

Surds, Indices, Calculator Need to Know

Surds

A surd is a number square rooted

A simple surd is of the form $a\sqrt{b}$. The number in front a is called the rational part and the square root \sqrt{b} is called the irrational part. This is exactly the same as algebra and so most of the rules are the same as the rules in algebra.

Remember if there seems to be no number in front that number is really 1.

Simplifying Surds

Here we are trying to break down surds by getting the number inside the square root as small as possible.

$$\sqrt{ab} = \sqrt{a}\sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

$$\sqrt{a^2} = (\sqrt{a})^2 = a$$

$$\sqrt{a+b} \neq \sqrt{a} + \sqrt{b}$$

Note What we are looking for is to break up surds in two more surds but one of which we can find the square root of in our heads.

Note Remember what the square roots of 4, 9, 16, 25, 36, 49, 64, 81, 100, 121 and 144 are.

Simplify surds. Split into two numbers one of which we know the square root of.

Adding and Subtracting Surds

This is the same as in algebra except instead of having letters we have square roots.

Only add like surds. Add the numbers in front.

Multiply surds

Done just the same as in algebra so remember the following

$$a(x + y) = ax + ay$$

$$(a + b)(x + y) = ax + ay + bx + by$$

$$\sqrt{a}\sqrt{a} = a$$

Division of Surds

When there is a single surd on the bottom multiply above and below by that surd

The surd will not disappear altogether but there will be no surd on the bottom.

Surd equations

These are question with a square root and an equals sign.

Note Square and square root cancel each other out.

Step 1 Bring the square root to one side and everything else to the other.

Step 2 Square both sides usually to get quadratic equation.

Step 3 Solve the quadratic equation.

Note Must check your answers because when dealing with surd the square root is positive only.

Indices

There are 6 rules and 3 properties of indices that you must learn before you can do any of this.

Rules

$$a^m \times a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$a^0 = 1$$

$$\frac{1}{a^m} = a^{-m}$$

$$(a^m)^n = a^{mn}$$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

Properties of indices

$$(ab)^n = a^n b^n$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$(a+b)^n \neq a^n + b^n$$

Evaluations

Simplify $\frac{3^2 \times 9^{\frac{1}{2}}}{3^4 \times 27^{\frac{2}{3}}}$. Give your answer in the form 3^n , where $n \in \mathbb{Z}$

Figure out each part and put back together.

Note $\sqrt{a} = a^{\frac{1}{2}}$ or $a^{\frac{1}{2}} = \sqrt{a}$

Unknown in the powers

Find the value of x in each of the following $8^x = \frac{16}{\sqrt{2}}$

The main idea is to change all the numbers to the same base and then use the rules of indices to have one power = one power so that the powers must be equal.

Calculator Use

Scientific notation

This is one of the easier parts to deal with as we use the EXP button on the calculator

A number in scientific notation is written in the form $a.bc \times 10^n$ so it has only one digit before the decimal point.

A big number has a positive power on the 10.

$$2300000 = 2.3 \times 10^6$$

$$1.5 \times 10^4 = 15000$$

A small number has a negative power on the 10.

$$0.0000023 = 2.3 \times 10^{-6}$$

$$1.5 \times 10^{-4} = 0.00015$$

Decimal Places

This is when we asked to round off our answer to a required number of decimal places.

If we are asked to round off to two decimal places we need to have only two digits after the decimal point.

Significant Figures

This is nearly the same as decimal places but this time we are to round off to two significant figures we need to have only two digits and every other digit must turn into zeros.

Estimations and calculator use

Square roots

$$\sqrt{41.5} = \boxed{\sqrt{\quad}} 41.5 = 6.44$$

Powers

$$(4.1)^3 = 4.1 \boxed{y^x} 3 = 68.921$$

Fractions or reciprocals

$$\frac{1}{3.5} = 1 \boxed{\div} 3.5 = 0.2875714286$$

Estimations

This is where we need to round a number so that it is easy to evaluate.

Estimate the value of $\sqrt{34.56}$

Have to decide which number 34.56 is closest to, which we know the root of.
Answer 36

$$\sqrt{34.56} \text{ is approximately } = 6.$$

Estimate the value of $(5.3)^3$

5.3 is close to 5

$$(5.3)^3 \text{ is approximately } = 5^3 = 125$$

Estimate the value of $\frac{1}{0.23}$

0.23 is close to 0.2

$$\frac{1}{0.23} \text{ approximately } = \frac{1}{0.2} = 5$$

How to use fractions on the calculator

We need to be able to use the $\frac{a}{b} \div c$