

## Lesson 6

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

### 6.1 Surd arithmetic work-out

#### Example

Show how to calculate  $2\sqrt{15} \times 4\sqrt{10}$  without using a calculator.

Write your answer in the form  $a\sqrt{b}$  where  $a$  and  $b$  are integers and  $b$  is  $\square$  free.

[ 2 marks ]

### 6.2 Exercise

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

Marks Available : 50

***Do NOT use a calculator***

#### Question 1

Show how to calculate each of the following without using a calculator.

Write your answers in the form  $a\sqrt{b}$  where  $a$  and  $b$  are integers and  $b$  is  $\square$  free.

(i)  $5\sqrt{6} \times 11\sqrt{21}$

(ii)  $5\sqrt{14} \times 3\sqrt{10}$

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

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

[ 8 marks ]

**Question 2**

Show how to rationalise the denominator of the following without using a calculator. However, check your answer is correct by using a calculator.

(i)  $\frac{3}{2\sqrt{3}}$

(ii)  $\frac{3}{4\sqrt{5}}$

(iii)  $\frac{21}{\sqrt{7}}$

(iv)  $\frac{18}{11\sqrt{3}}$

[ 8 marks ]

**Question 3**

Show how to rationalise the denominator of the following without using a calculator. However, check your answer is correct by using a calculator.

(i)  $\frac{1}{2 - \sqrt{3}}$

(ii)  $\frac{1}{\sqrt{5} + \sqrt{3}}$

[ 3, 3 marks ]

**Question 4**

- (i) Write 252 as a product of primes.  
You may use the factorise button on your calculator, marked FACT

[ 1 mark ]

- (ii) If  $\sqrt{252} = x\sqrt{7}$  deduce the value of the integer  $x$

[ 2 marks ]

**Question 5**

- (i) Write 882 as a product of primes.  
You may use the factorise button on your calculator, marked FACT

[ 1 mark ]

- (ii) If  $\sqrt{882} = y\sqrt{2}$  deduce the value of the integer  $y$

[ 2 marks ]

**Question 6**

Combine your answers from questions 4 and 5 to determine  $\sqrt{252} \times \sqrt{882}$

[ 2 marks ]

**Question 7**

Show how to rationalise the denominator of the following without using a calculator.  
However, check your answer is correct by using a calculator.

(i)  $\frac{3}{2\sqrt{5} + 1}$

[ 4 marks ]

(ii)  $\frac{\sqrt{2}}{3\sqrt{2} - 1}$

[ 4 marks ]

**Question 8**

- ( i ) Write 2541 as a product of primes  
You may use the factorise button on your calculator

[ 1 mark ]

- ( ii ) Write 3024 as a product of primes  
You may use the factorise button on your calculator

[ 1 mark ]

- ( iii ) Show how to combine your answers to parts ( i ) and ( ii ) to determine the value of  $\sqrt{2541} + \sqrt{3024}$

[ 2 marks ]

**Question 9**

- ( i ) Write 3146 as a product of primes  
You may use the factorise button on your calculator

[ 1 mark ]

- ( ii ) Write 936 as a product of primes  
You may use the factorise button on your calculator

[ 1 mark ]

- ( iii ) Show how to combine your answers to parts ( i ) and ( ii ) to determine the value of  $\sqrt{3146} - \sqrt{936}$

[ 2 marks ]

**Question 10**

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

Show clear working that demonstrates that you did not use a calculator.

$$\frac{75 + 3\sqrt{6000}}{5}$$

**HINT :**  $\frac{a + b}{c} = \frac{a}{c} + \frac{b}{c}$

[ 4 marks ]

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In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**"

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Teachers may obtain detailed worked solutions to the exercises by email from [mhh@shrewsbury.org.uk](mailto:mhh@shrewsbury.org.uk)