Year 10 Higher Maths KO
Autumn Term 2026

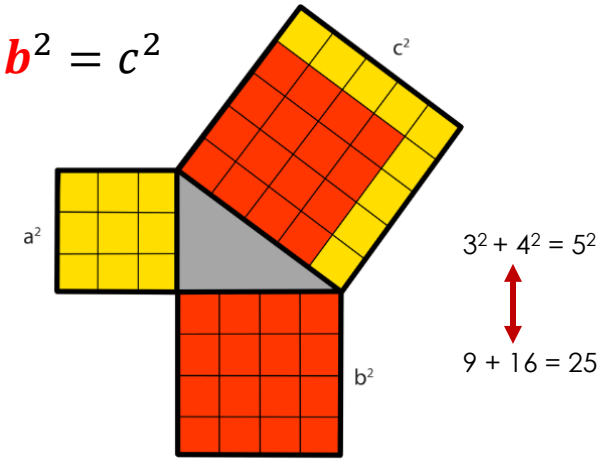
Pages	Topic
2 – 4	Right Angled Triangles
5 – 10	Circles
11 – 13	Continuous Data
14 – 16	Set Theory & Logic
17 – 21	Advanced Drawing, Measuring and Constructing
22 – 28	Advanced Proportion & Rates of Change

Year 10 – Maths – Unit GM5 Right-Angled Triangles

PYTHAGORAS

Pythagoras' Theorem $a^2 + b^2 = c^2$ Where c is the hypotenuse.
a and b can be either of the two shorter sides.

$$a^2 + b^2 = c^2$$



$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

You can use the theorem to calculate the length of the hypotenuse (the longest side)

$$a^2 + b^2 = c^2$$

You can rearrange the theorem to calculate the length of the shorter sides

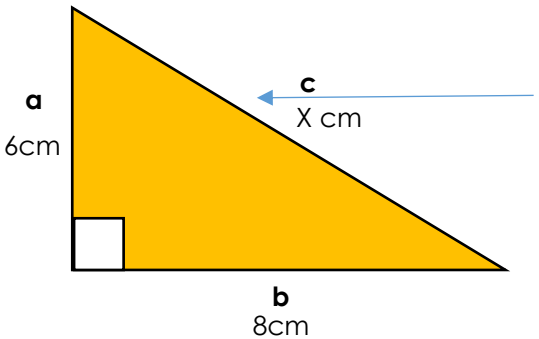
$$a^2 = c^2 - b^2$$

OR

$$b^2 = c^2 - b^2$$

Example of calculating the hypotenuse:

Calculate the value of x:



Label the sides of your triangle with a, b and c. The hypotenuse must be labelled c. The other sides can be labelled a and b (it doesn't matter which way round these are).

Substitute the lengths you have into this formula:

$6^2 + 8^2 = c^2$ ⟸ $a^2 + b^2 = c^2$

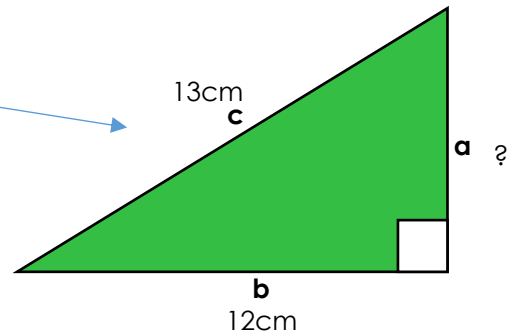
$36 + 64 = 100$

$100 = c^2$ ⇒ $\sqrt{100} = c$ ⇒ $10cm = c$

Don't forget, this is c^2. We want to calculate c so we need to square root!

Example of calculating the shorter sides:

Calculate the value of the missing side:



Substitute the lengths you have into this formula:

$a^2 = 13^2 - 12^2$ ⟸ $a^2 = c^2 - b^2$

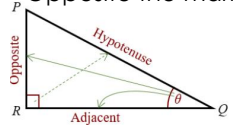
$a^2 = 169 - 144$

$a^2 = 25$ ⇒ $a = \sqrt{25}$ ⇒ $a = 5cm$

Don't forget, this is a^2. We want to calculate a so we need to square root!

