Lesson 3

A-Level Pure Mathematics : Year 1
GCSE (Grades 8 and 9)
Algebra of Surds and Indices I

3.1 Rationalising the Denominator #1

Mathematicians' dislike fractions which have a square root in the denominator.
There are standard techniques for manipulating such fractions to remove the offending square root from the denominator.
This may well result in a square root in the numerator, but this is considered fine !

Example:

Rationalise the denominator of $\frac{4\sqrt{3}}{\sqrt{5}}$

[1 mark]

3.2 Exercise

Any solution based entirely on graphical or numerical methods is not acceptable
Marks Available : 35

Do NOT use a calculator

Question 1

Rationalise the denominators of the following fractions;

(i) $\frac{20}{\sqrt{5}}$ **(ii)** $\frac{28}{\sqrt{7}}$ **(iii)** $\frac{24\sqrt{3}}{\sqrt{2}}$

(iv) $\frac{12}{\sqrt{3}}$ **(v)** $\frac{5}{\sqrt{13}}$ **(vi)** $\frac{14\sqrt{3}}{\sqrt{2}}$

(vii) $\frac{55}{\sqrt{11}}$ **(viii)** $\frac{1}{\sqrt{2}}$ **(ix)** $\frac{15\sqrt{2}}{\sqrt{15}}$

[9 marks]

Question 2

By multiplying both numerator and denominator by $\sqrt{2}$ rationalise the denominator of $\frac{5}{8\sqrt{2}}$

[1 mark]

Question 3

Rationalise the denominators of the following fractions, simplifying the result.

(i) $\frac{52}{3\sqrt{13}}$ **(ii)** $\frac{48}{5\sqrt{6}}$ **(iii)** $\frac{7}{3\sqrt{15}}$

(iv) $\frac{11}{12\sqrt{3}}$ **(v)** $\frac{6\sqrt{3}}{7\sqrt{2}}$ **(vi)** $\frac{3}{\sqrt{7}}$

(vii) $\frac{44}{5\sqrt{11}}$ **(viii)** $\frac{14}{\sqrt{2}}$ **(ix)** $\frac{28}{3\sqrt{14}}$

[9 marks]

Question 4

Show that, $\frac{3}{\sqrt{2}} + \frac{5}{\sqrt{3}} = \frac{9\sqrt{2} + 10\sqrt{3}}{6}$

[2 marks]

Question 5

Simplify, $\frac{1}{\sqrt{5}} + \frac{4\sqrt{5}}{5}$

[2 marks]

Question 6

Simplify, $\frac{7}{\sqrt{6}} + \frac{\sqrt{3}}{\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}}$

[3 marks]

Question 7

A-Level Examination Question from January 2019, C12, Q2 (Edexcel)

Given $y = 2^x$, express each of the following in terms of y.

Write each expression in its simplest form.

(a) 2^{2x}

[1 mark]

(b) 2^{x+3}

[1 mark]

(c) $\frac{1}{4^{2x-3}}$

[2 marks]

Question 8

A-Level Examination Question from June 2018, C12, Q4 (Edexcel)

Given that,

$$y = \frac{64x^6}{25}, \quad x > 0$$

express each of the following in the form $k x^n$ where k and n are constants.

(a) $y^{-\frac{1}{2}}$

[3 marks]

(b) $(25y)^{\frac{2}{3}}$

[2 marks]