

1.3 Indices, prime factors, HCF and LCM

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS lowest common multiple

Indices, prime factors, HCF and LCM

Objective

Use squares, cubes, roots and index laws; factorise integers into primes; find HCFs and LCMs including from Venn regions (objectives Foundation 1.4 A–E and Higher 1.4 C).

1 Key knowledge and worked examples

Powers and primes. $2^3 \times 2^4 = 2^7$ and $2^7 \div 2^3 = 2^4$ – same base, indices add or subtract. Every integer is a product of primes: $360 = 2^3 \times 3^2 \times 5$; the June 2024 paper factors $19600 = 2^4 \times 5^2 \times 7^2$.

HCF and LCM. HCF: lowest power of each COMMON prime. LCM: highest power of EVERY prime. For $360 = 2^3 \cdot 3^2 \cdot 5$ and $84 = 2^2 \cdot 3 \cdot 7$: $\text{HCF} = 2^2 \cdot 3 = 12$; $\text{LCM} = 2^3 \cdot 3^2 \cdot 5 \cdot 7 = 2520$. In a prime-factor Venn, the HCF is the overlap's product and the LCM everything's product.

$$0.000072 = 7.2 \times 10^{-5}$$

7.2 is the coefficient; -5 is the power

The coefficient is between 1 and 10

Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 Work out $2^3 \times 2^4$ as a single power, then evaluate [2]

2.2 Write 360 as a product of prime factors [2]

2.3 Find $\sqrt{196}$ [1]

2.4 Work out 5^3 [1]

2.5 Find the HCF and LCM of 360 and 84

[4]

3 Exam-style questions

3.1 (*Edexcel 4MA1 1HR June 2024 Q11 family, adapted.*) (a) Write 19600 as a product of powers of prime factors. (b) Given that $A = 2^4 \times 5^2 \times 7^2$ and $B = 2^2 \times 5 \times 7^4$, write $A \times B$ as a product of powers of primes. [4]

3.2 (*Original.*) Two lighthouses flash together every n seconds; one flashes every 18 s, the other every 24 s. Find n . [3]

3.3 (*Original.*) A floor is 360 cm by 252 cm. Find the side of the LARGEST square tile that fits exactly. [3]

Solutions

2.1 $2^7 = 128$.

2.2 $360 = 2^3 \times 3^2 \times 5$.

2.3 14.

2.4 125.

2.5 $84 = 2^2 \cdot 3 \cdot 7$; $\text{HCF} = 2^2 \cdot 3 = 12$; $\text{LCM} = 2^3 \cdot 3^2 \cdot 5 \cdot 7 = 2520$.

3.1 (a) $19600 = 2^4 \times 5^2 \times 7^2$. (b) Add the powers of each prime: $A \times B = 2^6 \times 5^3 \times 7^6$.

3.2 n is the LCM of 18 and 24: $18 = 2 \cdot 3^2$, $24 = 2^3 \cdot 3$, so $n = 2^3 \cdot 3^2 = 72$ seconds.

3.3 The tile side is the HCF of 360 and 252: $360 = 2^3 \cdot 3^2 \cdot 5$, $252 = 2^2 \cdot 3^2 \cdot 7$, so $\text{HCF} = 2^2 \cdot 3^2 = 36$ cm.

Local review guidance: prime factorisations before any product; power notation exact; context answers name which of HCF/LCM the question needs. This is authored classroom guidance.