

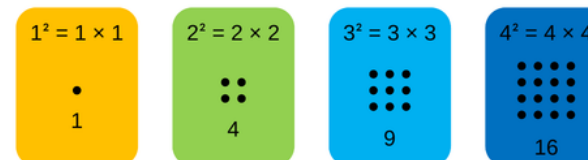
Year 8 - Mathematics - Summer Term: Helpful Hints



Key Word	Definition
Factor	A number that divides a given number exactly, leaving no remainder.
Multiple	The result of one number multiplied by another number.
Square Number	The answer when a number has been multiplied by itself.
Cube Number	The answer when a number is multiplied by itself and then by itself again.
Prime Numbers	A whole number that has exactly two factors.

Square Numbers:

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, ...



The pattern of dots gives a clue as to where the name square numbers come from...

Multiplication Grid:

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Prime Number Grid:

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

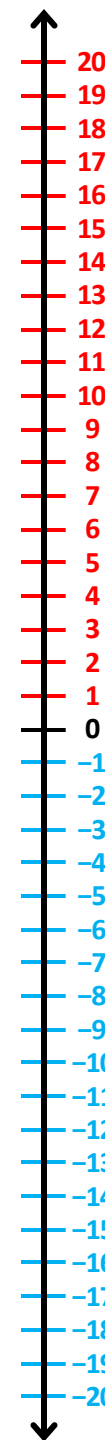
Cube Numbers:

1 is the first cube number, because $1 \times 1 \times 1 = 1$

8 is the second cube number, because $2 \times 2 \times 2 = 8$

27 is the third cube number, because $3 \times 3 \times 3 = 27$

64 is the fourth cube number, because $4 \times 4 \times 4 = 64$



Year 8 - Mathematics - Summer Term: Number

Key Word	Definition
Index or Indices	A multiplicative relationship between values.
Root	Using common factors to divide all the numbers in a ratio until they cannot be divided further.
Standard Form	a number or ratio that can be expressed as a fraction of 100

Powers

Index (Indices)
Power
Exponent

"2 to the power of 4"
"2 to the 4"

Base → 2^4

$$2 \times 2 \times 2 \times 2 = 16$$

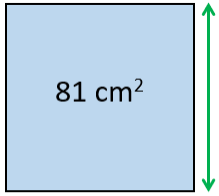
Roots

The reverse of a power. For example, the square roots is the inverse of squaring.

What number, multiplied by itself, equals 36?

$$\sqrt{36} = 6$$

We can think of this using Area. Finding a missing side in a square given its Area...



$\sqrt{81} = 9 \text{ cm}$

Laws of Indices:

This year you must know the following index laws:

- When multiplying add the powers.

$$2^4 \times 2^3 = 2^7$$

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^7$$

- When dividing indices, subtract the powers.

$$\frac{2^6}{2^3} = 2^3$$

$$2 \times 2 \times 2 = 2^3$$

Standard Form

Standard form is useful way of writing really big numbers and really small numbers so that they can be compared.

Example 1:

Convert 3000 to standard form.

$$3 \times 10^3$$

A number between 1 and 10 Integer power of 10

Example 2: Don't just count the zero's...

Convert 14,800 to standard form.

$$1.48 \times 10^4$$

A number between 1 and 10 Integer power of 10

Example 3: This one is a small decimal so has a negative power!

Convert 0.00073 to standard form.

$$7.3 \times 10^{-4}$$

A number between 1 and 10 Integer power of 10



Year 8 - Mathematics - Summer Term: Number

Key Word	Definition
Units of Measure	Units used to measure the length of something. E.g. mm, cm, m, km
Units of Capacity	Units used to measure the weight of an object. E.g. grams, kg,
Units of Mass	Units used to measure the amount of a liquid. E.g. ml, litres.

Fractions, Decimals and Percentages

Here are some common conversions you should **learn** off by heart...