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Powers and roots (NP4)	Pythagoras' Theorem	Advanced length and area (GM9)
Substitution and rearranging a formulae (A5)	Trigonometry in right-angled triangles	Trigonometric graphs (A13)
Angles in triangles (GM2)	Exact values in surd form	A Level mathematics, physics, engineering and more
Similarity (GM4)		

Keyword/Skill	Definition/Tips
Pythagoras	A Greek mathematician. He is famous for proving a theorem about the right-angle triangle.
Pythagoras' Theorem	In a right-angled triangle the square of the long side (**hypotenuse**) is equal to the sum of the squares of the other two sides.
Hypotenuse	The longest side of a right-angled triangle. It is always opposite the right angle.
Adjacent & Opposite	Adjacent side – Next to the marked angle Opposite side – Opposite the marked angle 
Trigonometry	Trigonometry is the study of triangles: their angles, lengths and more.
Trigonometric Ratios/Functions	The special measurements of a right-angled triangle: **Sin**/Sine **Cos**/Cosine **Tan**/Tangent
Inverse Trig Functions	You use these when calculating angles: $Sin^{-1}(x)$ $Cos^{-1}(x)$ $Tan^{-1}(x)$
Sin/Sine	The ratio of the length of the **opposite** side to the length of the **hypotenuse**
Cos/Cosine	The ratio of the length of the **adjacent** side to the length of the **hypotenuse**
Tan/Tangent	The ratio of the length of the **opposite** side to the length of the **adjacent** side

Year 10 – Maths – Unit GM5 Right-Angled Triangles

TRIGONOMETRY

Trig Ratios

S O H

sin(θ) equals opposite over hypotenuse

$$\sin(\emptyset) = \frac{opposite}{hypotenuse}$$

C A H

cos(θ) equals adjacent over hypotenuse

$$\cos(\emptyset) = \frac{adjacent}{hypotenuse}$$

T O A

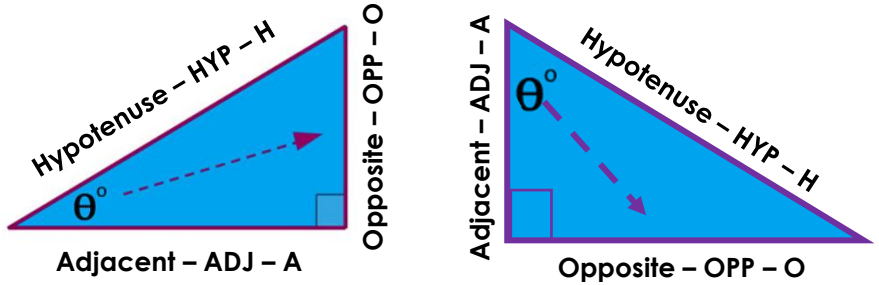
tan(θ) equals opposite over adjacent

$$\tan(\emptyset) = \frac{opposite}{adjacent}$$

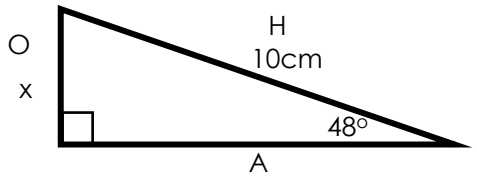
When you are calculating angles, it will involve the inverse trig functions:

$Sin^{-1}(x)$ $Cos^{-1}(x)$ $Tan^{-1}(x)$

Your first step in a trigonometry question is to label the triangle's sides.
The three sides are the **hypotenuse, opposite & adjacent** sides.
The **hypotenuse** side is always the longest side.
The **opposite** and the **adjacent** depend on the given angle:

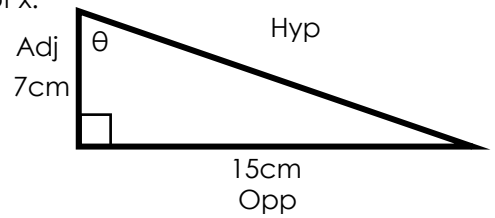


Ex1: Calculate the value of x:

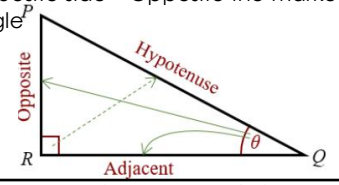


1. Label the sides.
2. Write what we know in S O H (x, 10, Sin(48))
3. Write an equation for the unknown. $x = 10 \times \sin(48)$
4. Solve the equation. $x = 7.43$ (Rounded to 2d.p.)

