Hillcrest Mathematics Knowledge Organiser

39 - Prime Numbers

2 3 5 7 11 13 17 19 23 29 31 37 41 43...

Content:

- A prime number (or a prime) is a natural number greater than 1 that has no positive divisors other than 1 and itself.
- Any number can be written as the product of prime factors – you can use the factor tree method to do this.
- Any number can be broken down into a string of prime factors all multiplied together – this is called 'prime factor decomposition' or 'prime factorisation'.
- Product means 'times' or 'multiply'.
- We can write the product of a number in the form of index notation.
  e.g. $2^3 \times 5$

HCF & LCM:

When you have found the prime factors of a number you can use this information in order to find out the LCM and HCF.

Common Misconceptions

- 0 and 1 are not considered prime numbers.

Vocabulary

- Prime Number
- Product
- Decomposition
- Positive Integer
- Index Notation

No matter which numbers you choose at each step, you'll find that the prime factorisation is exactly the same. Each number has a unique set of prime factors.

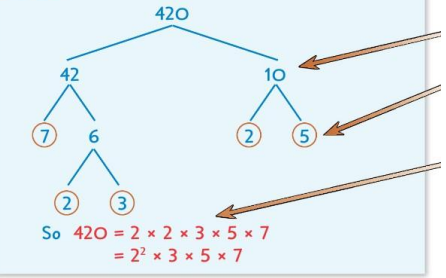
Linked Future Topics:

- Re-occurring decimals
- Coding

Linked Prior Topics:

- Factors, Multiples & Prime Numbers
- Multiplication
- Division

EXAMPLE: Express 420 as a product of prime factors.



To write a number as a product of its prime factors, use the Factor Tree method:

1) Start with the number at the top, and split it into factors as shown.
2) Every time you get a prime, ring it.
3) Keep going until you can't go further (i.e. you're just left with primes), then write the primes out in order.
   If there's more than one of the same factor, you can write them as powers.

Finding the HCF:

1) List all the PRIME FACTORS that appear in BOTH numbers.
2) MULTIPLY these together to find the HCF.

EXAMPLE: $180 = 2^2 \times 3^2 \times 5$ and $84 = 2^2 \times 3 \times 7$. Use this to find the HCF of 180 and 84.

$180 = (2) \times (2) \times (3) \times 3 \times 5$ $\quad 84 = (2) \times (2) \times (3) \times 7$

2, 2 and 3 are prime factors of both numbers, so
HCF = 2 × 2 × 3 = 12

Finding the LCM:

1) List all the PRIME FACTORS that appear in EITHER number.
2) If a factor appears MORE THAN ONCE in one of the numbers, list it THAT MANY TIMES.
3) MULTIPLY these together to give the LCM.

EXAMPLE: $18 = 2 \times 3^2$ and $30 = 2 \times 3 \times 5$. Find the LCM of 18 and 30.

$18 = 2 \times 3 \times 3$ $\quad 30 = 2 \times 3 \times 5$

So the prime factors that appear in either number are: 2, 3, 3, 5 (List 3 twice as it appears twice in 18.)

LCM = 2 × 3 × 3 × 5 = 90