EXAM PAPERS PRACTICE

GCSE OCR Math J560

Surds

Answers

"We will help you to achieve A Star "

Answer 1

Work out the value of $\left(\sqrt{12}-\sqrt{3}\right)^2$

$(\sqrt{12}-\sqrt{3})(\sqrt{12}-\sqrt{3})$ = F O I L $12-\sqrt{36}-\sqrt{36}+3$

$= 12-6-6+3$

$= 3$

Answer 2

ABD is a right angled triangle.

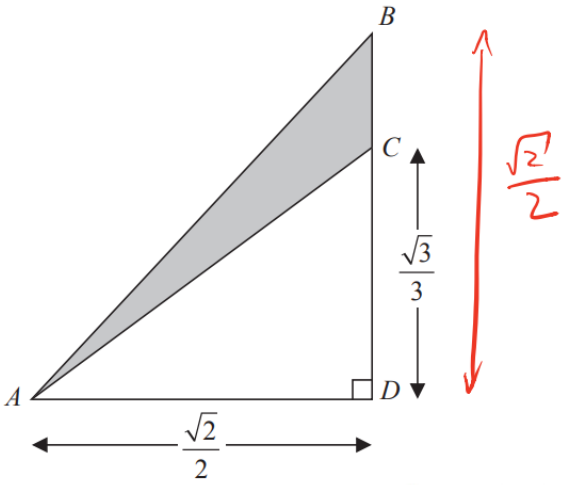


Diagram **NOT** accurately drawn

All measurements are given in centimetres.

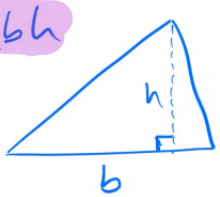
C is the point on BD such that $CD = \frac{\sqrt{3}}{3}$

$AD = BD = \frac{\sqrt{2}}{2}$

Work out the exact area, in cm^2, of the shaded region.

AREA OF TRIANGLE

$A = \frac{1}{2}bh$



SHADED AREA = AREA OF ABD − AREA OF ACD

$= \frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{2}}{2} - \frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{3}$

$= \frac{2}{8} - \frac{\sqrt{6}}{12}$

$= \frac{1}{4} - \frac{\sqrt{6}}{12}$

Answer 3

Rationalise the denominator of $\frac{12}{\sqrt{3}}$

"MAKE RATIONAL" "BOTTOM"

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

Answer 4

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

SURDS

TOP: $(4-\sqrt{3})(4+\sqrt{3})$

F O I L

$= 16 + 4\sqrt{3} - 4\sqrt{3} - 3$

$= 13$

WHOLE: $\frac{(4-\sqrt{3})(4+\sqrt{3})}{\sqrt{13}} = \frac{13}{\sqrt{13}} \times \frac{\sqrt{13}}{\sqrt{13}}$

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

$= \sqrt{13}$

Answer 5

Rationalise the denominator of $\frac{10}{\sqrt{5}}$

Give your answer in its simplest form.

$\sqrt{5}$ IS A SURD (IRRATIONAL NUMBER)

NB. $\sqrt{5} \times \sqrt{5} = 5$ ← RATIONAL NUMBER

$$\frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\cancel{10}\sqrt{5}}{\cancel{5}_1}$$

$$= 2\sqrt{5}$$

Answer 6

SURDS

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

↳ "WHOLE NUMBER"

Find the value of a.

$\sqrt{5}(\sqrt{8} + \sqrt{18}) = \sqrt{40} + \sqrt{90}$

$= \sqrt{4} \times \sqrt{10} + \sqrt{9} \times \sqrt{10}$

$= 2\sqrt{10} + 3\sqrt{10}$

$= 5\sqrt{10}$

So $a = 5$

Answer 7

SURDS

(a) Rationalise the denominator of $\frac{5}{\sqrt{2}}$ $\times \frac{\sqrt{2}}{\sqrt{2}}$

$= \frac{5\sqrt{2}}{2}$

Answer 8

(b) Expand and simplify $(2 + \sqrt{3})^2 - (2 - \sqrt{3})^2$

$= (2+\sqrt{3})(2+\sqrt{3}) - (2-\sqrt{3})(2-\sqrt{3})$

F O I L F O I L

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

$= 4\sqrt{3} + 2\sqrt{3} + 2\sqrt{3}$

$= 8\sqrt{3}$

OR $a^2 - b^2 = (a+b)(a-b)$ DOTS

Let $a = 2 + \sqrt{3}$, $b = 2 - \sqrt{3}$

$a^2 - b^2 = (2 + \sqrt{3} + 2 - \sqrt{3})(2 + \sqrt{3} - (2 - \sqrt{3}))$

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

$= 8\sqrt{3}$

Answer 9

SURDS

$a = \sqrt{8} + 2$

$b = \sqrt{8} - 2$

$T = a^2 - b^2$

Work out the value of T.