Fraction	Decimal	Percentage
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{1}{5}$	0.2	20%
$\frac{1}{3}$	0.3	33.3%
$\frac{2}{3}$	0.6	66.6%
$\frac{1}{10}$	0.1	10%
$\frac{1}{100}$	0.01	1%

Useful Conversions

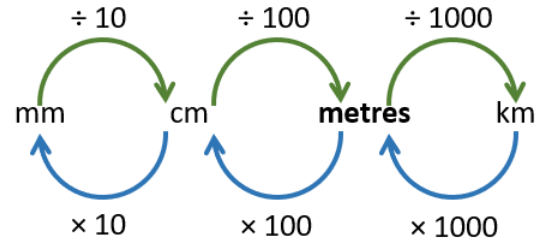
Here are some units conversions to **learn** off by heart...

Conversions
1cm = 10mm
1m = 100cm
1km = 1000m
1kg = 1000g
1litre = 1000ml
1 minute = 60 seconds
1 hour = 60 minutes
1 day = 24 hours

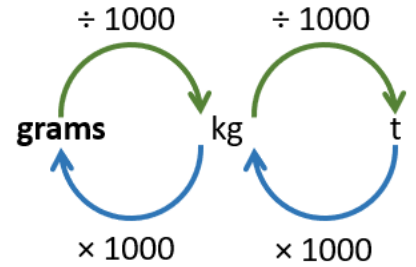
Converting Units

The following conversion charts can be used to convert between different units.

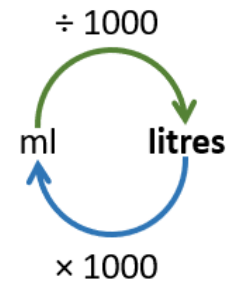
Units of Measure:



Units of Mass:



Units of Capacity





Year 8 - Mathematics - Summer Term: Geometry

Key Word	Definition
Polygon	A 2D shape made up of straight sides joined together.
Regular Polygon	A Polygon where all sides and angles are equal.
Interior Angle	An angle on the inside of the Polygon.
Exterior Angle	An angle on the outside of the polygon which lies on a straight line with the interior angle.

Interior Angle Sum in Polygons

As you increase the number of sides a polygon has, its total angle sum increases too...

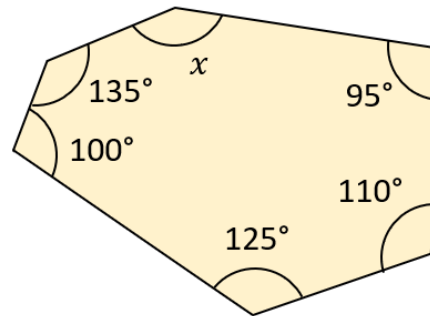
Number of Sides	Name of Shape	Angle Sum
3	Triangle	180°
4	Quadrilateral	360°
5	Pentagon	540°
6	Hexagon	720°
7	Heptagon	900°
8	Octagon	1080°

More generally, the angle sum for any polygon with n sides can be found using this formula:

$$\text{Sum of Interior Angles} = (n-2) \times 180$$

Example:

Find missing angle x



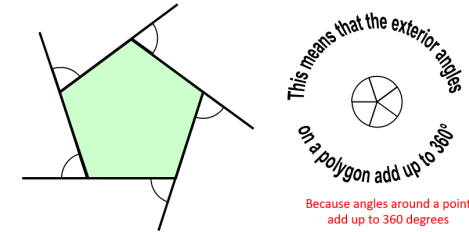
$$(6-2) \times 180 = 720^\circ$$

Interior Angles of a Hexagon Total 720°

$$720 - 95 - 110 - 125 - 100 - 135 = 155^\circ$$

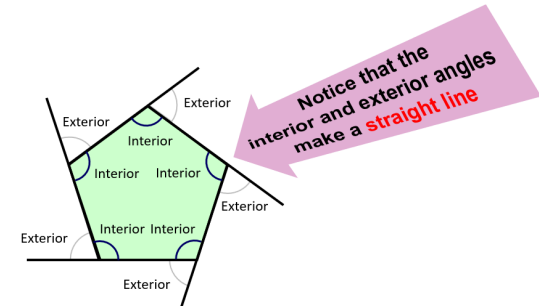
Regular Polygons

In a regular polygon, all the exterior angles add to 360 degrees.



$$\text{So, Exterior Angle} = \frac{360}{\text{number of sides}}$$

In any polygon the interior and exterior angles lie on a straight line...



