Expressing a number as a product of prime factors:

Every number can be expressed as a product of its prime factors in a unique (only one) way.

Let's look at a couple of examples, using different methods (ladder and tree)

600 using a ladder

600 using a tree

	600

480 using a ladder

480 using a tree

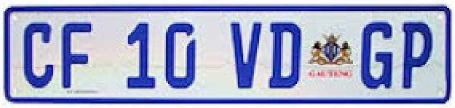
	480

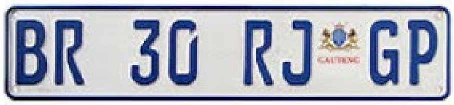
12100 using a ladder

12100 using a tree

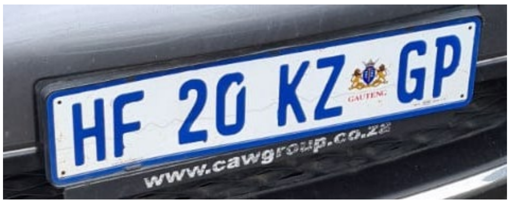
	12100

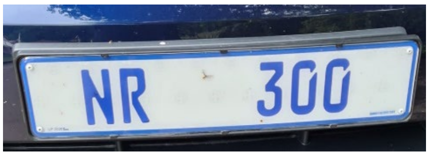
This is a skill you can practice. The new Gauteng number plates have a two-digit number in them. See how quickly you can factorise them!

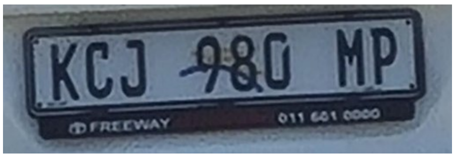


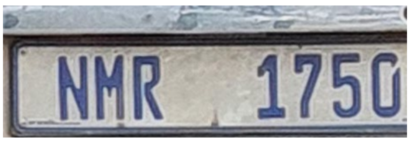


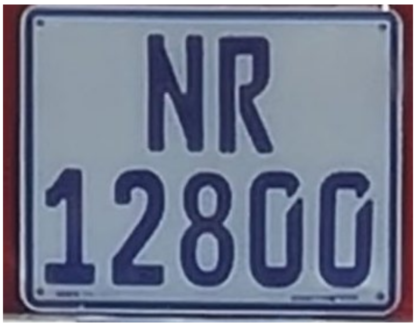
What about these ones?











Your teacher will create some more Gauteng number plates for you to prime factorise – as quickly as you can – see who is the quickest in your class!

9. Express the following as a product of prime numbers using any method you choose:

a. 36

b. 100

c. 350

d. 510

e. 16200

Four great reasons to prime factorise!

There is at least one more but we only come across it later this year!

Finding the HCF of two or more numbers by prime factors

1. Write each of the numbers as a product of its prime factors
2. Next, we write down only those bases that occur in **all** the numbers
3. We give each base the **lowest** power that occurs

e.g.

$$24 \quad and \quad 28 \quad and \quad 300$$
$$= 2^3 \times 3 \qquad = 2^2 \times 7 \qquad = 2^2 \times 3 \times 5^2$$
$$the\ only\ common\ base\ is\ 2$$
$$we\ choose\ the\ lowest\ power\ for\ it\ which\ is\ 1$$
$$so,\ our\ HCF\ is\ 2^2 = 4$$

Find the HCF of:

200, 300 and 4800

Find the HCF of:

$180 = 2^2 \times 3^2 \times 5 \quad and \quad 264600 = 2^3 \times 3^3 \times 5^2 \times 7^2$

Finding the LCM of two or more numbers by prime factors

1. Write each of the numbers as a product of its prime factors
2. Next, we write down **all** the bases that occur
3. We give each base the **highest** power that occurs

e.g.

$$\begin{array}{lll} 24 \quad \textit{and} & 28 \quad \textit{and} & 150 \\ = 2^3 \times 3 & = 2^2 \times 7 & = 2 \times 3 \times 5^2 \end{array}$$

$$\textit{we use } 2, 3, 5 \textit{ and } 7 \textit{ as our bases}$$

$$\underline{\textit{and our LCM} = 2^3 \times 3^1 \times 5^2 \times 7 = 4200} \rightarrow$$

Find the LCM of:

200, 300 and 350

Find the LCM of:

$180 = 2^2 \times 3^2 \times 5 \quad \textit{and} \quad 264600 = 2^3 \times 3^3 \times 5^2 \times 7^2$

Finding the number of factors a number has

If you increase each of the powers (exponents) in the prime factorisation by 1 and then multiply the results together you will have the number of factors in the original number.

$150 = 2 \times 3 \times 5^2$

so 150 *has* $2 \times 2 \times 3 = 12$ *factors*!

CHECK : 1 ; 150 ; 2 ; 75 ; 3 ; 50 ; 5 ; 30 ; 6 ; 25 ; 10 ; 15

How many factors does 100 have?

What about 6000?

What about 420?

What about $18000 = 2^4 \times 3^2 \times 5^3$

Finding the square root (or cube root) of a number

By splitting the prime factors into 2 (or 3) **equal** groups we can easily find the square root (or cube root).
For a fourth root we would need to split the factors into four equal groups and so on.

If we cannot split the factors into the desired number of **equal** groups it means that the result does not work out to a whole (Natural) number!

e.g.

Find $\sqrt{144}$ *and* $\sqrt[3]{13824}$ *by prime factorising*

$$144 = 2^4 \times 3^2$$
$$= (2^2 \times 3) \times (2^2 \times 3)$$
$$so, \quad \sqrt{144} = 2^2 \times 3 = 12$$

$$13824 = 2^9 \times 3^3$$
$$= (2^3 \times 3) \times (2^3 \times 3) \times (2^3 \times 3)$$
$$so, \quad \sqrt[3]{13824} = 2^3 \times 3 = 24$$

Find $\sqrt{3600}$

$\sqrt[3]{2^6 \times 3^3 \times 5^3}$

Is $3175200 = 2^5 \times 3^4 \times 5^2 \times 7^2$ a perfect square?

What is the smallest number we would need to multiply it by to get a perfect square?