

Surds

The PowerPoint contains the slides shown below and these give an animated presentation explaining how to use surds to write the value of a number having an irrational square root such as, for example, $\sqrt{20}$ in surd form. There are questions with answers.

Surds

Objective: Use surds to write the value of a number having an irrational square root such as, for example, $\sqrt{20}$ in surd form

☆ **1**

Sometimes, the square root of a number is a whole number. All of these square roots, for example, are whole numbers:
 $\sqrt{9} = 3, \sqrt{25} = 5, \sqrt{81} = 9, \sqrt{625} = 25$

But often this is not the case and the answer is a decimal that goes on forever without recurring.
 The square root of 2 is an example of this
 $\sqrt{2} = 1.414213562...$

Goes on for ever and has no recurring pattern

☆ **2**

The Greeks discovered this in their work with Pythagoras' theorem.

They could see that a right angle triangle like this one had a hypotenuse with an exact size but could not calculate it exactly!

$h^2 = 1^2 + 1^2$
 $h^2 = 1 + 1$
 $h^2 = 2$
 $h = \sqrt{2}$
 $h = 1.414213562...$

☆ **3**

We call numbers like the $\sqrt{2}$ *irrational numbers* because we know that they exist but cannot find their exact values.

The square root of any prime number, for example, is an irrational number.

In real life, we rarely need exact answers so we can find an approximation for an irrational number of a suitable accuracy to fulfil our needs.

☆ **4**

But pure mathematicians want to give exact answers, and they would write an irrational square roots exactly like this

$\sqrt{50} = 7.071067812...$
 $\sqrt{50} = 5\sqrt{2}$

This is called surd form

☆ **5**

Sometimes, you may be asked to write a square root in surd form. Here is how to do it...

☆ **6**

To write a number in surd form, we need to know the square numbers. Here are the first fourteen square numbers:
 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225

Square numbers can be found by
 $2 \times 2 = 4$
 $3 \times 3 = 9$
 $4 \times 4 = 16$
 $5 \times 5 = 25$
 etc.

☆ **7**

Here is an example of how we would use a square to write $\sqrt{18}$ in surd form...

Find the largest square number that will divide exactly into 18

Use this square number to write $\sqrt{18}$ as...

$18 \div 4 = 4r2$
 $18 \div 9 = 2$

9 is the largest

Take out the square root of 9 like this...

$\sqrt{18} = \sqrt{9 \times 2}$
 $\Rightarrow \sqrt{18} = 3\sqrt{2}$

This is $\sqrt{18}$ in surd form

☆ **8**

Here is another example of how to write $\sqrt{75}$ in surd form...

Find the largest square number that will divide exactly into 75

Use 25 to write $\sqrt{75}$ as...

$\sqrt{75} = \sqrt{25 \times 3}$
 $\Rightarrow \sqrt{75} = 5\sqrt{3}$

Take out the square root of 25 like this...

This is $\sqrt{75}$ in surd form

$75 \div 4 = 18r3$
 $75 \div 9 = 8r3$
 $75 \div 16 = 4r11$
 $75 \div 25 = 3$

☆ **9**

Write in surd form

1. $\sqrt{8}$	6. $\sqrt{32}$
2. $\sqrt{12}$	7. $\sqrt{50}$
3. $\sqrt{20}$	8. $\sqrt{63}$
4. $\sqrt{28}$	9. $\sqrt{45}$
5. $\sqrt{27}$	10. $\sqrt{300}$

☆ **10**

Write in surd form

1. $\sqrt{8} = 2\sqrt{2}$	6. $\sqrt{32} = 4\sqrt{2}$
2. $\sqrt{12} = 2\sqrt{3}$	7. $\sqrt{50} = 5\sqrt{2}$
3. $\sqrt{20} = 2\sqrt{5}$	8. $\sqrt{63} = 3\sqrt{7}$
4. $\sqrt{28} = 2\sqrt{7}$	9. $\sqrt{45} = 3\sqrt{5}$
5. $\sqrt{27} = 3\sqrt{3}$	10. $\sqrt{300} = 10\sqrt{3}$

☆ **11**