$$\text{So, Exterior} + \text{Interior} = 180$$

Example:

$$\text{Exterior angle of a Hexagon} = \frac{360}{6} = 60^\circ$$

$$\text{Interior angle of a Hexagon} = 180 - 60 = 120^\circ$$

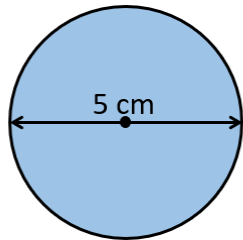


Year 8 - Mathematics - Summer Term: Geometry

Key Word	Definition
Circumference	The distance around the edge of a circle.
Area	The amount space inside a 2D shape.
Radius	The distance between the centre and the circumference of a circle (see diagram below).
Diameter	A straight line passing from side to side through the centre of the circle (see diagram below).
Volume	The amount of space inside a 3D object.
Surface Area	The total area of the 2D flat faces of a 3D object added together.

Circumference of a Circle

$$\text{Circumference} = \pi \times \text{Diameter}$$

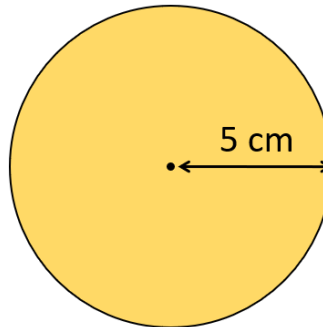


$$C = \pi \times 5$$

$$= 15.71 \text{ cm} \quad (2\text{dp})$$

Area of a Circle

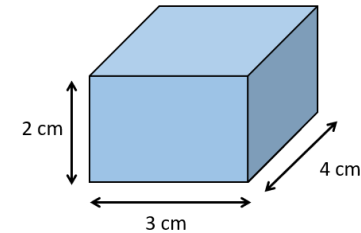
$$A = \pi r^2$$



$$A = \pi \times (5)^2$$

$$= 78.5 \text{ cm}^2$$

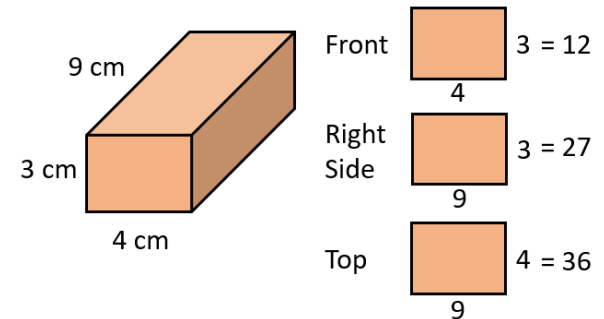
Volume



$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

$$2 \times 3 \times 4 = 24 \text{ cm}^3$$

Surface Area



$$\text{Front \& Back}$$

$$(2 \times 12) = 24$$

$$\text{Right \& Left Side}$$

$$(2 \times 27) = 54$$

$$\text{Top \& Bottom}$$

$$(2 \times 36) = 72$$

$$\text{Total Surface Area}$$

$$= 150 \text{ cm}^2$$



Year 8 - Mathematics - Summer Term: Data

Key Word	Definition
Bar Chart	A diagram in which the numerical values of frequency are represented by the height each bar.
Dual Bar Chart	A bar chart that shows a comparison between two or more sets of data, for example adults and children.
Pictogram	A chart which uses icons and images to represent frequency.
Frequency	The frequency of a particular data is the number of times the data value occurs.

Pictogram

Pay close attention to the key to help read the pictogram...

