The Singapore Syllabus

ALIGNED TO THE LATEST 2027 EDITION MOE SYLLABUS

Secondary 1 Mathematics

ASSESSMENT BOOK



- **Notes** with worked examples
- **Practice questions** with marks shown
- **Answers** with full working
- **A full practice exam** with mark scheme

14 chapters **483** pages **336** questions

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CHAPTER 1

Primes, HCF and LCM

Part 1: Notes and Worked Examples



In the notes

12 ideas. Read each idea and its worked example, then try the Try This question before you check its answer. The practice questions start on page 16.

- Factors, Multiples and Prime Numbers
- Prime Factorisation with a Factor Tree
- Repeated Division and Index Notation
- Highest Common Factor (HCF)
- Lowest Common Multiple (LCM)
- HCF and LCM in Index Notation
- Word Problems on HCF
- Word Problems on LCM
- Square Numbers and Square Roots
- Cube Numbers and Cube Roots
- Making a Perfect Square or a Perfect Cube
- Formulas to Remember

Name: _____ Class: _____ Date: _____

SECONDARY 1 · MATHEMATICS · PRIMES, HCF AND LCM

Primes, HCF and LCM

Theory and worked examples

Factors, Multiples and Prime Numbers

A factor of a whole number divides it exactly, with no remainder. A multiple of a number is that number times 1, 2, 3, ... For example, the factors of 12 are 1, 2, 3, 4, 6 and 12, and the multiples of 12 are 12, 24, 36, 48, ... A prime number is a whole number greater than 1 that has exactly two different factors: 1 and itself. A whole number greater than 1 that is not prime is called a composite number.

> KEY IDEA
> **A prime number has exactly two factors. 1 has only one factor, so 1 is NOT a prime number.**

- The prime numbers less than 50 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43 and 47.
- 1 is neither prime nor composite, because it has only one factor.
- 2 is the only even prime number. Every other even number has 2 as a factor.
- Quick tests: a number is divisible by 2 if its last digit is even, by 3 if its digit sum is divisible by 3, by 5 if it ends in 0 or 5, and by 9 if its digit sum is divisible by 9.
- To test whether a number is prime, divide it by the primes 2, 3, 5, 7, ... in turn. You can stop once the prime you are trying, multiplied by itself, is bigger than the number.

WORKED EXAMPLE

Is 91 a prime number? Explain your answer.

1. 91 is odd, so 2 is not a factor.
2. Digit sum 9 + 1 = 10, which is not divisible by 3, so 3 is not a factor.
3. 91 does not end in 0 or 5, so 5 is not a factor.
4. Try 7: 91 ÷ 7 = 13 exactly. So 91 = 7 × 13.
5. 91 has factors 1, 7, 13 and 91, which is more than two factors.

No. 91 = 7 × 13, so 91 is a composite number.

TRY THIS

Which one of 51, 53 and 57 is a prime number?

Answer: 53 (51 = 3 × 17 and 57 = 3 × 19)

Prime Factorisation with a Factor Tree

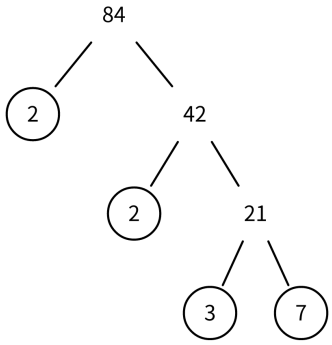
Every composite number can be written as a product of prime numbers in exactly one way (apart from the order). Writing a number like this is called prime factorisation. A factor tree is one way to find it: split the number into two factors, then keep splitting each factor that is not prime. Circle each prime as you reach it. The circled primes at the ends of the branches are the prime factors.

- Start with any pair of factors. Different starting pairs give different trees, but the same prime factors at the end.
- Stop a branch only when you reach a prime number.
- Write the prime factors in order from smallest to largest.
- Check by multiplying the primes back together.

WORKED EXAMPLE

Use a factor tree to express 84 as a product of its prime factors.

1. 84 = 2 × 42, then 42 = 2 × 21, then 21 = 3 × 7. Circle each prime as you reach it.



2. The circled primes are 2, 2, 3 and 7. Check: 2 × 2 × 3 × 7 = 4 × 21 = 84 ✓

84 = 2 × 2 × 3 × 7

TRY THIS

Use a factor tree to express 150 as a product of its prime factors.

Answer: 150 = 2 × 3 × 5 × 5

Repeated Division and Index Notation

For a larger number, repeated division is neater than a factor tree. Divide by the smallest prime that goes in exactly, write the answer below, and repeat until you reach 1. The primes down the left side are the prime factors. When a prime factor appears more than once, write the product in index notation: $2 \times 2 \times 2 = 2^3$, where 2 is the base and 3 is the index. The table shows the working for 1260, used in the worked example.

KEY IDEA

The final answer must contain prime numbers only. $2^2 \times 9 \times 35$ is NOT a prime factorisation, because 9 and 35 are not prime.

- Try the primes in order: 2, then 3, then 5, then 7, then 11, ...
- Keep using the same prime for as long as it still divides exactly.
- In index notation, 5^1 is just written 5.
- Read the question: "in index notation" means you must use indices, such as $2^2 \times 3^2 \times 5 \times 7$.

