72}} \quad \begin{matrix} \times \sqrt{72} \\ \times \sqrt{72} \end{matrix}$$

$$= \frac{4\sqrt{72}}{72}$$

$$= \frac{\sqrt{72}}{18}$$

$$= \frac{\sqrt{9}\,\sqrt{8}}{18}$$

$$= \frac{3\sqrt{4}\,\sqrt{2}}{18}$$

$$= \boxed{\frac{\sqrt{2}}{3}}$$

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1 Rationalise the denominators of these expressions.

a $\frac{1}{\sqrt{5}}$ **b** $\frac{1}{\sqrt{2}}$ **c** $\frac{6}{\sqrt{3}}$ **d** $\frac{8}{\sqrt{2}}$

e $\frac{1}{3\sqrt{2}}$ **f** $\frac{5}{2\sqrt{7}}$ **g** $\frac{\sqrt{12}}{\sqrt{7}}$ **h** $\frac{6}{5\sqrt{3}}$

2 Express each of the following in its simplest form with a rational denominator.

a $\frac{\sqrt{5}}{\sqrt{3}}$ **b** $\frac{1}{4\sqrt{2}}$ **c** $\frac{4}{5\sqrt{5}}$ **d** $\sqrt{\frac{1}{7}}$

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

i $\frac{4}{5\sqrt{2}}$ **j** $\frac{10}{\sqrt{40}}$ **k** $\frac{3\sqrt{5}}{\sqrt{8}}$ **l** $\frac{4}{\sqrt{18}}$

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Answers

1

a $\frac{\sqrt{5}}{5}$

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

c $2\sqrt{3}$

d $4\sqrt{2}$

e $\frac{\sqrt{2}}{6}$

f $\frac{5\sqrt{7}}{14}$

g $\frac{2\sqrt{21}}{7}$

h $\frac{2\sqrt{3}}{5}$

2

a $\frac{\sqrt{15}}{3}$

b $\frac{\sqrt{2}}{8}$

c $\frac{4\sqrt{5}}{25}$

d $\frac{\sqrt{7}}{7}$

e $\frac{\sqrt{10}}{2}$

f $\frac{\sqrt{3}}{3}$

g $\frac{6\sqrt{5}}{5}$

h $\frac{2\sqrt{7}}{21}$

i $\frac{2\sqrt{2}}{5}$

j $\frac{\sqrt{10}}{2}$

k $\frac{3\sqrt{10}}{4}$

l $\frac{2\sqrt{2}}{3}$