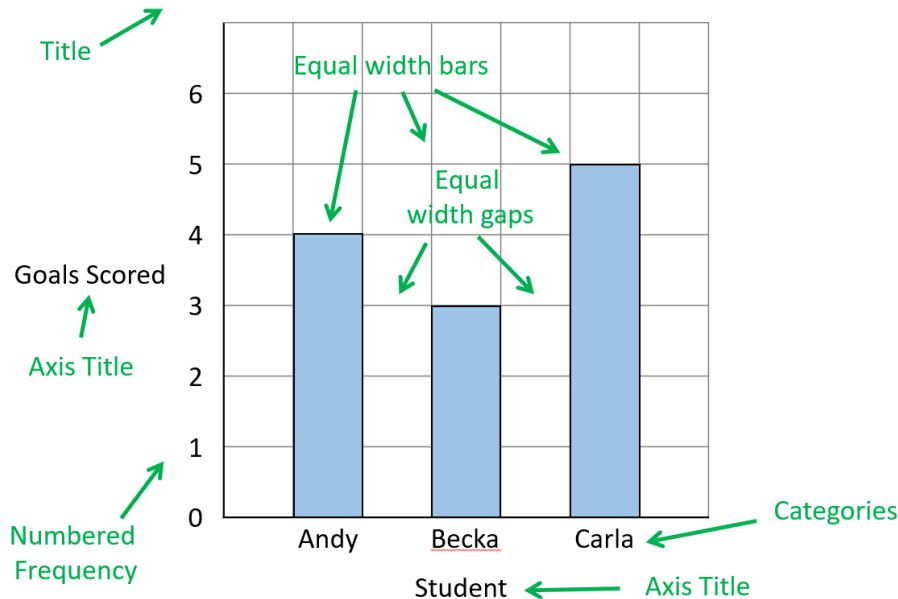
Goals scored by Year 8 boys.



KEY:
 = 4 goals

What makes a good bar chart?

Goals scored in the March football tournament



Pie Chart:

Julie surveyed 60 people about their favourite food. Complete the table to work out the angle to measure each section.

★ How many degrees for one person? ★

$$\frac{360}{60} = 6^\circ$$

Favourite Food	Frequency	Calculation	Angle
Pizza	20	$20 \times 6^\circ$	120°
Salad	30	$30 \times 6^\circ$	180°
Pie	10	$10 \times 6^\circ$	60°
Total	60		360°



Year 8 - Mathematics - Summer Term: Probability

Key Word	Definition
Probability	Probability is a number between 0 and 1 that describes the chance that a stated event will occur.
Mutually Exclusive Events	Two events which cannot both happen at the same time. The probabilities of mutually exclusive events always add to 1.

Calculating a Probability
 A probability is always a value between 0 and 1. It can be written as a fraction, decimal or percentage. Often the easiest way is to write a probability as a fraction (see below).

$$P(\text{outcome}) = \frac{\text{number of ways the outcome can happen}}{\text{total number of possible outcomes}}$$

10 cards are numbered 1-10 & one card is picked at random.
 What is...



$$P(\text{odd}) = \frac{5}{10} = \frac{1}{2}$$

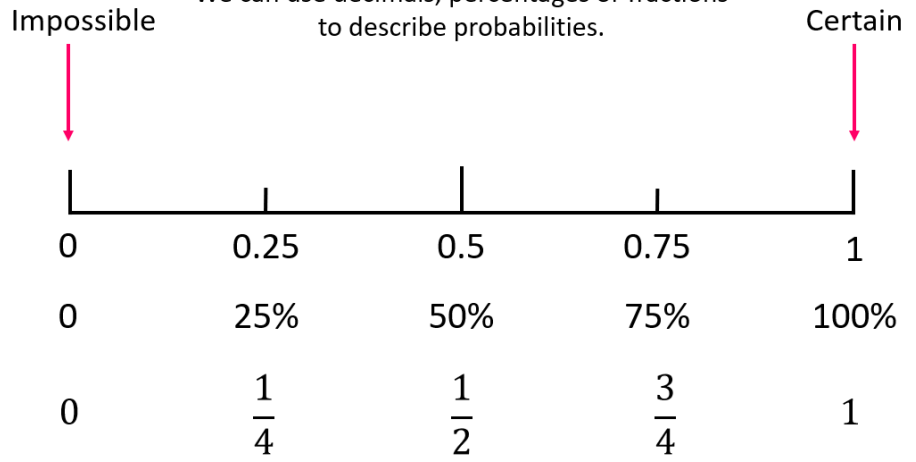
$$P(\text{prime}) = \frac{4}{10} = \frac{2}{5}$$

$$P(\text{multiple of 3}) = \frac{3}{10}$$

$$P(\text{even or 7}) = \frac{6}{10} = \frac{3}{5}$$

Probability Scale

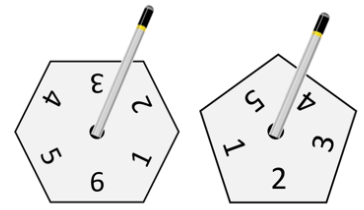
We can use decimals, percentages or fractions to describe probabilities.