Divide by	Number
2	1260
2	630
3	315
3	105
5	35
7	7
	1

WORKED EXAMPLE

Express 1260 as a product of its prime factors, giving your answer in index notation.

1. Divide by 2 twice, then by 3 twice (315 is odd), then by 5 and by 7, until you reach 1. The working is in the table above.
2. Read the primes down the left: $1260 = 2 \times 2 \times 3 \times 3 \times 5 \times 7 = 2^2 \times 3^2 \times 5 \times 7$

$1260 = 2^2 \times 3^2 \times 5 \times 7$

TRY THIS

Express 2016 as a product of its prime factors in index notation.

Answer: $2016 = 2^5 \times 3^2 \times 7$

Highest Common Factor (HCF)

A common factor of two or more numbers is a factor of every one of them. The highest common factor (HCF) is the largest of the common factors. For small numbers, list the factors. For larger numbers, use prime factorisation: write each number in index notation, take every prime that appears in ALL the numbers, and use its LOWEST power.

- Listing: the factors of 12 are 1, 2, 3, 4, 6, 12 and the factors of 18 are 1, 2, 3, 6, 9, 18. The common factors are 1, 2, 3 and 6, so the HCF of 12 and 18 is 6.
- Prime factorisation: line up the same primes in columns so the common ones are easy to see.
- A prime that is missing from even one of the numbers is NOT in the HCF.
- The HCF can never be larger than the smallest of the numbers.

Name: _____ Class: _____ Date: _____

SECONDARY 1 · MATHEMATICS · PRIMES, HCF AND LCM

Primes, HCF and LCM

INSTRUCTIONS

- 22 questions, 63 marks in total.
- Answer all questions in the spaces provided.
- Show your working clearly. Marks are given for correct working.

Section A: Short Questions

1 List all the prime numbers between 30 and 50.

Ans: _____ [1]

2 Express 252 as a product of its prime factors, giving your answer in index notation.

Ans: _____ [2]

3 Is 119 a prime number? Give a reason for your answer.

_____

_____

_____

_____

[1]

4 By listing the factors, find the highest common factor (HCF) of 36 and 54.

Ans: _____ [1]

5 Find the lowest common multiple (LCM) of 8 and 14.

Ans: _____ [1]

6 It is given that $1512 = 2^a \times 3^b \times 7$. Find the value of a and the value of b.

Ans: _____ [2]

7 Using prime factorisation, find the value of $\sqrt{576}$. Show your working.

Ans: _____ [2]

8 Using prime factorisation, find the value of $\sqrt[3]{1728}$. Show your working.

Ans: _____ [2]

Section B: Structured Questions

9 Using prime factorisation,

(a) express 84 and 132 as products of their prime factors,

Ans: _____ [2]

(b) find the HCF of 84 and 132,

Ans: _____ [1]

(c) find the LCM of 84 and 132.

Ans: _____ [1]

Chapter 1: Primes, HCF and LCM (Answer Key)

22 questions, 63 marks. M: method mark, A: answer mark, B: mark for the answer alone.

1. 31, 37, 41, 43, 47 **[1]**

B1 all five, and no others

2. $252 = 2 \times 2 \times 3 \times 3 \times 7 = 2^2 \times 3^2 \times 7$ **[2]**

M1 $2 \times 2 \times 3 \times 3 \times 7$ or a correct factor tree or division

A1 $2^2 \times 3^2 \times 7$

3. No. $119 = 7 \times 17$, so 119 has factors other than 1 and itself (1, 7, 17 and 119). **[1]**

B1 No, with $119 = 7 \times 17$ shown

4. Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36. Factors of 54: 1, 2, 3, 6, 9, 18, 27, 54. HCF = 18 **[1]**

B1 18

5. $8 = 2^3$, $14 = 2 \times 7$, LCM $= 2^3 \times 7 = 56$ **[1]**

B1 56

6. $1512 = 2^3 \times 3^3 \times 7$, so a = 3 and b = 3 **[2]**

M1 $1512 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7$

A1 a = 3, b = 3

7. $576 = 2^6 \times 3^2$, $\sqrt{576} = 2^3 \times 3 = 24$ **[2]**

M1 $576 = 2^6 \times 3^2$

A1 24

8. $1728 = 2^6 \times 3^3$, $\sqrt[3]{1728} = 2^2 \times 3 = 12$ **[2]**

M1 $1728 = 2^6 \times 3^3$

A1 12

9. (a) $84 = 2^2 \times 3 \times 7$, $132 = 2^2 \times 3 \times 11$ (b) 12 (c) 924 **[4]**

(a) $84 = 2^2 \times 3 \times 7$, $132 = 2^2 \times 3 \times 11$ [2]

B1 $84 = 2^2 \times 3 \times 7$

B1 $132 = 2^2 \times 3 \times 11$

(b) HCF $= 2^2 \times 3 = 12$ [1]

B1 12

(c) LCM $= 2^2 \times 3 \times 7 \times 11 = 924$ [1]

B1 924