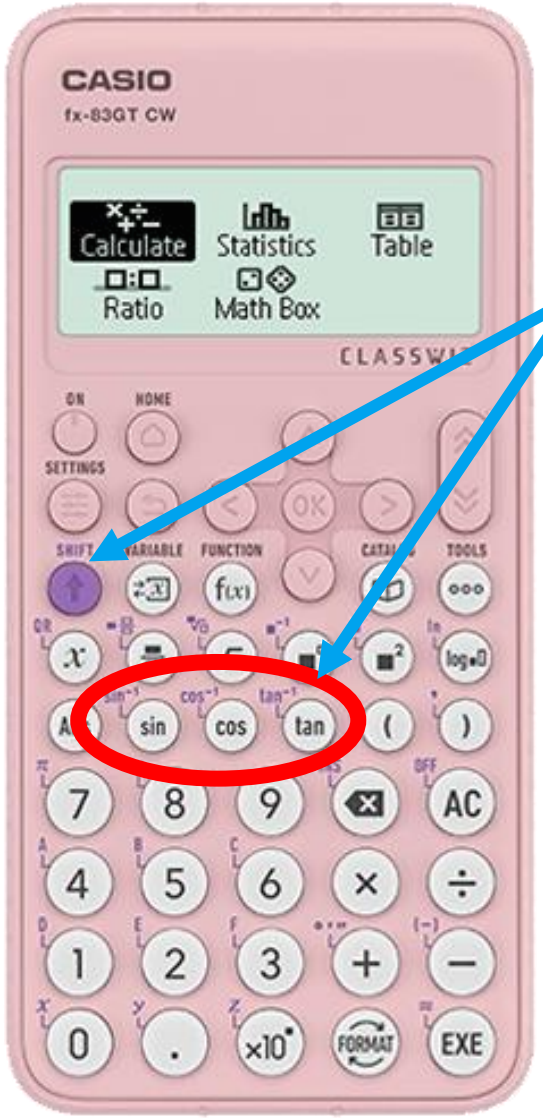
Ex2: Calculate the value of x:



1. Label the sides.
2. Write what we know in T O A (3, Tan(θ), 4)
3. Write an equation for the unknown. $\tan(\theta) = \frac{3}{4}$ $\theta = \tan^{-1}\left(\frac{3}{4}\right)$
4. Solve the equation. $\theta = 36.9°$ (to 3 s.f.)

Keyword/Skill	Definition/Tips
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Year 10 – Maths – Unit GM5 Right-Angled Triangles



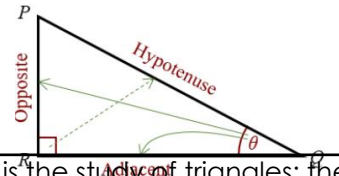
Calculator Help

Here are the **trig functions** on your calculator. You use these ones when you are finding a length.

To get the **inverse trig functions** you need to press the SHIFT button first before you press the function you need. You use these ones when you are finding an angle.

You will need to remember some trig values without a calculator. Here are some exact trig values you need to remember:

Angle, θ	$30°$	$45°$	$60°$
$\sin\theta$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
$\cos\theta$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$
$\tan\theta$	$\frac{1}{\sqrt{3}}$	$\frac{\sqrt{2}}{\sqrt{2}} = 1$	$\frac{\sqrt{3}}{1} = \sqrt{3}$

