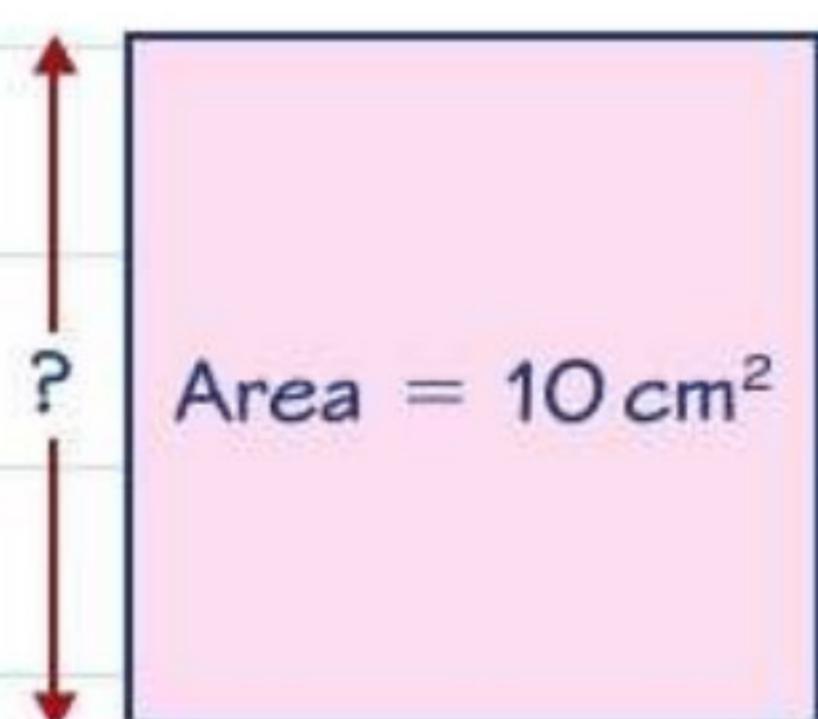


Tricky
Topic

You can give exact answers to calculations by leaving some numbers as square roots.



This square has a side length of $\sqrt{10}$ cm.

You can't write $\sqrt{10}$ exactly as a decimal number. It is called a **surd**.

Surds 1

Rules for simplifying square roots

These are the most important rules to remember when dealing with surds:

$$1 \quad \sqrt{ab} = \sqrt{a} \times \sqrt{b} \quad \sqrt{8} = \sqrt{4} \times \sqrt{2} = 2\sqrt{2}$$

$$2 \quad \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \quad \sqrt{\frac{3}{25}} = \frac{\sqrt{3}}{\sqrt{25}} = \frac{\sqrt{3}}{5}$$

You need to remember these rules for your exam.

Worked example

Target grade 7

Show that $\sqrt{45} = 3\sqrt{5}$

Show each stage of your working clearly. (2 marks)

$$\begin{aligned} \sqrt{45} &= \sqrt{9 \times 5} \\ &= \sqrt{9} \times \sqrt{5} \\ &= 3\sqrt{5} \end{aligned}$$

Rationalising the denominator of a fraction means making the denominator a whole number.

You can do this by multiplying the top and bottom of the fraction by the surd part in the denominator.

$$\frac{5}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{6}$$

The surd part of the denominator is $\sqrt{2}$

Remember that $\sqrt{2} \times \sqrt{2} = 2$
So $3\sqrt{2} \times \sqrt{2} = 3 \times 2 = 6$

This question says 'Show that...' so you can't use your calculator. You need to show each step of your working clearly:

1. Look for a factor of 45 which is a square number: $45 = 9 \times 5$
2. Use the rule $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ to split the square root into two square roots.
3. Write $\sqrt{9}$ as a whole number.

Good form

Most surd questions ask you to write a number or answer in a certain **form**.

This means you need to find **integers** for all the letters in the expression.

$6\sqrt{3}$ is in the form $k\sqrt{3}$

$$k = 6$$

The integers can be positive or negative.

$4 - 9\sqrt{2}$ is in the form $p + q\sqrt{2}$

$$p = 4 \text{ and } q = -9$$

You can check your answer by writing down the integer value for each letter.

Now try this

Target grade

8

1 Write $\sqrt{32} + \sqrt{98}$ in the form $p\sqrt{2}$ where p is an integer. Show each stage of your working clearly. (2 marks)

2 Show that $\frac{35}{\sqrt{7}} = 5\sqrt{7}$ (2 marks)

Rationalise the denominator by multiplying top and bottom by $\sqrt{7}$

Find factors of 32 and 98 which are **square** numbers.

Target grade

9

3 x is an integer such that

$$\frac{\sqrt{x} \times \sqrt{18}}{\sqrt{3}} = 8\sqrt{3}$$

Find the value of x . (4 marks)