NUMBER BASICS

Factor Numbers that divide exactly into another number;
e.g. Factors of 18 are 1 x 18, 2 x 9, 3 x 6
= 1, 2, 3, 6, 9, 18

Multiples Multiples of 2 are 2, 4, 6, 8, 10…….
Multiples of 3 are 3, 6, 9, 12, 15……..

Prime Numbers have only two factors 1 and the number itself.
The first prime numbers are 2, 3, 5, 7, 11, 13, 17, 19

Square Numbers are 1^2, 2^2. 3^2, 4^2, 5^2, …
that is 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, …..

Cube Number are 1^3, 2^3. 3^3, 4^3, 5^3 … that is 1, 8, 27, 64, 125, …

Power 4 $1^4 = 1$, $2^4 = 16$, $3^4 = 81$

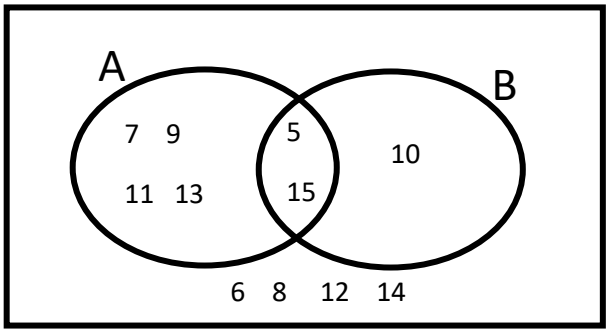
Root Square and Square root are opposite operations,
$8^2 = 64$ $\sqrt{64} = 8$ (*there are two roots of 64, 8 and -8)*
Cube and cubic root $4^3 = 64$ $\sqrt[3]{64} = 4$

Venn Diagrams

The universal set, Ɛ = {5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,} (This includes all numbers inside the rectangle)
Set A = Odd Numbers, Set B = Multiples of 5

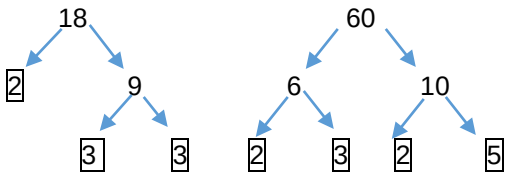
The middle bit is called the **intersection** of A ∩ B

The two circles together is called the **union** of A U B



Use a Venn Diagram to find the Highest Common Factor (HCF) and Lowest Common Multiple (LCM) of 18 and 45

Writing 18 and 45 as a product of their prime factors write in index form.

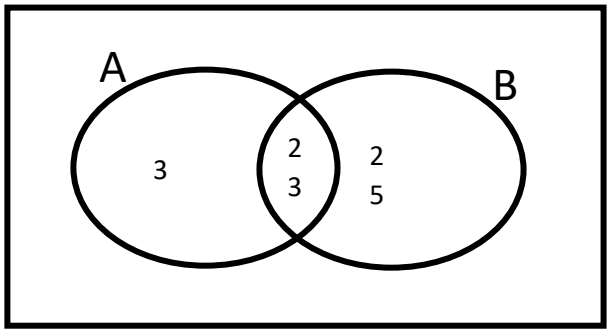


Set A 2 x 3 x 3 2 x 3^2 = 18

Set B 2 x 2 x 3 x 5 2^2 x 3 x 5 = 60

HCF = 2 x 3 = 6 (middle numbers)

LCM = 3 x 2 x 3 x 2 x 5 = 180 (all numbers)



INDICES 3^4 (*3 to the power of 4), 4 is the index* ($3^4 = 81$)

Rules of Indices

1. $a^m \times a^n = a^{m+n}$ $2^3 \times 2^2 = 2^{3+2} = 2^5$
2. $a^m \div a^n = a^{m-n}$ $2^3 \div 2^2 = 2^{3-2} = 2^1$
3. $(a^m)^n = a^{mn}$ $(2^3)^2 = 2^{2 \times 3} = 2^6$
4. $a^0 = 1$ power 'zero' answer 1 every time
5. $a^{-1} = \frac{1}{a^n}$ $4^{-2} = \frac{1}{4^2} =$
6. $\sqrt[n]{a} = a^{1/n}$ $\sqrt[2]{4} = 4^{1/2}$ or $\sqrt[3]{8} = 8^{1/3}$
7. $\sqrt[n]{a^m} = a^{m/n}$ $\sqrt[2]{4^3} = 4^{3/2}$ (Power, Root)

