

Lesson 2

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

2.1 SURD Manipulation

There are benefits in 'using your wits' to try and spot 'short cuts' and 'clever moves' to avoid long-winded and pedantic solutions.

However, if you need to put in lots of steps to be certain of getting a question right, put them in - it's often quicker to scribble down a few extra lines rather than agonise over a tricky step in your mind.

Also keep in mind that there are often a couple of different methods that could be employed - use what you are comfortable with, which may differ from what your neighbour is doing.

Example

Without using a calculator, calculate $2\sqrt{15} \times 4\sqrt{10}$

Write your answer in the form $a\sqrt{b}$

where a and b are integers

and b is as small as possible.

[2 marks]

2.2 Exercise

*Any solution based entirely on graphical
or numerical methods is not acceptable*

Marks Available : 70

Do NOT use a calculator

Question 1

Calculate each of the following, writing your answers in the form $a\sqrt{b}$
where a and b are integers
and b is as small as possible.

(i) $3\sqrt{6} \times 7\sqrt{21}$

[2 marks]

(ii) $5\sqrt{14} \times 2\sqrt{10}$

[2 marks]

(iii) $10\sqrt{22} \times 4\sqrt{6}$

[2 marks]

(iv) $3\sqrt{10} \times 4\sqrt{55}$

[2 marks]

Question 2

Simplify:

(i) $\sqrt{12}$

(ii) $\sqrt{20}$

(iii) $\sqrt{8}$

(iv) $\sqrt{3^2 \times 5}$

(v) $\sqrt{2^4 \times 3}$

(vi) $\sqrt{242}$

(vii) $\sqrt{75}$

(viii) $\sqrt{6 \times 27}$

(ix) $\sqrt{147}$

(x) $\sqrt{5^3}$

(xi) $\sqrt{567}$

(xii) $\sqrt{8 \times 14}$

[12 marks]

Question 3

Simplify:

(i) $5\sqrt{18}$

(ii) $2\sqrt{30 \times 10}$

(iii) $5\sqrt{54}$

(iv) $3\sqrt{2^3 \times 10}$

(v) $2\sqrt{2^2 \times 5 \times 35}$

(vi) $2\sqrt{245}$

[6 marks]

Question 4

Simplify:

(i) $\frac{\sqrt{44}}{2}$

(ii) $\frac{\sqrt{24}}{2}$

(iii) $\frac{\sqrt{200}}{5}$

(iv) $\frac{\sqrt{243}}{3}$

(v) $\frac{\sqrt{288}}{4}$

(vi) $\frac{\sqrt{450}}{3}$

[6 marks]

Question 5

Simplify:

(i) $\frac{\sqrt{98}}{\sqrt{2}}$

(ii) $\frac{\sqrt{500}}{\sqrt{5}}$

(iii) $\frac{\sqrt{63}}{\sqrt{7}}$

[3 marks]

Question 6

Simplify:

(i) $\frac{\sqrt{10}}{\sqrt{5}}$

(ii) $\frac{\sqrt{22}}{\sqrt{11}}$

(iii) $\frac{\sqrt{56}}{\sqrt{7}}$

[3 marks]

Question 7

Simplify:

(i) $3\sqrt{75} + 2\sqrt{12}$

[2 marks]

(ii) $2\sqrt{18} + \sqrt{2^3 \times 5^2} - \sqrt{72}$

[2 marks]

(iii) $5\sqrt{20} + 3\sqrt{45} - 4\sqrt{80}$

[2 marks]

(iv) $6\sqrt{6} - \sqrt{24} + 3\sqrt{2 \times 3 \times 7^2}$

[2 marks]

Question 8

Simplify:

(i) $5\sqrt{63}$

(ii) $7\sqrt{200}$

(iii) $10\sqrt{216}$

(iv) $2\sqrt{90}$

(v) $11\sqrt{3 \times 5^3}$

(vi) $12\sqrt{2^5 \times 3^2}$

[6 marks]

Question 9

Write each of the following in the form $a + b\sqrt{c}$ for integer a , b and c .
Furthermore, c is to be square free.

[Your answers to **Question 8** will be helpful...]

(i) $\frac{18 + 5\sqrt{63}}{3}$

(ii) $\frac{14 + 7\sqrt{200}}{14}$

$$(iii) \quad \frac{45 + 10\sqrt{216}}{15}$$

$$(iv) \quad \frac{12 + 2\sqrt{90}}{3}$$

$$(v) \quad \frac{30 - 11\sqrt{375}}{5}$$

$$(vi) \quad \frac{36 + 12\sqrt{288}}{9}$$

[12 marks]

Question 10

Write in the form $a + b\sqrt{c}$ where a , b and c are integers.

Furthermore, c , is to be Free.

(i) $\frac{200 + 3\sqrt{1000}}{5}$

(ii) $\frac{-64 + 16\sqrt{88}}{32}$

(iii) $\frac{2 + 3\sqrt{156}}{2}$

[6 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk