

### Law of Surds:

$$\sqrt{a} \times \sqrt{a} = a$$

$$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

$$\frac{b}{\sqrt{a}} = \frac{b}{\sqrt{a}} \times \frac{\sqrt{a}}{\sqrt{a}} = \frac{b\sqrt{a}}{a}$$

### Quadratic Formula:

$$\text{If } ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Indices

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

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

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

$$a^0 = 1 \quad 3^0 = 1$$







$$a^{\frac{1}{2}} = \sqrt{a} \quad 16^{\frac{1}{2}} = 4$$

$$a^{\frac{1}{b}} = \sqrt[b]{a} \quad 81^{\frac{1}{4}} = \sqrt[4]{81} = 3$$

$$a^{\frac{b}{c}} = (\sqrt[c]{a})^b \quad 8^{\frac{4}{3}} = (\sqrt[3]{8})^4 = 16$$

$$a^{-b} = \frac{1}{a^b} \quad 10^{-2} = \frac{1}{10^2} = \frac{1}{100}$$

### Angles in a Polygon:

Number of sides	Sum of interior angles	Shape
3	180°	
4	180° + 180° = 360°	
5	360° + 180° = 540°	
6	540° + 180° = 720°	
8	900° + 180° = 1080°	
10	1260° + 180° = 1440°	

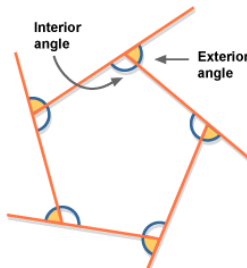
$$\text{Interior angle} + \text{exterior angle} = 180^\circ$$

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

$$\text{Each Interior Angle (of a Regular Polygon)} = \frac{(n-2) \times 180^\circ}{n}$$

$$\text{Sum of Exterior Angles} = 360^\circ$$

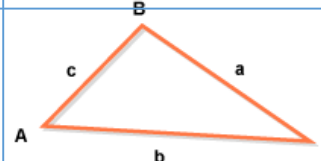
$$\text{Each Exterior angle (regular polygon)} = \frac{360}{n}$$



$$\text{Sine Rule } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine Rule } a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of Triangle } \frac{1}{2} ab \sin C$$



### Trig Values

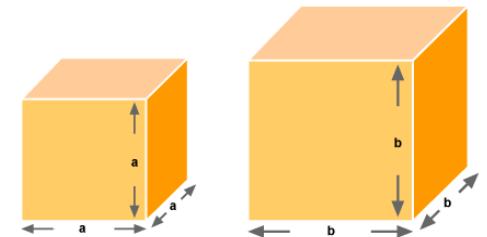
Degrees	Sin $\theta$	Cos $\theta$	Tan $\theta$
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	1	0	-

### Similarity and Congruence

#### Length, Area and Volume

For any pair of **SIMILAR** figures corresponding **sides** are in the **same ratio** and corresponding **angles** are **equal**. Two objects are **CONGRUENT** if they are the **exact same size and shape**.

The cubes are similar, and the ratio of their lengths is  $\frac{a}{b}$



#### Direct Proportion

If y is directly proportional to x  $\rightarrow y \propto x$

Also written as  $y = kx$

k is the constant of proportionality

#### Inverse Proportion

When one value increases as the other decreases

$$y \propto \frac{k}{x} \quad y \propto \frac{1}{x} \quad y = \frac{k}{x}$$

## Histograms

The area of each rectangle in a histogram represents the frequency of the class

$$\text{Frequency Density} = \text{Frequency} \div \text{Class Width}$$

## Cumulative Frequency

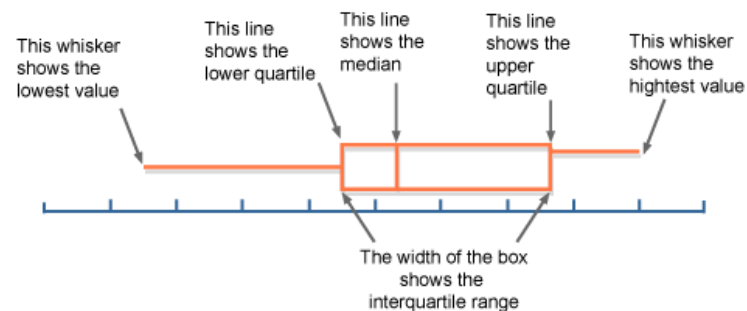
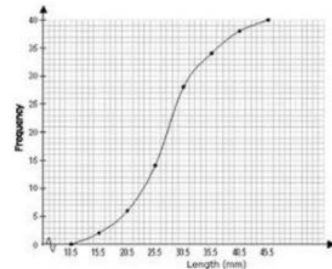
“running total” – adding frequencies as you go along

### Cumulative frequency

Cumulative frequency table

Class Limits	Frequency	Cumulative Frequency
5-10	1	1
10-15	2	3
15-20	4	7
20-25	0	7
25-30	3	10
30-35	5	15
35-40	6	21