Exam Examples

a. Simplify

(i) $3x^{3/2} \times 2x^{5/2} = 66x^{3/2+5/2} = 6x^{8/2} = 6x^4$

(ii) $\frac{24x^{7/2}}{6x^{-3/2}} = \frac{4x^{7/2}}{x^{-3/2}} = 4x^{7/2 - -3/2} = 4x^{10/2} = 4x^5$

(iii) $(4ab^2)^3 = 64a^2b^6$

b. Express $25^{-½}$ as and fraction. $= \frac{1}{\sqrt{25}} = \frac{1}{5}$

STANDARD FORM

Standard form is used to write large numbers and small numbers
A number in standard form is (a number between 1 and 10) x (a power of 10)

A flea weighs around 0.000087kg Written in standard form = 8.8×10^{-5}kg *(negative power of 10 small number)*
The speed of light is 2.998×10^8 meters 299,800,000 meters. *(positive power of 10 small number)*

When writing a number in standard form count the bounce carefully 6 5 4 3 2 1 $6{,}380{,}000 = 6.36 \times 10^6$

Adding or subtracting numbers in standard form

If powers of 10 are the same $5 \times 10^6 + 3 \times 10^6 = 8 \times 10^6$ (*5 million + 3 million = 8 million)*

If powers of 10 are different numbers must be rewritten $6 \times 10^9 + 5 \times 10^8$
$= 60 \times 10^8 + 5 \times 10^8$
$= 65 \times 10^8$
$= 6.5 \times 10^9$ *Rewrite in standard form*

#TopTip
increasing number
decrease power

Multiplying (or dividing) two numbers in standard form.

$(5 \times 10^7) \times (3 \times 10^3) = 5 \times 3 \times 10^7 \times 10^3$ *use the rules of indices (**add** the powers for multiply)*
$= 15 \times 10^{10}$
$= 1.5 \times 10^{11}$ *Rewrite in standard form*

Dividing numbers in standard form **subtract** powers $9{\cdot}6 \times 10^{-4} \div 3 \times 10^{-3} = 3{\cdot}2 \times 10^{-1}$ (-4 – -3 = -1)

You will need to be able to work with numbers in standard form on your calculator.

ROUNDING (5 or greater round up)

Decimal Places

2.6̲37 rounded to **1** decimal place is 2.6 (Underline **1st** number after the decimal point – look at the second decimal number)

2.63̲7 rounded to **2** decimal place is 2.64 (Underline **2nd** number after the decimal point – look at the third decimal number)

Significant Figures

To round to a specific number of significant figures (sig.fig)
Count from the first figure that is **not** zero.

- 34·548 i 3 sig.fig is 34·5
  34·548 i 1 sig.fig is 30
  0·03458 i 2 sig.fig is 0·035

Estimating (Round numbers to approximate an eanswer)

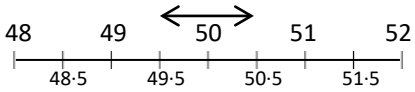
(In an exam question if you see the word **ESTIMATE** round the numbers to make the sum **easier**)

e.g$_1$ 895 x 41 We can approximate 895 as 900 and 41 as 40
900 x 40 = 36000
Therefore 895 x 41 is almost 36000

e.g$_2$ $\frac{2.8 \times 4.23}{61} \approx$ = 0.2

ACCURACY Upper and Lower Bounds. (± **half the units)**

- Examples
  Sacks of potatoes weigh 50 kg measured to the nearest kg.
  Upper bound + 0·5kg 50·5kg
  Lower Bound – 0·5kg 49·5kg



300mm is measured to the nearest mm *Therefore ± 0·5mm*

Upper boundary 299·5mm Lower boundary 300·5mm

8·2cm is measured to the nearest 10th of a cm. *Therefore ± 0.05cm*
Upper boundary 8·25cm Lower boundary 8·15cm

- What ever the accuracy add and subtract half these measurements e.g **½ up ½ down**
- For every question find the upper and lower bounds.
- Be careful of the units in the question

Example A rectangular field has a length of 120m and a width of 67m, correct to the nearest metre. Work out the maximum and minimum Area of the field.

Upper and Lower bounds 120.5m and 119.5m 67.5m and 66.5m

Max area = 121.5 x 67.5 = 8201.25m^2 Min area = 119.5 x 66.5 = 7946.75m^2

RECIPROCAL (flip the fraction)

The reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$

Example the reciprocal of $\frac{2}{7}$ is $\frac{7}{2}$

the reciprocal of 0·4 = $\frac{4}{10}$ is $\frac{10}{4}$ = 2·5