KNOWLEDGE ORGANISER: Year 10 Developing – Units 10A-10C

PRIME NUMBERS

2 3 5 7 11 13 17 19 23 29 31 37 41 43...

The FACTORS of a number are all the numbers that divide into it.

There's a method that guarantees you'll find them all:

1) Start off with 1 × the number itself, then try 2 ×, then 3 × and so on, listing the pairs in rows.
2) Try each one in turn. Cross out the row if it doesn't divide exactly.
3) Eventually, when you get a number repeated, stop.
4) The numbers in the rows you haven't crossed out make up the list of factors.

EXAMPLE: Find all the factors of 24.

Increasing by 1 each time

1 × 24
2 × 12
3 × 8
4 × 6
~~5 × 5~~
6 × 4

So the factors of 24 are:
1, 2, 3, 4, 6, 8, 12, 24

Indices are the numbers written above a base number. E.g. For 8^2 – 8 is the base number and 2 is the index

The **index** shows how many times it has been multiplied by itself. E.g. 3^7 = 3x3x3x3x3x3x3

1) When MULTIPLYING, you ADD THE POWERS.
e.g. $3^6 \times 3^4 = 3^{6+4} = 3^{10}$, $a^2 \times a^7 = a^{2+7} = a^9$

2) When DIVIDING, you SUBTRACT THE POWERS.
e.g. $5^4 \div 5^2 = 5^{4-2} = 5^2$, $b^8 \div b^5 = b^{8-5} = b^3$

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

Long multiplication

24 × 16 becomes

		2	
		2	4
×		1	6
2	4	0	
1	4	4	
3	8	4	

Answer: 384

124 × 26 becomes

		1	2	
		1	2	4
×			2	6
2	4	8	0	
		7	4	4
3	2	2	4	
1	1			

Answer: 3224

DIRECTED NUMBERS

Example 1: -5 + -3
Where the signs in the middle are different, the resulting sum becomes a subtraction so the above example would be -5 – 3 which equals -8.

Example 2: -6 - -3
Where the signs in the middle are the same, the resulting sum becomes an addition so the above example would be -6 + 3 which equals -3.

DECIMAL ADDITION

Example:

0.32 + 12.965 + 1.1

Line up the decimal points

'Pad' with zeros

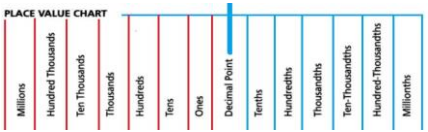
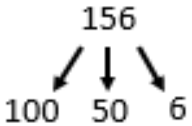
$$\begin{array}{r} 0.320 \\ 12.965 \\ +\ \ 1.100 \\ \hline 14.385 \end{array}$$

Square numbers	Cube numbers
$1^2 = 1 \times 1 = 1$	$1^3 = 1 \times 1 \times 1 = 1$
$2^2 = 2 \times 2 = 4$	$2^3 = 2 \times 2 \times 2 = 8$
$3^2 = 3 \times 3 = 9$	$3^3 = 3 \times 3 \times 3 = 27$
$4^2 = 4 \times 4 = 16$	$4^3 = 4 \times 4 \times 4 = 64$
$5^2 = 5 \times 5 = 25$	$5^3 = 5 \times 5 \times 5 = 125$
$6^2 = 6 \times 6 = 36$	$6^3 = 6 \times 6 \times 6 = 216$
$7^2 = 7 \times 7 = 49$	$7^3 = 7 \times 7 \times 7 = 343$
$8^2 = 8 \times 8 = 64$	$8^3 = 8 \times 8 \times 8 = 512$
$9^2 = 9 \times 9 = 81$	$9^3 = 9 \times 9 \times 9 = 729$
$10^2 = 10 \times 10 = 100$	$10^3 = 10 \times 10 \times 10 = 1000$

Here are the square roots of all the perfect squares from 1 to 100.

$\sqrt{1} = 1$ since $1^2 = 1$
$\sqrt{4} = 2$ since $2^2 = 4$
$\sqrt{9} = 3$ since $3^2 = 9$
$\sqrt{16} = 4$ since $4^2 = 16$
$\sqrt{25} = 5$ since $5^2 = 25$
$\sqrt{36} = 6$ since $6^2 = 36$
$\sqrt{49} = 7$ since $7^2 = 49$

KNOWLEDGE ORGANISER: Year 10 Developing – UNITS 10D, 10E, 10F

1. Place Value	The value of a digit that relates to its position or place in a number.	53 000 000 The value of the 3 is 3 million because it is in the millions column
2. Digits	The symbols we use to write a number.	456 has 3 digits
3. Place Value Columns	The position that the digit can be put into that's determines the value of that digit.	
4. Partitioning	Splitting a number up.	
5. Comparing Numbers	We use these symbols: **=** Equal to **<** Less than **>** Greater than $\geq$ Greater than or equal to	3 < 6 3 is less than 6 6 > 3