Sample Space Diagrams

These enable us to see all the possible outcomes of an experiment and calculate the probability of each one happening.

A student makes a hexagonal spinner (1-6) and a pentagonal spinner (1-5).



a) Complete the Sample Space Diagram for spinning both and adding their scores.

		1 st Spinner					
		1	2	3	4	5	6
2 nd Spinner	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
		Total Score					

Calculate:

- b) $P(11) = \frac{1}{30}$
- c) $P(7) = \frac{1}{6}$
- d) $P(8 \text{ or more}) = \frac{1}{3}$
- e) $P(4 \text{ or } 9) = \frac{1}{5}$
- f) $P(\text{the same number on both spinner}) = \frac{1}{6}$

Year 8 - Mathematics - Summer Term: Data - Averages and the Range

Key Definitions

Key Word	Definition
Mean	The average of a data set, found by adding all numbers together and then dividing the sum of the numbers by the number of numbers.
Median	Another type of average of a data set. The middle number; found by ordering all data points and picking out the one in the middle
Mode	The mode is the most common number that appears in your set of data.
Range	A way of measuring the spread of the data. The difference between the largest value and smallest value within the data.

Calculating the Mean

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Total number of values}}$$

Example :

8, 3, 10, 4, 2, 6, 2

$$\begin{aligned} \text{Mean} &= (2+2+3+4+6+8+10) \div 7 \\ &= 35 \div 7 \\ &= 5 \end{aligned}$$

Calculating the Mode

The mode is the number or numbers that appear the most. It can be more than one value.

3, 1, 5, 1, 1, 3, 7

1, 1, 1, 3, 3, 5, 7

Mode = 1

7, 2, 4, 3, 9

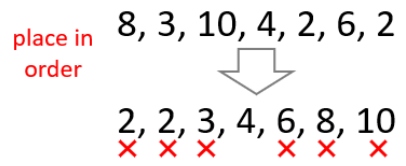
2, 3, 4, 7, 9

Mode = No Mode

Calculating the Median

To find the middle number of the data, we must first order the data from smallest to largest.

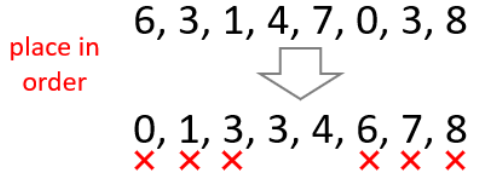
Example:



Median = 4

For an even number of data values, there will be two numbers left in the middle. To get the median, we need the middle of these two values.

Example:

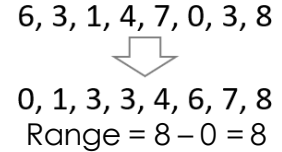


Median = 3.5

Calculating the Range

To find the **range** work out the difference between the largest and smallest values.

Example:





Year 8 - Mathematics - Summer Term: Data - Averages and the Range

Ungrouped frequency tables

For large amounts of data collect, the values can be recorded in a frequency table rather than a list of values as it is more efficient to read.

You could be asked to calculate the **Mean, Median, Mode and Range** of a Frequency table.

Mean from a Frequency Table

- 1) **Multiply the two values in each row together to calculate the total for each row.**

E.g. 9 students scored 1 goal so there were 9 goals scored altogether.

20 students scored goals for the school hockey team last month. The table gives information about the number of goals they scored.

Goals scored		Number of students	
1	x	9	9
2	x	3	6
3	x	5	15
4	x	3	12

= 20

= 42

- 2) **Total the new column containing the answers to each multiplication.**

- 3) **Divide the total of the new column by the total frequency**

$$\text{Mean} = \frac{42}{20} = 2.1$$

Note: this is equivalent to having a big long list of 20 values, adding them all up and dividing by the amount of values.