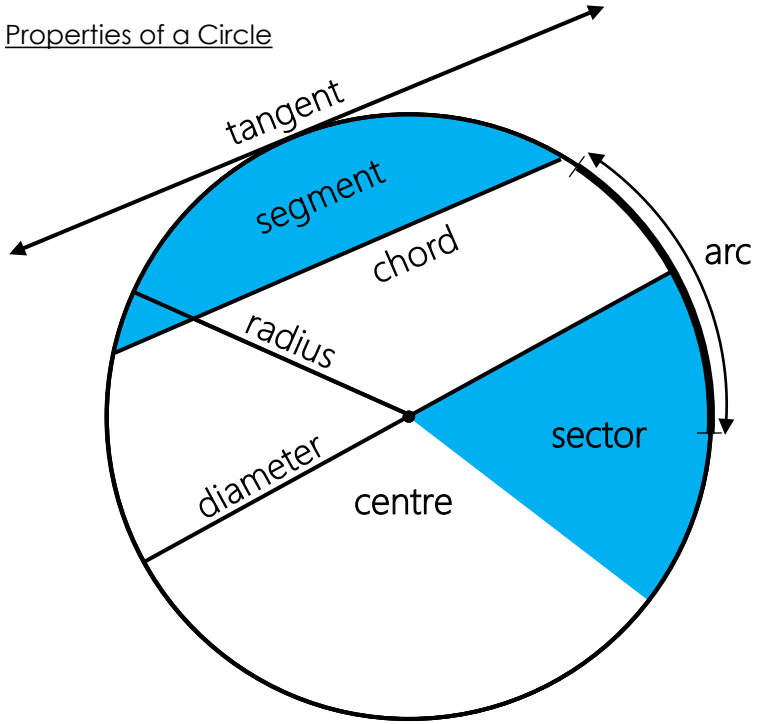
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Year 10 – Maths – Unit GM6 – Circles

My mathematical journey

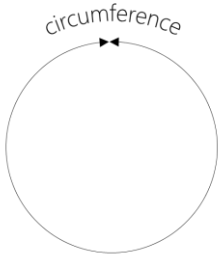
What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Angle facts (GM2)	Naming the parts of a circle	Surface area and volume (GM8)
Area and perimeter (GM3)	Finding the area and perimeter of circles and sectors of circles	Advanced length and area (GM9)
Rearranging formulae (A5)	Finding angles in circles using circle theorems	

Properties of a Circle



The diameter is always double the radius.
The radius is the same length wherever you draw it.

The circumference is the line that makes up the edge of the circle (the perimeter of the circle).

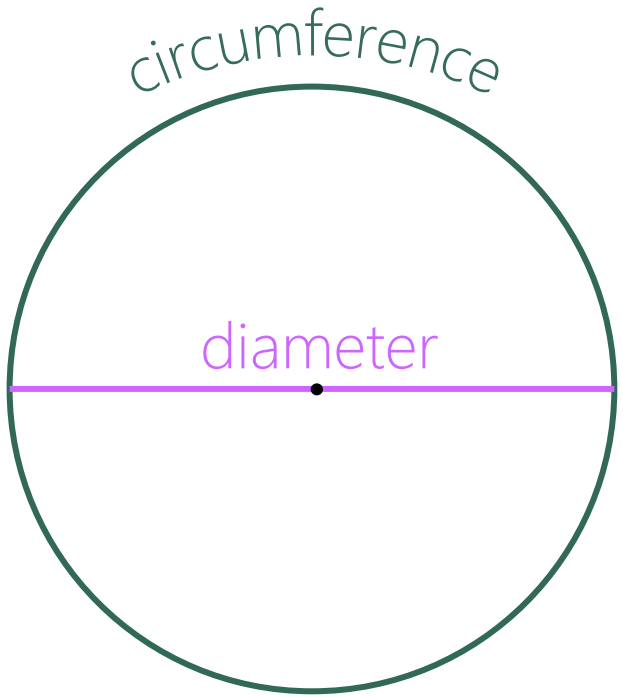


π is the ratio of circumference to diameter.

$\times \pi$

diameter → circumference

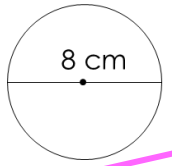
This means the diameter fits π times into the circumference.