Cumulative frequency graph



## Mean from a Grouped Frequency table

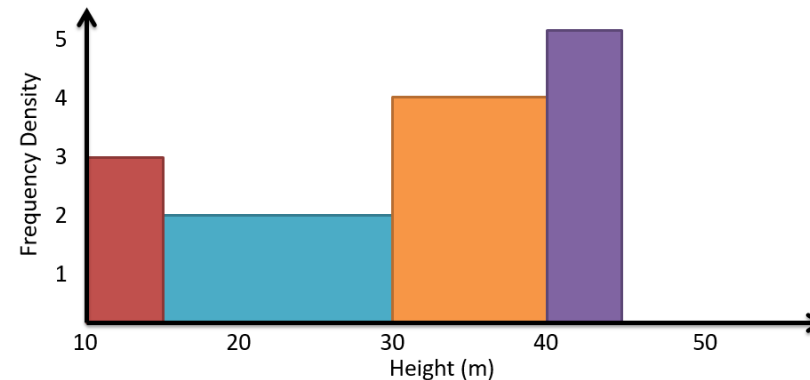
We find the **Average Number of Coffees per Hour** by adding two new columns to our Frequency Table and using a Formula.

Cappuccinos	Freq	Interval Midpoint	Freq x Midpt
0-3	2	1.5	2 x 1.5 = 3
4-7	3	5.5	3 x 5.5 = 16.5
8-11	8	9.5	8 x 9.5 = 76
12-15	3	13.5	3 x 13.5 = 40.5
16-19	2	17.5	2 x 17.5 = 35
<b>TOTALS</b>	<b>18</b>		<b>171</b>

$$\text{MEAN Average} = \text{Total of (Freq x Midpt)} / \text{Total Frequency} \\ = 171 / 18 = 10 \text{ cappuccinos per hour}$$

## Histograms

Height (m)	Frequency	Frequency Density
10 < w ≤ 15	45	3
15 < w ≤ 30	30	2
30 < w ≤ 40	40	4
40 < w ≤ 45	25	5



# To do

**Year group: 10**

## Ratio

A recipe for biscuits uses butter to sugar in the ratio 5 : 3

How much sugar is needed with 360 grams of butter?

A

B

C

D

135 grams

216 grams

225 grams

600 grams

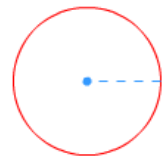
Answer: B  $360 \div 5 = 72$

$72 \times 3 = 216$  grams

## Locus

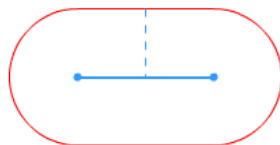
The *locus* of a point moves so that it is always a set distance (x) from a fixed point (O)

O x



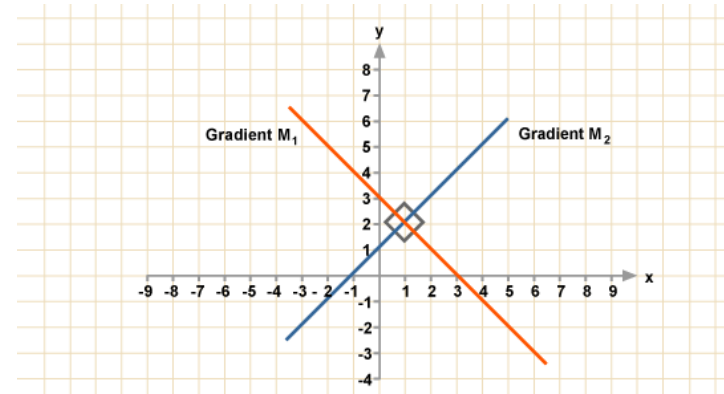
P Q

r



## Construction

*Perpendicular:* two lines drawn at right angles to each other



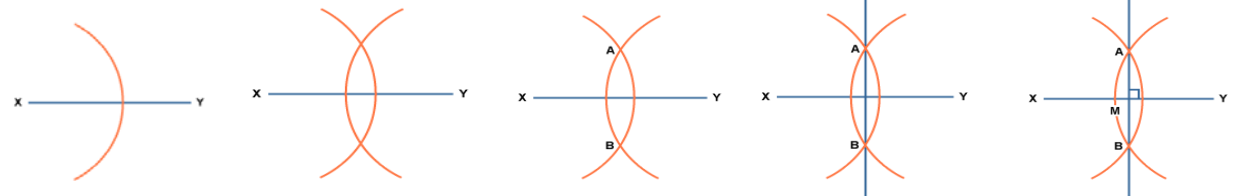
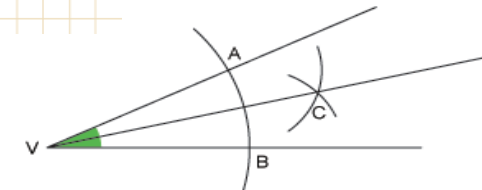
The product of the gradient of perpendicular lines will always be -1.

If lines are perpendicular,

$$M_1 \times M_2 = -1$$

*Bisector:*

Line drawn to cut another line/ angle (USING A COMPASS)



*Construction of a perpendicular line:*

Place the compass on point P. Using an arbitrary radius, draw arcs intersecting **line XY** at two points. Label the intersection points A and B. Place compass on A then B they will intercept at C