Median from a Frequency Table

Remember that the **Median** value is the middle value in the data. Our frequency table has a total of 20 values in it. The middle of 20 values would be the 10.5th value, we need to find it...

20 students scored goals for the school hockey team last month. The table gives information about the number of goals they scored.

Goals scored	Number of students	
1	9	9 values
2	3	9 + 3 = 12 values
3	5	
4	3	

As shown above the Median value must lie in the second row of the table. Therefore the median number of goals scored would have been 2.

Mode from a Frequency Table

Remember the **Mode** is the most common value in the data. It is easy to see the mode in a frequency table as it is the value that has the highest frequency.

In the table above, the highest frequency is 9 so the Mode is 1 goal.

Range from a Frequency Table









Remember the **Range** is the biggest value take away the smallest value.

In the table above, the highest amount of goals scored was 4 and the least goals scored was 1. So the range is **4 - 1 = 3**






Year 8 - Mathematics - Summer Term: Calculator Skills

Important buttons on your calculator:

- **Equals button** → 
- **Power of 2** – e.g. $3^2 = 9$ → 
- **Any power** – e.g. $2^3 = 8$ → 
- **Square root** – e.g. $\sqrt{16} = 4$ → 
- **Any root** – e.g. $\sqrt[3]{27} = 3$ → 
- **Fraction button** – e.g. $\frac{3}{4}$ → 
- **Pi button** – e.g. π →  
(This one is in blue above the number 7 so we must press the blue shift button first!)

Helpful Hints

- Convert your answer to a decimal use the **FORMAT** button and select “**decimal.**” → 
- Use the delete button to remove a mistake rather than deleting the whole thing. → 
- Use the keypad to move the cursor around the calculation you have typed in on the screen. → 

Check

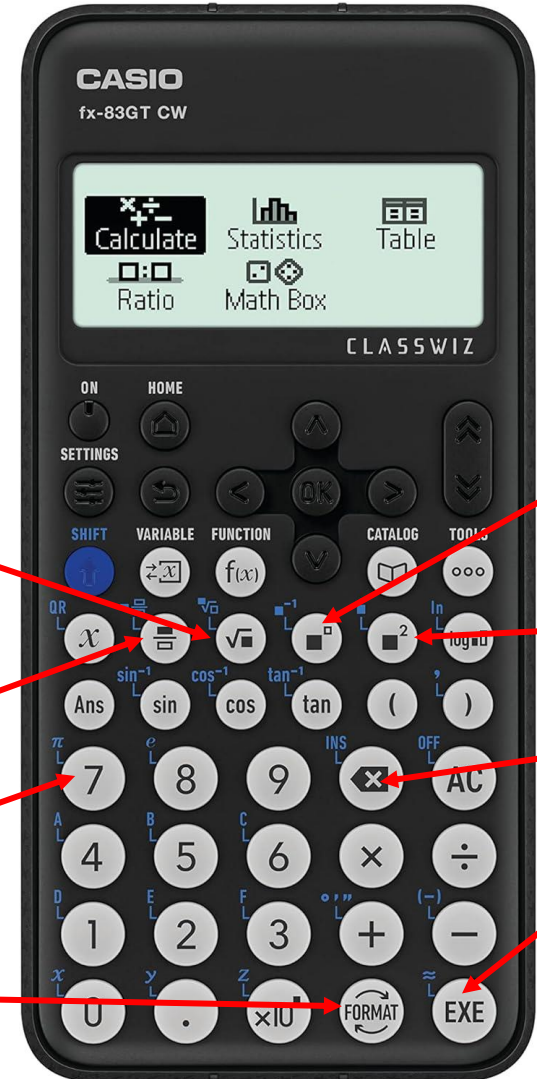
Can you type these questions in your calculator and get the following answers...

1) $8.3^3 = 571.787$

2) $\frac{7.5^2 - 1.2}{5} = 11.01$

3) $\sqrt{37} - 1.71 = 4.37276253$

Use the QR code to watch a short video on how to use your calculator



- Any Power
- Power of 2
- Delete button
- Equals button
- To convert to a decimal
- Pi button (shift first)
- Fraction button
- Square root