Give your answer in the form $c\sqrt{2}$ where c is an integer. — WHOLE NUMBER

$T = a^2 - b^2$

$= (\sqrt{8}+2)^2 - (\sqrt{8}-2)^2$

$= (\sqrt{8}+2)(\sqrt{8}+2) - (\sqrt{8}-2)(\sqrt{8}-2)$

F O I L F O I L

$= 8 + 2\sqrt{8} + 2\sqrt{8} + 4 - (8 - 2\sqrt{8} - 2\sqrt{8} + 4)$

$= 8 + 2\sqrt{8} + 2\sqrt{8} + 4 - 8 + 2\sqrt{8} + 2\sqrt{8} - 4$

$= 8\sqrt{8}$

$= 8 \times 2\sqrt{2}$

$= 16\sqrt{2}$

$\sqrt{8} = \sqrt{4} \times \sqrt{2}$

$= 2\sqrt{2}$

Answer 10

SURDS

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.

WHOLE NUMBER

$$\frac{6-\sqrt{8}}{(\sqrt{2}-1)} \times \frac{\sqrt{2}+1}{(\sqrt{2}+1)}$$

DIFFERENCE OF TWO SQUARES

$$a^2 - b^2 = (a-b)(a+b)$$

$$2 - 1 = (\sqrt{2}-1)(\sqrt{2}+1)$$

$$= \frac{(6-\sqrt{8})\times(\sqrt{2}+1)}{1}$$

F O I L

$$= 6\sqrt{2} + 6 - \sqrt{8}\sqrt{2} - \sqrt{8}$$

$$= 6\sqrt{2} + 6 - 4 - 2\sqrt{2}$$

$$= 2 + 4\sqrt{2}$$

$$\sqrt{8}\times\sqrt{2} = \sqrt{16}$$
$$= 4$$

$$\sqrt{8} = \sqrt{4}\times\sqrt{2}$$
$$= 2\sqrt{2}$$

Answer 11

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

You must show your working.

SURDS

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

F O I L

$= \frac{36 + 6\sqrt{5} - 6\sqrt{5} - 5}{\sqrt{31}}$

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

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

$= \sqrt{31}$

Answer 12

Martin did this question.

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

Here is how he answered the question.

$$\frac{14}{2+\sqrt{3}} = \frac{14\times(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$$

$$= \frac{28-14\sqrt{3}}{4+2\sqrt{3}-2\sqrt{3}+3}$$

$$= \frac{28-14\sqrt{3}}{7}$$

$$= 4-2\sqrt{3}$$

$\frac{14}{(2+\sqrt{3})} \times \frac{(2-\sqrt{3})}{(2-\sqrt{3})}$

$= \frac{28-14\sqrt{3}}{4-2\sqrt{3}+2\sqrt{3}-3}$

F O I L

Martin's answer is wrong.

(a) Find Martin's mistake.

HE DID $\sqrt{3} \times -\sqrt{3} = +3$ X

Answer 13

Sian did this question.

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

Here is how she answered the question.

$$\frac{5}{\sqrt{12}} = \frac{5\sqrt{12}}{\sqrt{12} \times \sqrt{12}}$$

$$= \frac{5 \times 3\sqrt{2}}{12}$$

$$= \frac{5\sqrt{2}}{4}$$

$\frac{5}{\sqrt{12}} \times \frac{\sqrt{12}}{\sqrt{12}}$

$= \frac{5 \times 2\sqrt{3}}{12}$

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

$= 2\sqrt{3}$

Sian's answer is wrong.

(b) Find Sian's mistake.

SHE DID $\sqrt{12} = 3\sqrt{2}$

INSTEAD OF $\sqrt{12} = 2\sqrt{3}$

Answer 14

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

SURDS

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

"RATIONALISE THE DENOMINATOR"

$$= \frac{\sqrt{2}(\sqrt{2}-1)}{(\sqrt{2}+1)(\sqrt{2}-1)}$$

$$= \frac{2-\sqrt{2}}{\text{F}\quad\text{O}\quad\text{I}\quad\text{L}}$$

$$2 - \sqrt{2} + \sqrt{2} - 1$$

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

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