	$\leq$ Less than or equal to	6 is greater than 3
Simplifying fractions	Cancel down by dividing both numerator and denominator by a common factor. Using the highest common factor means less steps are necessary	$\frac{20}{50} = \frac{2}{5}$ dividing by HCF of 10
3. Place Value	The value of a digit that relates to its position or place in a number.	In 12.34 the digits represent 1 ten, 2 ones, 3 tenths and 4 hundredths respectively.
4. Decimal Places	The number of digits after the decimal place.	5.34 has 2 decimal places 0.0915 has 4 decimal places
2. Inequality symbols	$x > 2$ means **x is greater than 2** $x < 3$ means **x is less than 3** $x \geq 1$ means **x is greater than or equal to 1** $x \leq 6$ means **x is less than or equal to 6**	State the integers that satisfy $-2 < x \leq 4.$ -1, 0, 1, 2, 3, 4

Equivalent Fractions	Fractions which represent the same value	$\frac{2}{5} = \frac{4}{10} = \frac{20}{50}$
9. Expand	To expand a bracket, **multiply** each term **in the bracket** by the expression **outside** the bracket.	$3(m + 7) = 3x + 21$
9. Brackets Index Laws	When raising a power to another power, multiply the powers together. $(\boldsymbol{a^m})^{\boldsymbol{n}} = \boldsymbol{a^{mn}}$	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$
10. Notable Powers	$\boldsymbol{p = p^1}$ $\boldsymbol{p^0 = 1}$	$99999^0 = 1$

KNOWLEDGE ORGANISER: Year 10 Developing – Units 10G-10I

10. Fraction of an Amount	**Divide** by the **bottom**, **times** by the **top**	Find $\frac{2}{5}$ of £60 $60 \div 5 = 12$ $12 \times 2 = 24$
9. Comparing Fractions	To compare fractions, they each need to be rewritten so that they have a **common denominator**. **Ascending** means **smallest to biggest**. **Descending** means **biggest to smallest**.	Put in to ascending order : $\frac{3}{4}, \frac{2}{3}, \frac{5}{6}, \frac{1}{2}$. Equivalent: $\frac{9}{12}, \frac{8}{12}, \frac{10}{12}, \frac{6}{12}$ Correct order: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$

Changing between mixed numbers and improper fractions:

Example: Convert $\frac{11}{4}$ to a mixed fraction.

Divide:

11 ÷ 4 = 2 with a remainder of 3

Write down the 2 and then write down the remainder (3) above the denominator (4).

Answer:

$$2\frac{3}{4}$$

Example: Convert $\frac{10}{3}$ to a mixed fraction.

$$\frac{10}{3} = 10 \div 3 = 3 \text{ R } 1$$

$$= 3\frac{1}{3}$$

Answer:

$$3\frac{1}{3}$$

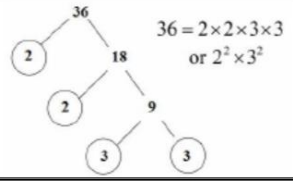
11. Adding or Subtracting Fractions	Find the **LCM of the denominators** to find a common denominator. Use equivalent fractions to change each fraction to the **common denominator**. Then just **add or subtract the numerators** and keep the **denominator the same**.	$\frac{2}{3} + \frac{4}{5}$ Multiples of 3: 3, 6, 9, 12, **15**.. Multiples of 5: 5, 10, **15**.. LCM of 3 and 5 = 15 $\frac{2}{3} = \frac{10}{15}$ $\frac{4}{5} = \frac{12}{15}$ $\frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$
5. Simplifying Expressions	**Collect 'like terms'.** Be careful with negatives. x^2 and x are not like terms.	$2x + 3y + 4x - 5y + 3$ $= 6x - 2y + 3$ $3x + 4 - x^2 + 2x - 1 = 5x - x^2 + 3$
5. Substitution	**Replace letters with numbers.** Be careful of $5x^2$. You need to square first, then multiply by 5.	$a = 3, b = 2$ *and* $c = 5$. Find: 1. $2a = 2 \times 3 = 6$ 2. $3a - 2b = 3 \times 3 - 2 \times 2 = 5$ 3. $7b^2 - 5 = 7 \times 2^2 - 5 = 23$

Example: Find the least common multiple of 6 and 15:

The multiples of 6 are: ***6, 12, 18, 24, 30, ...***
and the multiples of 15 are: ***15, 30, ...***

There is a match at 30

So the least common multiple of 6 and 15 is **30**

7. Product of Prime Factors	Finding out which **prime numbers multiply** together to make the **original** number. Use a **prime factor tree.** Also known as 'prime factorisation'.	 $36 = 2 \times 2 \times 3 \times 3$ or $2^2 \times 3^2$

Rounding to the nearest 10, 100, 1000:

134.9 rounded to tens is 130

as the next digit (4) is less than 5

12,690 rounded to thousands is 13,000

as the next digit (6) is 5 or more

KNOWLEDGE ORGANISER: Year 10 Developing – Units 10J, 10K and 10L

To **Solve** an equation you find the value of the unknown by isolating it on one side by performing inverse operations. Remember that solutions can be integers, decimals, fractions and negative numbers.

$$4x + 8 = 24$$
$$-8 \quad -8$$
$$4x + 0 = 16$$
$$\frac{4x}{4} = \frac{16}{4}$$
$$x = 4$$

Balancing method

$$8a - 5 = 11$$
$$+5 \quad +5$$
$$8a = 16$$
$$\div 8 \quad \div 8$$
$$a = 2$$

Balancing method

$$10 + 6y = 34$$
$$-10 \quad -10$$
$$6y = 24$$
$$\div 6 \quad \div 6$$
$$y = 4$$

Balancing method

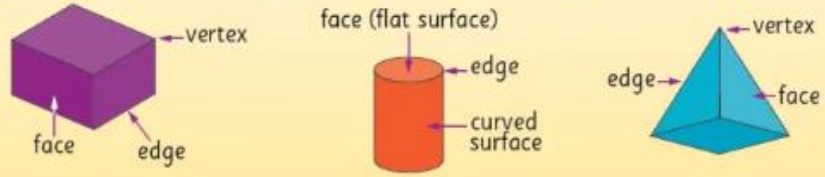
$$\frac{x}{12} - 5 = 4$$
$$+5 \quad +5$$
$$\times 12 \quad \frac{x}{12} = 9 \quad \times 12$$
$$x = 108$$

$$5p - 7 = 3p + 3 \quad -3p \quad -3p$$
$$2p - 7 = 3 \quad +7 \quad +7$$
$$2p = 10 \quad \div 2 \quad \div 2$$
$$p = 5$$

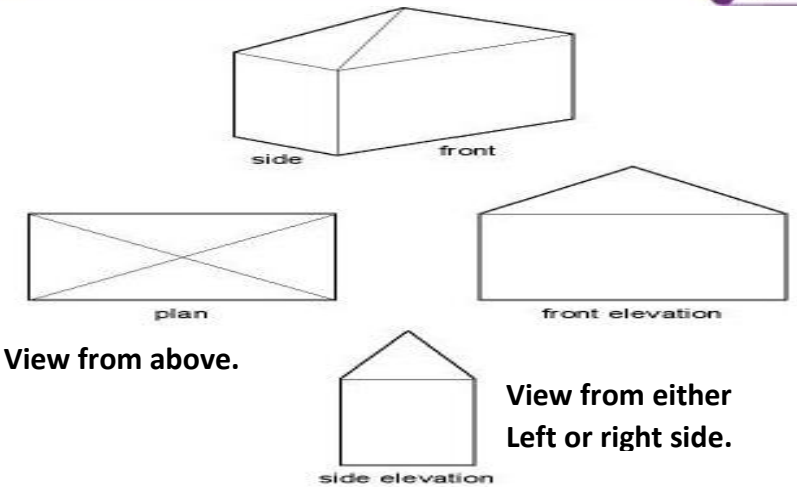
$$2(10-2x) = 4(2x+2)$$
$$20 - 4x = 8x + 8$$
$$20 - 4x + 4x = 8x + 8 + 4x$$
$$20 = 12x + 8$$
$$20 - 8 = 12x + 8 - 8$$
$$12 = 12x$$
$$\frac{12}{12} = \frac{12x}{12}$$
$$1 = x$$

- **Surface:** Can be flat (face) or curved.
- **Edge:** where two surfaces meet. An edge can be straight or curved.
- **Vertex:** where two or more edges meet at a point.

(a) Cuboid (b) Cylinder (c) Square pyramid



Maths Around Us video 3.4



View from above.

View from either Left or right side.

Percentages without a calculator

To work out **15%** of £300...

Break up into 10% and 5%

10% of £300
£300 ÷ 10 = £30
10% = £30

5% of £300 is half of 10%
10% = £30
5% = £15

15% of £300 = 10% + 5%
= £30 + £15
= £45

You can use a ratio table to organise your working out more clearly.

%	100%	10%	5%	15%
£	300	30	15	45

÷10 ÷2 + =

Top Tip
There is no "correct" way to break up percentages.
Use whatever amounts you find easiest.

Increase 540 by 36%

10%	(Divide by 10)	54
5%	(Divide by 10% by 5)	27
1%	(Divide by 100 or divide 10% by 10)	5.4

540 + (3x54) + 27 + 5.4 = **734.4**

Decrease 470 by 16%

$$10\% = 47$$
$$5\% = 23.5$$
$$1\% = 4.7$$
$$470 - 47 - 23.5 - 4.7 = 394.8$$