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STUDY GUIDE

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SEC 1 ELEMENTARY MATHEMATICS

UNIT 1: PRIMES, HIGHEST COMMON FACTOR AND LOWEST COMMON MULTIPLE

1.1 PRIME NUMBERS AND COMPOSITE NUMBERS

1.1 CONCEPTUAL BRIDGING OF PRIME NUMBERS

A **Prime Number** is a whole number that has exactly 2 different factors, 1 and itself.

A **Composite** is a whole number that has more than 2 different factors.

SIEVE OF ERATOSTHENES

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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1.1.1 Worked Example (Test for Prime Numbers)

Determine whether each of the following is a prime number or composite number

(a) 17 **(b)** 67 **(c)** 357 **(d)** 449 **(e)** 547

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1.1.1 Practice Now

Question 1

Determine whether each of the following is a prime or a composite number.

(a) 253 **(b)** 311 **(c)** 447 **(d)** 409 **(e)** 509

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1.1.2 Worked Example (Problem Involving a Prime Number)

If p, q and r are whole numbers such that $p \times q \times r = 34$. Given that r is an even number, find the value of $p+q$. Explain your answer.

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1.1.2 Practice Now

Question 1

If k and m are whole numbers such that $k \times m = 47$, find the value of $k+m$. Explain your answer.

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QUESTION 2

If p, q and r are whole numbers such that $p \times q \times r = 142$. Given that r is an even number, find the value of $p+q$. Explain your answer.

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1.2 PRIME FACTORISATION AND ITS APPLICATIONS

1.2.1 WORKED EXAMPLE (WHY AND HOW DO WE PRIME FACTORISE?)

(i) Find the prime factorisation of 54, leaving your answer in index notation

(ii) Find the prime factorisation of 15400, leaving your answer in index notation.

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1.2.1 Practice Now

QUESTION 1

Find the prime factorisations of the following numbers, leaving your answer in index notation.

(i) 1200 **(ii)** 6120 **(iii)** 163350

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1.2.2 Worked Example (Finding the Square and Cube Roots using Prime Factorisation)

(i) Find $\sqrt{627264}$ by using prime factorisation.

(ii) Find $\sqrt[3]{250047}$ using prime factorisation.

(iii) Find $\sqrt{15376}$ using primes factorisation.

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1.2.3 Worked Example (Explanation of Perfect Squares and Cubes)

(i) Use prime factors to explain why 6×96 is a perfect square.

(ii) What is the greatest perfect square that is a factor of 9450?

(iii) What is the smallest and greatest perfect cube that is a factor of 55566?

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1.2.4 Worked Example (Changing a number to a Perfect Cube)

(i) Find the smallest possible integer k such that $7920k$ is a cube number.

(ii) Find the smallest possible integer k such that $8400k$ is a cube number.

(iii) What is the greatest perfect cube that is a factor of 124416?

(iv) Find the smallest value of n such that $800n$ is both a perfect square and a perfect cube.

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1.2.5 Worked Example (Higher Order Thinking Questions)

(i) Find the smallest positive integer n for which $\sqrt{136n}$ is a whole number.

(ii) Find the smallest positive integer k for which $240k$ is a multiple of 7056.

(iii) When 180 is multiplied by a whole number k, the product is a perfect cube. Suggest two possible values of k.

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1.2 EXERCISE

QUESTION 1

Expressed as the product of its prime factors, $240 = 2^4 \times 3 \times 5$.

(a) Express 7056 as a product of prime factors.

(b) Use your answer in **(a)** to find the positive square root of 7056, leaving your answer in index notation.

(c) Find the smallest positive integer k for which $240k$ is a multiple of 7056.

(d) Find the smallest positive integer n for which $\sqrt{240n}$ is a whole number.

QUESTION 2

The numbers 54 and 468, written as the product of their prime factors, are $54 = 2 \times 3^3$ and $486 = 2^2 \times 3^2 \times 13$. Find

(a) the smallest integer, m such that $468m$ is a perfect square,

(b) the largest integer, which is a factor of both 54 and 468,

(c) the smallest positive integer, n such that $54n$ is a multiple of 468.

QUESTION 3

The dimensions of a rectangle are $(2^2 \times 5^2 \times 7)$ cm by $(5^2 \times 7^3)$ cm.

(a) Find the area of the rectangle. Express your answer in prime factorization form.

(b) Given that a square has the same area as the rectangle in part **(a)**. Find the length of the square side.

QUESTION 4

A 2-digit prime number is less than 50 and the product of its digits is 12. What is the number?

QUESTION 5

Written as the product of its prime factors $1800 = 2^3 \times 3^2 \times 5^2$.

(a) Express 588 as the product of its prime factors.

(b) Write down the smallest integer, k, such that $1800k$ is a perfect cube.