



Surds

About 50 minutes No calculator 41 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks] **A2** Last lesson [2 marks]
- $x^2 = 49$ and $y^3 = -216$. Find the smallest possible value of $x + y$.
- Work out $\left(\frac{1}{64}\right)^{-\frac{2}{3}}$. Give your answer as a fraction or a whole number.

Answer

Answer

- A3** From chapter 6 [2 marks] **A4** From chapter 16 [2 marks]
- The bearing of B from A is 224° .
The bearing of C from B is 312° .
Work out the size of angle ABC .
- Write $0.\dot{0}\dot{2}$ as a fraction in its simplest form.

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Simplify $\sqrt{63} + \sqrt{28}$.**Hint** Take the largest square factor out of each root first.

- B1**
- Simplify
- $\sqrt{98} + \sqrt{8}$
- . [2 marks]

Answer

EXAMPLE 2

Rationalise the denominator of $\frac{4}{3 + \sqrt{5}}$.**Hint** Multiply the top and the bottom by $3 - \sqrt{5}$.

- B2**
- Rationalise the denominator of [3 marks]

$$\frac{6}{4 - \sqrt{10}}$$

Answer

C Practice

C1 Simplify $\sqrt{180}$. [2 marks]

Answer

C2 Work out $\sqrt{10} \times \sqrt{22}$. Give your answer in its simplest form. [2 marks]

Answer

C3 Expand and simplify $(2 + \sqrt{7})(5 - \sqrt{7})$. [2 marks]

Answer

C4 Rationalise the denominator of $\frac{20}{\sqrt{10}}$. [2 marks]

Answer

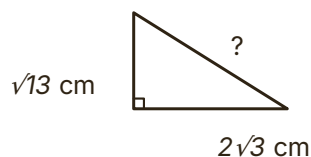
C5 Simplify $\frac{\sqrt{192}}{\sqrt{6}}$. [2 marks]

Answer

C6 $\sqrt{60} + \sqrt{135} = \sqrt{k}$. Find the value of k . [2 marks]

Answer $k = \dots$

C7 A right-angled triangle has shorter sides of length $2\sqrt{3}$ cm and $\sqrt{13}$ cm. The diagram is not drawn accurately. Work out the length of the longest side. [2 marks]



Answer

C8 Expand and simplify $\sqrt{8}(\sqrt{2} + \sqrt{6})$. [2 marks]

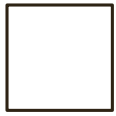
Answer

D Exam-style questions

D1 Zoe says, " $\sqrt{12} + \sqrt{3} = \sqrt{15}$." [2 marks]

Show that Zoe is wrong, and write $\sqrt{12} + \sqrt{3}$ in its simplest form.

D2 A square has sides of length $(1 + \sqrt{5})$ cm.



$(1 + \sqrt{5})$ cm

(a) Show that the area of the square is $(6 + 2\sqrt{5})$ cm². [2 marks]

(b) Write the length of a diagonal of the square in the form $\sqrt{a} + \sqrt{b}$. [2 marks]

Answer

(c) A rectangle has the same area as the square. Its width is $(\sqrt{5} - 1)$ cm. Work out its length. Give your answer in the form $a + b\sqrt{5}$. [3 marks]

Answer

Total for D2: 7 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 Work out the exact value of $\frac{1}{\sqrt{2} + 1} + \frac{1}{\sqrt{3} + \sqrt{2}} + \frac{1}{2 + \sqrt{3}}$. [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

E1 **Hint 1** Rationalise the denominator of each fraction on its own.

Hint 2 $(\sqrt{2} + 1)(\sqrt{2} - 1) = 1$, so $\frac{1}{\sqrt{2} + 1} = \sqrt{2} - 1$.

Hint 3 In the same way the others are $\sqrt{3} - \sqrt{2}$ and $2 - \sqrt{3}$. Adding, everything cancels except $2 - 1 = 1$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can simplify a surd and add surds with the same root.



I can multiply surds and expand brackets with surds in them.



I can rationalise the denominator of a fraction and use surds in Pythagoras.

