

Lesson 12 – Uses of Prime Factorisation

Starter

Write the following numbers as the product of prime factors

- 1) 80
- 2) 28
- 3) 420
- 4) 1680

Starter Answers

- 1) $2^4 \times 5$ 2) $2^2 \times 7$ 3) $2^2 \times 3 \times 5 \times 7$ 4) $2^4 \times 3 \times 5 \times 7$

In this lesson, we will look at two main uses of prime factorisation.

Finding Factors

We can find the factors of a number by using the prime factorisation.

Example 1

Find the factors of 12.

$$12 = 2 \times 2 \times 3$$

First use a factor tree to find the product of prime factors

2

3

$$2 \times 2 = 4$$

$$2 \times 3 = 6$$

$$2 \times 2 \times 3 = 12$$

Apart from the factor of 1, the factors of 12 can be made using combinations of the prime factors

So the factors of 12 are 1, 2, 3, 4, 6 and 12

Example 2

Find the factors of 100

$$100 = 2 \times 2 \times 5 \times 5$$

2

5

$$2 \times 2 = 4$$

$$2 \times 5 = 10$$

$$5 \times 5 = 25$$

$$2 \times 2 \times 5 = 20$$

$$5 \times 5 \times 2 = 50$$

$$2 \times 2 \times 5 \times 5 = 100$$

The factors of 100 are 1, 2, 4, 5, 10, 20, 25, 50 and 100

Finding Square Roots

We can also use prime factorisation to find the **square root** of a number. The square root of a number is the opposite of squaring a number.

$$\begin{aligned}\sqrt{25} &= 5 && \text{because } 5^2 = 25 \\ \sqrt{36} &= 6 && \text{because } 6^2 = 36 \\ \sqrt{49} &= 7 && \text{because } 7^2 = 49\end{aligned}$$

Example 3

Find the square root of 196

$$196 = 2 \times 2 \times 7 \times 7$$

first use a factor tree to write 196 as the product of prime factors

$$196 = (2 \times 7) \times (2 \times 7)$$

since we can do multiplication in any order, we can rewrite the calculation like this.

Now you can see that we have 2 x 7 multiplied by itself

$$196 = 14 \times 14$$

$$\text{So, } \sqrt{196} = 14$$

Example 4

Find the square root of 784

$$784 = 2 \times 2 \times 2 \times 2 \times 7 \times 7$$

$$784 = (2 \times 2 \times 7) \times (2 \times 2 \times 7)$$

$$784 = 28 \times 28$$

$$\sqrt{784} = 28$$

Example 5

What is the smallest number you could multiply 180 by to make a square number?

$$180 = 2 \times 2 \times 3 \times 3 \times 5$$

Split 180 into the product of prime factors

$$180 = (2 \times 3 \times 5) \times (2 \times 3 \times ?)$$

You can see that the missing number has to be a 5 to make it match the other number

$$\text{Answer} = 5$$