

# Surds (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

|              |               |
|--------------|---------------|
| Name:        | Mel@JustMaths |
| Total Marks: |               |

1. Simplify  $\frac{3\sqrt{7}}{4+\sqrt{7}}$   $\frac{(4-\sqrt{7})}{(4-\sqrt{7})}$

$$\frac{12\sqrt{7} - 3\sqrt{7}\sqrt{7}}{16 - 4\sqrt{7} + 4\sqrt{7} - \sqrt{7}\sqrt{7}} = \frac{12\sqrt{7} - 3 \times 7}{16 - 7} = \frac{12\sqrt{7} - 21}{9}$$

$$= 3 \left( \frac{4\sqrt{7} - 7}{3} \right) = \frac{4\sqrt{7} - 7}{3} \quad [4]$$

2. Rationalise the denominator and simplify  $\frac{10}{3\sqrt{5}} \times \frac{3\sqrt{5}}{3\sqrt{5}}$

$$\frac{30\sqrt{5}}{9 \times 5} = \frac{30\sqrt{5}}{45} = \frac{2\sqrt{5}}{3} \quad [2]$$

3. Without using a calculator, show that  $\sqrt{20} = 2\sqrt{5}$

$$\sqrt{20} = \sqrt{4 \times 5} = \sqrt{4} \times \sqrt{5} = 2\sqrt{5} \quad [2]$$

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

$$\frac{1}{1+\frac{1}{\sqrt{2}}} = \frac{1}{\frac{\sqrt{2}+1}{\sqrt{2}}} = 1 \times \frac{\sqrt{2}}{\sqrt{2}+1}$$

$$= \frac{\sqrt{2}}{\sqrt{2}+1}$$

rationalising the denominator

$$\frac{\sqrt{2}(\sqrt{2}-1)}{(\sqrt{2}+1)(\sqrt{2}-1)} = \frac{2-\sqrt{2}}{2-1} = \underline{\underline{2-\sqrt{2}}} \quad [3]$$

5. a) Write this list of numbers in order, smallest first.

we know  $\sqrt{36} = 6$

$\sqrt{35}$        $\frac{20}{3}$   $6\frac{2}{3}$        $2.5^2$        $6.83$

$6.25$

(a)  $\sqrt{35}$  .....  $2.5^2$  .....  $\frac{20}{3}$  .....  $6.83$  ..... [2]

b) Write  $(1 + \sqrt{3})^2$  in the form  $a + b\sqrt{3}$ .

$$\begin{aligned} (1 + \sqrt{3})(1 + \sqrt{3}) \\ 1 + \sqrt{3} + \sqrt{3} + 3 \\ = 4 + 2\sqrt{3} \end{aligned}$$

b)  $4 + 2\sqrt{3}$  ..... [3]

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

$$\frac{16 + \cancel{4\sqrt{3}} - \cancel{4\sqrt{3}} - 3}{\sqrt{13}} = \frac{13}{\sqrt{13}} \quad \frac{13}{\sqrt{13}} \frac{\sqrt{13}}{\sqrt{13}} = \frac{13\sqrt{13}}{13} = \sqrt{13}$$

[2]

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

$$\begin{aligned} a - 2\sqrt{a}\sqrt{b} + 2\sqrt{a}\sqrt{b} - 4b \\ = a - 4b \end{aligned}$$

[3]

8. Simplify fully  $\frac{(6 - \sqrt{5})(6 + \sqrt{5})}{\sqrt{31}}$   $\frac{36 + \cancel{6\sqrt{5}} - \cancel{6\sqrt{5}} - 5}{\sqrt{31}}$

You must show your working.

$$= \frac{31}{\sqrt{31}}$$

rationalising  $\frac{31\sqrt{31}}{\sqrt{31}\sqrt{31}} = \frac{31\sqrt{31}}{31} = \sqrt{31}$

[3]

9. Write  $\frac{26}{\sqrt{2}} - \frac{12}{\sqrt{18}} + 2\sqrt{50}$  in the form  $a\sqrt{2}$  where  $a$  is an integer

$$\frac{26\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{26\sqrt{2}}{2} = 13\sqrt{2}$$

$$\begin{aligned} 13\sqrt{2} - 2\sqrt{2} + 10\sqrt{2} \\ = 21\sqrt{2} \end{aligned}$$

$$\begin{aligned} \frac{12}{\sqrt{18}} &= \frac{12}{\sqrt{9}\sqrt{2}} = \frac{12}{3\sqrt{2}} = \frac{4}{\sqrt{2}} \\ \frac{4}{\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}} &= \frac{4\sqrt{2}}{2} = 2\sqrt{2} \end{aligned}$$

[4]

$$2\sqrt{50} = 2\sqrt{2}\sqrt{25} = 2 \times 5 \times \sqrt{2} = 10\sqrt{2}$$

10. a) Show that  $\sqrt{396}$  can be written as  $6\sqrt{11}$

$$\begin{aligned}\sqrt{396} &= \sqrt{36 \times 11} \\ &= 6\sqrt{11}\end{aligned}$$

[2]

b) Without using a calculator, show that  $\frac{4+2\sqrt{2}}{2-\sqrt{2}}$  can be simplified to  $6+4\sqrt{2}$

$$\begin{aligned}\frac{(4+2\sqrt{2})(2+\sqrt{2})}{(2-\sqrt{2})(2+\sqrt{2})} &= \frac{8+4\sqrt{2}+4\sqrt{2}+2 \times 2}{4+\cancel{2\sqrt{2}}-\cancel{2\sqrt{2}}-2} \\ &= \frac{12+8\sqrt{2}}{2} \\ &= \frac{2(6+4\sqrt{2})}{2} \\ &= 6+4\sqrt{2}\end{aligned}$$

[6]

11. Write  $\sqrt{12} + \frac{15}{\sqrt{3}}$  in the form  $a\sqrt{b}$  where  $a$  and  $b$  are prime numbers

$$\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$$

$$2\sqrt{3} + 5\sqrt{3} = 7\sqrt{3}$$

$$\frac{15}{\sqrt{3}} = \frac{15\sqrt{3}}{\sqrt{3}\sqrt{3}} = \frac{15\sqrt{3}}{3} = 5\sqrt{3}$$

[3]

12. A calculator gives a value of  $\pi$  as 3.14159

An approximation for  $\pi$  is  $\sqrt{\frac{40}{3}} - \sqrt{12} = 3.141533339$

Show that the value of the approximation is within 0.01% of the calculator value.

$$\begin{aligned}\text{Difference} &= 3.14159 - 3.141533339 \\ &= 0.0005666129\end{aligned}$$

[4]

$$\begin{aligned}\% &= \frac{0.0005666129}{3.14159} \times 100 = 0.0018\% \\ &\text{which is } < 0.01\%\end{aligned}$$

## CREDITS AND NOTES

| Question | Awarding Body   | Question | Awarding Body |
|----------|-----------------|----------|---------------|
| 1        | WJEC Eduqas     | 11       | AQA           |
| 2        | AQA             | 12       | AQA           |
| 3        | OCR             |          |               |
| 4        | Pearson Edexcel |          |               |
| 5        | OCR             |          |               |
| 6        | Pearson Edexcel |          |               |
| 7        | Pearson Edexcel |          |               |
| 8        | Pearson Edexcel |          |               |
| 9        | AQA             |          |               |
| 10       | OCR             |          |               |

### Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board s (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.



### Links:

AQA <http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300>

OCR <http://ocr.org.uk/gcsemaths>

Pearson Edexcel <http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html>

WJEC Eduqas <http://www.eduqas.co.uk/qualifications/mathematics/gcse/>

### Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material