MATHS – YEAR 9 – UNIT 13 – FACTORS, PRIMES AND INDICES

1. Tier 3 Vocabulary

Factor	Numbers we can multiply together to get another number
Multiple	The result of multiplying a number by an integer
Prime Number	A number that is divisible only by itself and one e.g. 2, 3, 5, 7, 11, 13, 17, 19, …
Base Number	The number that get multiplied when raised by an exponent
Exponent	The power, or index. The number of times the base number is multiplied
Prime Factor	A factor of a number that is also a prime number
Reciprocal	The multiplicative inverse of a number. The reciprocal of n is $^1/_n$. The product of a number and its reciprocal is always 1
Rational Number	A number that results from the division of two integers
Irrational Number	A number that cannot be made from the division of two integers. It is a decimal that goes on without ending or recurring
Natural Number	Integers from 1 upwards. No fractional or negative numbers

2. MULTIPLES AND FACTORS

The find multiples of a number, we multiply that number by another integer. The first ten multiples of 9 are:
9, 18, 27, 36, 45, 54, 63, 72, 81, 90

To find the factors of a number we find the numbers that multiply together to get that number.
To find the factors of 20:
1 x 20
2 x 10
~~3~~
4 x 5
The factors of 20 are:
1, 2, 4, 5, 10 and 20.

3. HIGHEST COMMON FACTOR AND LOWEST COMMON MULTIPLE

To find the highest common factor of some numbers, we list the factors of those numbers and find the highest number in all lists.

To find the lowest common multiple of some numbers, we list the multiples of those numbers and find the lowest number in all lists.

4. Command Words

Estimate the value of (used with a calculation)	Use approximations to work out a value. Unless told otherwise, students should round the given values to 1 significant figure.
Show that...	Give every step of a process that will lead to the required outcome.
Factorise (fully)	Take out any common factors of an expression or convert a quadratic expression into two linear factors. This should always be done fully, even if that word is absent from the instruction. Use of the word 'fully' is a hint that more than one factor can be taken out.
Why	Give a calculation and/or written evidence to support the given statement.
Solve	Find the value(s) that satisfy a given equation or inequality.
Construct	Draw accurately. If told to use compasses, all construction arcs and lines should be shown.

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5. LAWS OF INDICES

Multiplying indices

When multiplying indices with the same base, add the powers.

$$a^m \times a^n = a^{m+n}$$

Dividing indices

When dividing indices with the same base, subtract the powers.

$$a^m \div a^n = a^{m-n}$$

Brackets with indices

When there is a power outside the bracket multiply the powers.

$$(a^m)^n = a^{m \times n}$$

6. FURTHER LAWS OF INDICES

Power of 0

Any non-zero value raised to the power of 0 is equal to 1.

$$a^0 = 1$$

Negative indices

When the index is negative, put it over 1 and flip (write its reciprocal) to make it positive.

$$a^{-m} = \frac{1}{a^m}$$

Fractional indices

The **denominator** of the fraction is the **root** of the number or letter. The **numerator** of the fraction is the power to raise the answer to.

STANDARD FORM

Large numbers can be written in standard form.

$a \times 10^n$

Where n is a positive integer and $1 \leq a < 10$.

E.g. 32 400 000 = 3.24×10^7

Small numbers can be written in standard form.

$a \times 10^n$

Where n is a negative integer and $1 \leq a < 10$.

E.g. 0.00000628 = 6.28×10^{-6}

ORDERING NUMBERS IN STANDARD FORM

When ordering numbers in standard form, we covert them into ordinary form first and then order them.

7. CALCULATING WITH NUMBERS IN STANDARD FORM

When adding and subtracting numbers in standard form, we can convert out of standard form into ordinary numbers first and then add or subtract as required.

$$(8.1 \times 10^3) + (2 \times 10^4)$$
$$= 8100 + 20000$$
$$= 28100$$
$$= 2.81 \times 10^4$$

$$(2.35 \times 10^4) - (4.7 \times 10^3)$$
$$= 23500 - 4700$$
$$= 18800$$
$$= 1.88 \times 10^4$$

8. CALCULATING WITH NUMBERS IN STANDARD FORM

Multiplying numbers in standard form

When multiplying numbers in standard form, we multiply the numbers and add the indices.

$$(5 \times 10^3) \times (6 \times 10^8) = 30 \times 10^{11} = 3 \times 10^{12}$$

Dividing numbers in standard form

When dividing numbers in standard form, we divide the numbers and subtract the indices.

$$(1.4 \times 10^6) \div (2 \times 10^4) = 0.7 \times 10^2 = 7 \times 10^1$$