Class 10 Mathematics · Chapter 1: Real Numbers

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. The HCF of $2^3 \times 5^2 \times 7$ and $2^2 \times 5^3 \times 11$ is [1]

(a) 10 (b) 20
(c) 1000 (d) 100

Answer: (d) Common primes are 2 and 5. Smallest powers: 2^2 and 5^2. HCF = 4 × 25 = 100. 7 and 11 are not common, so they do not enter.

2. Which of the following is irrational? [1]

(a) $\sqrt{196}$ (b) 2.5
(c) $\sqrt{50}$ (d) $\frac{22}{7}$

Answer: (c) $\sqrt{196} = 14$ and $2.5 = 5/2$ are rational, and $22/7$ is a ratio of integers. $\sqrt{50} = 5\sqrt{2}$, and $5\sqrt{2}$ cannot be written as p/q, so it is irrational.

3. In the prime factorisation of 1764, the power of 7 is [1]

(a) 1 (b) 3
(c) 2 (d) 4

Answer: (c) $1764 = 2 \times 882 = 2 \times 2 \times 441 = 2^2 \times 3^2 \times 49 = 2^2 \times 3^2 \times 7^2$. The power of 7 is 2.

4. The LCM of 11, 13 and 19 is [1]

(a) 2717 (b) 1
(c) 143 (d) 247

Answer: (a) No two of 11, 13, 19 share a prime, so the LCM is the product $11 \times 13 \times 19 = 2717$. 1 is their HCF.

5. If a and b are two different primes, the LCM of a^2b^3 and a^3b is [1]

(a) a^3b^3 (b) a^2b
(c) a^5b^4 (d) ab

Answer: (a) LCM takes the greatest power of each prime involved: a^3 and b^3. a^2b is the HCF; a^5b^4 is the product.

6. Find the HCF and LCM of 84 and 126 by prime factorisation. [2]

$84 = 2^2 \times 3 \times 7$, $126 = 2 \times 3^2 \times 7$. HCF = $2 \times 3 \times 7 = 42$. LCM = $2^2 \times 3^2 \times 7 = 252$. Check: $42 \times 252 = 10584 = 84 \times 126$.

- both prime factorisations (1)
- HCF 42 and LCM 252 (1)

7. Can 14^n end with the digit 5 for any natural number n? Give a reason. [2]

A number ending in 5 is divisible by 5, so 5 must be in its prime factorisation. $14^n = 2^n \times 7^n$. By the uniqueness of prime factorisation, its only primes are 2 and 7. So 14^n never ends in 5.

- ending in 5 needs the prime 5 (1)
- $14^n = 2^n \times 7^n$; uniqueness rules out 5, so no (1)

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8. Find the least natural number that is divisible by every number from 1 to 10. [2]

The number must contain each prime up to 10 at its greatest power among 1 to 10: 2^3 (from 8), 3^2 (from 9), 5 and 7. So the least such number is $2^3 \times 3^2 \times 5 \times 7 = 2520$.

- greatest prime powers 2^3, 3^2, 5, 7 (1)
- 2520 (1)

9. Two numbers are in the ratio 3 : 7 and their LCM is 357. Find the numbers and their HCF. [3]

Let the numbers be 3k and 7k; 3 and 7 are coprime, so HCF = k and LCM = 21k. 21k = 357 gives k = 17. Numbers 51 and 119, HCF 17. Check: 17 × 357 = 6069 = 51 × 119.

- writes 3k, 7k with LCM 21k (1)
- k = 17, numbers 51 and 119 (1)
- HCF 17 (1)

10. Given that $\sqrt{7}$ is irrational, prove that $\frac{3 - 2\sqrt{7}}{5}$ is irrational. [3]

Suppose $(3 - 2\sqrt{7})/5 = a/b$, with a, b integers, $b \neq 0$. Then $3 - 2\sqrt{7} = 5a/b$, so $2\sqrt{7} = 3 - 5a/b = (3b - 5a)/b$ and $\sqrt{7} = (3b - 5a)/(2b)$. The right side is a ratio of integers, so $\sqrt{7}$ would be rational. This contradicts the given fact. So $(3 - 2\sqrt{7})/5$ is irrational.

- assumes the number equals a/b (1)
- isolates $\sqrt{7} = (3b - 5a)/(2b)$ (1)
- notes the right side is rational, states the contradiction (1)

11. Find the HCF and LCM of 28, 42 and 70 by prime factorisation, and show that their product is not the product of the three numbers. [3]

$28 = 2^2 \times 7$, $42 = 2 \times 3 \times 7$, $70 = 2 \times 5 \times 7$. HCF = $2 \times 7 = 14$. LCM = $2^2 \times 3 \times 5 \times 7 = 420$. HCF × LCM = 5880, but $28 \times 42 \times 70 = 82320$. They differ: the product rule holds for two numbers only.

- the three prime factorisations (1)
- HCF 14 and LCM 420 (1)
- $5880 \neq 82320$ (1)

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