Keyword/Skill	Definition/Tips
Area	The size of a surface. The space inside a 2D surface.
Perimeter	The distance around a two-dimensional shape.
Formula	A rule or fact written with mathematic symbols.
Semi-Circle	It is half of a circle
Chord	The line segment between two points on the circumference
Tangent	a line that touches the circumference at one point.
Segment	The smallest part of a circle made when it is cut by a line.
Arc	Part of the circumference of a circle or any curve.
Sector	A "pie-slice" part of a circle.
Circumference	The distance around the edge of a circle.
Radius	The distance from the centre to the circumference of a circle. It is half of the circle's diameter.
Diameter	A chord that passes through the centre of the circle.
Pi	The ratio of a circle's circumference to its diameter. The symbol is π π = 3.14159265358979323846... (the digits go on forever without repeating)

Year 10 – Maths – Unit GM6 – Circles

Find the circumference of a circle with diameter 8 cm.

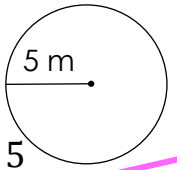


$C = \pi d$
$= \pi \times 8$
$= 8\pi$ cm
≈ 25.1 cm

exact answer, in terms of π

approximate answer, to 1 d.p.

Find the circumference of a circle with radius 5 m.



$C = 2\pi r$
$= 2 \times \pi \times 5$
$= 10\pi$ m
≈ 31.4 m

exact answer, in terms of π

approximate answer, to 1 d.p.

Circumference of a circle:

$$C = \pi d$$

As the diameter is double the radius we can also use:

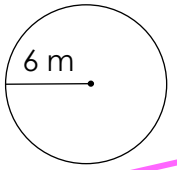
$$C = 2\pi r$$

Keyword/Skill	Definition/Tips
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Area of a circle:

$$A = \pi r^2$$

Find the area of a circle with radius 6 m.

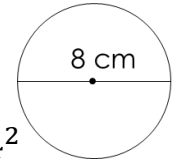


$A = \pi r^2$
$= \pi \times 6^2$
$= 36\pi$ cm^2
≈ 113.1 cm^2

exact answer, in terms of π

approximate answer, to 1 d.p.

Find the circumference of a circle with diameter 8 cm.

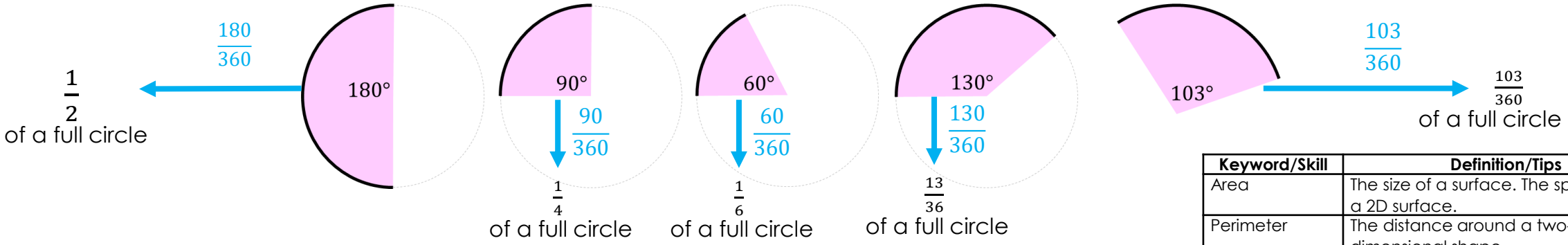


$A = \pi r^2$
$= \pi \times 4^2$
$= 16\pi$ cm^2
≈ 50.3 cm^2

exact answer, in terms of π

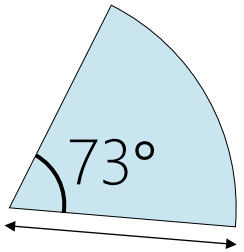
approximate answer, to 1 d.p.

Year 10 – Maths – Unit GM6 – Circles



Arc length | Fraction of circle | Circumference

$$l = \frac{\theta}{360} \times \pi d$$



To find the arc length of this sector:

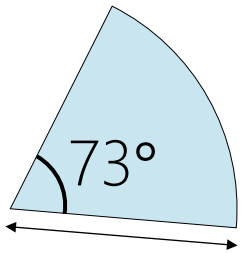
10cm is the radius, so the diameter will be $2 \times 10cm = 20cm$

$$l = \frac{73}{360} \times \pi \times 20$$

$$l = \frac{73}{18}\pi cm = 12.7\ cm\ (1d.p.)$$

Sector area | Fraction of circle | Circle area

$$A = \frac{\theta}{360} \times \pi r^2$$



To find the area of the sector:

