

Lesson 4

A-Level Pure Mathematics : Year 1 Algebra of Surds and Indices II

4.1 TEST on Surds & Indices

There are 75 marks available

Solutions based entirely on graphical or numerical methods are not acceptable

Target Time : 80 minutes

Question 1

A-level C1 Examination Question, May 2013, Q1

Simplify

$$\frac{7 + \sqrt{5}}{\sqrt{5} - 1}$$

giving your answer in the form $a + b\sqrt{5}$, where a and b are integers.

Show full working.

[4 marks]

Question 2

A-Level C1 Examination Question, January 2008, Q2

(a) Write down the value of

$$16^{\frac{1}{4}}$$

[1 mark]

(b) Simplify

$$(16x^{12})^{\frac{3}{4}}$$

[2 marks]

Question 3

Without using a calculator, simplify each of the following.

Answers should be written with denominators that are rational.

(i)

$$\left(\frac{18x^5y^2}{128x} \right)^{-\frac{1}{2}}$$

[3 marks]

(ii)

$$\left(\frac{8z^2}{12\sqrt{2}} \right)^3$$

[3 marks]

(iii)

$$\left(\frac{49w^6}{27} \right)^{\frac{1}{2}}$$

[2 marks]

(iv)

$$\left(\frac{1 + \sqrt{2}}{\sqrt{3}} \right)^{-2}$$

[4 marks]

Question 4

Let a , b , c and d be positive integers.

Given that,

$$(a + b\sqrt{c})^2 = 6 + d\sqrt{c}$$

find the two possible sets of values of a , b , c , and d

[3 marks]

Question 5

Find the exact value of

$$(5\sqrt{2} + 6\sqrt{3} - 2\sqrt{6})(4\sqrt{2} - 2\sqrt{3} + 3\sqrt{6})$$

[5 marks]

Question 6

Given that

$$64\sqrt{2} = 2^a$$

find the value of a .

[2 marks]

Question 7

Solve the equation,

$$12 - x\sqrt{24} = \frac{6x}{\sqrt{2}}$$

Give an exact answer in as simple a form as possible.

[5 marks]

Question 8

Consider the function,

$$f(x) = \frac{x}{\sqrt{x} - x^2} \quad x \in \mathbb{R}, x > 1$$

- (i) Carefully explain the restriction upon the domain of the function.

[3 marks]

- (ii) Given, furthermore, that x is a square free number, rationalise the denominator of the function.
Simplify your answer.

[3 marks]

Question 9

Given that,

$$\sqrt{18 + 2\sqrt{77}} = \sqrt{a} + \sqrt{b} \quad \text{with } a > b$$

find the value of a and the value of b , both of which are integers.

[3 marks]

Question 10

Without using a calculator, and making your reasoning clear, find the square root of

$$2^7 \times 3^3 \times 5^2$$

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

[2 marks]

Question 11

A-Level C1 Examination Question, May 2016, Q3 (edited)

(a) Showing the reasons why, simplify,

$$\sqrt{50} - \sqrt{18}$$

giving your answer in the form $a\sqrt{2}$ where a is an integer

[2 marks]

(b) Hence, or otherwise, simplify

$$\frac{12\sqrt{3}}{\sqrt{50} - \sqrt{18}}$$

giving your answer in the form $b\sqrt{c}$, where b and c are integers and $b \neq 1$.
Show full working.

[3 marks]

Question 12

GCSE Examination Question, January 2016, Paper 4H, Q25

Given that,

$$y = 16 \times 10^{8k}$$

where k is an integer, find an expression, in terms of k for

$$y^{\frac{5}{4}}$$

Give your answer in standard form.

[3 marks]

Question 13

Given that,

$$(4 + \sqrt{p})(3\sqrt{p} - 1) = 17 + k\sqrt{p}$$

where p and k are prime numbers, find the value of p and the value of k

[3 marks]

Question 14

Given

$$\frac{9^x}{27^y} = \frac{1}{3\sqrt{3}}$$

express y as a function of x .

[4 marks]

Question 15

P1, January 2002, Q1

Given that

$$2^x = \frac{1}{\sqrt{2}} \quad \text{and} \quad 2^y = 4\sqrt{2}$$

(a) find the exact value of x and the exact value of y

[3 marks]

(b) calculate the exact value of

$$2^{y-x}$$

[2 marks]

Question 16

Carefully showing your working, rationalise the denominator of,

$$\frac{12\sqrt{3}}{\sqrt{2} + \sqrt{3} + \sqrt{5}}$$

[5 marks]

Question 17

Given that

$$s = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}}}}$$

determine the value of s .

Provide detailed reasoning to support your answer.

[5 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from MHHShrewsbury@Gmail.com