

Name

Class



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Surds

(9 – 1) Topic booklet

Higher

These questions have been collated from previous years GCSE Mathematics papers.

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
 - *there may be more space than you need.*
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out**.
- If the question is a **1H** question you are not allowed to use a calculator.
- If the question is a **2H** or a **3H** question, you may use a calculator to help you answer.

Information

- The marks for **each** question are shown in brackets
 - *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

**Answer ALL questions
Write your answers in the space provided.
You must write down all the stages in your working.**

13 $\sqrt{5}(\sqrt{8} + \sqrt{18})$ can be written in the form $a\sqrt{10}$ where a is an integer.

Find the value of a .

$a = \dots$

June 2018 – Paper 1H

(Total for Question 13 is 3 marks)

14 Show that $\frac{(4 - \sqrt{3})(4 + \sqrt{3})}{\sqrt{13}}$ simplifies to $\sqrt{13}$

Specimen 2 – Paper 1H

(Total for Question 14 is 2 marks)

15 Given that a is a prime number, rationalise the denominator of $\frac{1}{\sqrt{a} + 1}$

Give your answer in its simplest form.



June 2024 – Paper 2H

(Total for Question 15 is 2 marks)

16 (a) Rationalise the denominator of $\frac{22}{\sqrt{11}}$

Give your answer in its simplest form.

(2)

(b) Show that $\frac{\sqrt{3}}{2\sqrt{3} - 1}$ can be written in the form $\frac{a + \sqrt{3}}{b}$ where a and b are integers.

(3)

November 2019 – Paper 1H

(Total for Question 16 is 5 marks)

17 (a) Rationalise the denominator of $\frac{1}{\sqrt{7}}$

.....
(1)

(b) Simplify fully $\sqrt{80} - \sqrt{5}$

.....
(2)

18 (a) Express $\sqrt{3} + \sqrt{12}$ in the form $a\sqrt{3}$ where a is an integer.

(2)

(b) Express $\left(\frac{1}{\sqrt{3}}\right)^7$ in the form $\frac{\sqrt{b}}{c}$ where b and c are integers.

(3)

18 Simplify fully $(\sqrt{a} + \sqrt{4b})(\sqrt{a} - 2\sqrt{b})$



Specimen 2 – Paper 2H

(Total for Question 18 is 3 marks)

19 Solve $\frac{1}{2x-1} + \frac{3}{x-1} = 1$

Give your answer in the form $\frac{p \pm \sqrt{q}}{2}$ where p and q are integers.

19 Show that $\frac{8 + \sqrt{12}}{5 + \sqrt{3}}$ can be written in the form $\frac{a + \sqrt{3}}{b}$, where a and b are integers.

19 Solve $\frac{1}{x} - \frac{1}{x+1} = 4$

Give your answer in the form $a \pm b\sqrt{2}$ where a and b are fractions.

19 Simplify fully $\frac{(6 - \sqrt{5})(6 + \sqrt{5})}{\sqrt{31}}$

You must show your working.

20 Show that $\frac{\sqrt{180} - 2\sqrt{5}}{5\sqrt{5} - 5}$ can be written in the form $a + \frac{\sqrt{5}}{b}$ where a and b are integers.

20 Show that $\frac{(\sqrt{18} + \sqrt{2})^2}{\sqrt{8} - 2}$ can be written in the form $a(b + \sqrt{2})$ where a and b are integers.

20 Martin did this question.



Rationalise the denominator of $\frac{14}{2 + \sqrt{3}}$

Here is how he answered the question.

$$\begin{aligned}\frac{14}{2 + \sqrt{3}} &= \frac{14 \times (2 - \sqrt{3})}{(2 + \sqrt{3})(2 - \sqrt{3})} \\ &= \frac{28 - 14\sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} + 3} \\ &= \frac{28 - 14\sqrt{3}}{7} \\ &= 4 - 2\sqrt{3}\end{aligned}$$

Martin's answer is wrong.

(a) Find Martin's mistake.

(1)

Sian did this question.

Rationalise the denominator of $\frac{5}{\sqrt{12}}$

Here is how she answered the question.

$$\begin{aligned}\frac{5}{\sqrt{12}} &= \frac{5\sqrt{12}}{\sqrt{12} \times \sqrt{12}} \\ &= \frac{5 \times 3\sqrt{2}}{12} \\ &= \frac{5\sqrt{2}}{4}\end{aligned}$$

Sian's answer is wrong.

(b) Find Sian's mistake.

(1)

21 Show that $\frac{6 - \sqrt{8}}{\sqrt{2} - 1}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

23 Here are the first five terms of a geometric sequence.

$$\sqrt{5} \quad 10 \quad 20\sqrt{5} \quad 200 \quad 400\sqrt{5}$$

(a) Work out the next term of the sequence.

..... (2)

The 4th term of a different geometric sequence is $\frac{5\sqrt{2}}{4}$

The 6th term of this sequence is $\frac{5\sqrt{2}}{8}$

Given that the terms of this sequence are all positive,

(b) work out the first term of this sequence.

You must show all your working.

..... (3)

23 Show that $\frac{1}{1 + \frac{1}{\sqrt{2}}}$ can be written as $2 - \sqrt{2}$

Sample 1 – Paper 1H

(Total for Question 23 is 3 marks)

23 Write $\frac{3\sqrt{3}}{4 - \sqrt{3}} - \frac{2}{\sqrt{3}}$ in the form $\frac{a\sqrt{3} + b}{c}$ where a, b and c are integers.