LO: Simplifying and rationalising surds.

30/09/2024

1. Find the value of x.

$$x^{-\frac{4}{3}} = \frac{1}{256}$$

2. Simplify:

$$\frac{9x^{\frac{1}{2}}}{(27x^{-2})^{\frac{1}{3}}}$$

Prerequisite	Prerequisite
Retrieval	Problem Solving

$$\sqrt{3}\,(5+\sqrt{3})$$

Prior knowledge

Simplifying surds

A surd is a root of a number that does not simplify to a rational number.

Laws:

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

A *rational* number is any which can be expressed as $\frac{a}{b}$ where a, b are integers. $\frac{2}{3}$ and $\frac{4}{1} = 4$ are rational numbers, but π and $\sqrt{2}$ are not.

---

1) $\sqrt{3} \times 2 =$

2) $3\sqrt{5} \times 2\sqrt{5} =$

3) $\sqrt{8} =$

4) $\sqrt{12} + \sqrt{27} =$

5) $(\sqrt{8} + 1)(\sqrt{2} - 3) =$

Prior knowledge

Here's a surd. What could we multiply it by such that it's no longer an irrational number?

1) $\sqrt{5} \times \square = \square$

2) $\frac{1}{\sqrt{2}} \times \square = \square$

Worked Examples – I do

Worked Examples – We do

Rationalising denominators

1) $\frac{3}{\sqrt{2}}$

2) $\frac{6}{\sqrt{3}}$

3) $\frac{7}{\sqrt{7}}$

4) $\frac{15}{\sqrt{5}} + \sqrt{5}$

Test Your Understanding:

1) $\frac{12}{\sqrt{3}} =$ $\mathbf{4\sqrt{3}}$

2) $\frac{2}{\sqrt{6}} =$ $\mathbf{\frac{\sqrt{6}}{3}}$

3) $\frac{4\sqrt{2}}{\sqrt{8}} =$ $\mathbf{\frac{16}{8} = 2}$

Worked Examples – I do

Worked Examples – We do

Rationalising denominators

More Complex Denominators

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

2) $\frac{3}{\sqrt{6}-2}$

3) $\frac{4}{\sqrt{3}+1}$

4) $\frac{3\sqrt{2}+4}{5\sqrt{2}-7}$

Test Your Understanding

Test Your Understanding

1) Rationalise the denominator and simplify

$$\frac{4}{\sqrt{5}-2}$$

$\mathbf{8+4\sqrt{5}}$

2) Rationalise the denominator and simplify

$$\frac{2\sqrt{3}-1}{3\sqrt{3}+1}$$

$$\mathbf{\frac{2\sqrt{3}-1}{3\sqrt{3}+1}\times\frac{3\sqrt{3}-1}{3\sqrt{3}-1}}$$
$$\mathbf{=\frac{18-2\sqrt{3}-3\sqrt{3}+1}{27-1}}$$
$$\mathbf{=\frac{19-5\sqrt{3}}{26}}$$

3) Solve $y\left(\sqrt{3}-1\right)=8$

Give your answer in the form $a+b\sqrt{3}$ where a and b are integers.

$$\mathbf{y=\frac{8}{\sqrt{3}-1}\times\frac{\sqrt{3}+1}{\sqrt{3}+1}}$$
$$\mathbf{=\frac{8\sqrt{3}+8}{2}=4+4\sqrt{3}}$$

Worked Examples – I do

Write each expression as a single fraction.

[i] $\dfrac{2}{3-\sqrt{2}}+\dfrac{2}{3+\sqrt{2}}$

Worked Examples – We do

Write each expression as a single fraction.

[iii] $\dfrac{1}{5-2\sqrt{6}}+\dfrac{3}{5+2\sqrt{6}}$

Worked Examples – I do

Use the expansion of $(a+b)^5$ to simplify $\left(2-\sqrt{5}\right)^5$.

Worked Examples – We do

(v) Use the expansion of $(a+b)^5$ to simplify $\left(1+\sqrt{5}\right)^5$.

Homework

Textbook

Page 20

Q1. First column
Q2. Second column
Q3. Even numbers
Q4. Second column
Q5 1-4
Q6. First column
Q8. 1 and 4
Q9
Q10.

Textbook

Page 22

Q1. Second column
Q3
Q5
Q7 and Q8