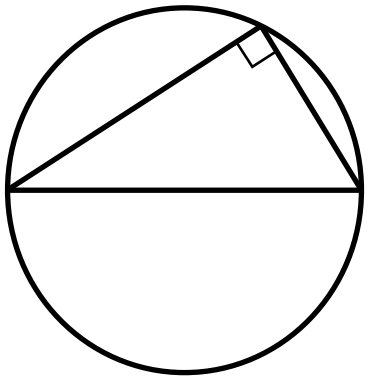
$$A = \frac{73}{360} \times \pi \times 10^2$$

$$A = \frac{365}{18}\pi cm^2 = 63.7cm^2\ (1d.p.)$$

Keyword/Skill	Definition/Tips
Area	The size of a surface. The space inside a 2D surface.
Perimeter	The distance around a two-dimensional shape.
Formula	A rule or fact written with mathematic symbols.
Semi-Circle	It is half of a circle
Chord	The line segment between two points on the circumference
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Circumference	The distance around the edge of a circle.
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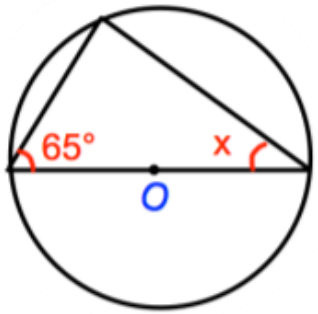
Year 10 – Maths – Unit GM6 – Circles

Angles in a Semi-Circle



The angle at the circumference standing on a diameter is equal to 90°

Example:

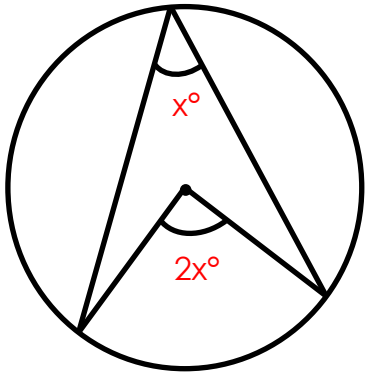


As angles in a semi-circle equal 90°, the angle at the circumference is 90°.

Angles in a triangle sum to 180°,
So therefore: 180° - (90° + 65°) = 25°

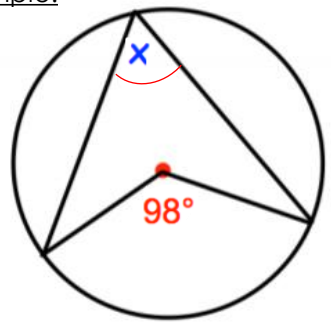
x = 25°

Angles at the Centre



The angle at the centre is double the angle at the circumference

Example:

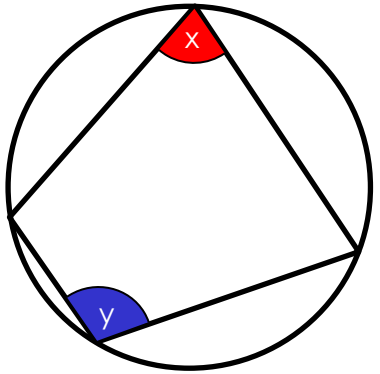


Here we have the angle at the centre. The angle at the centre is double the angle at the circumference.

Therefore: x = 98° ÷ 2

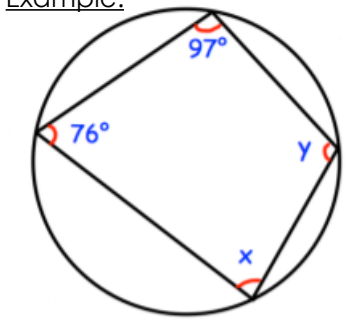
x = 49°

Opposite Angles in a Cyclic Quadrilateral



Opposite angles in a cyclic quadrilateral add up to 180°

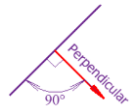
Example:



In a cyclic quadrilateral, opposite angles sum to 180°
So that means:

97° + x = 180°
-97° -97°
x = 83°

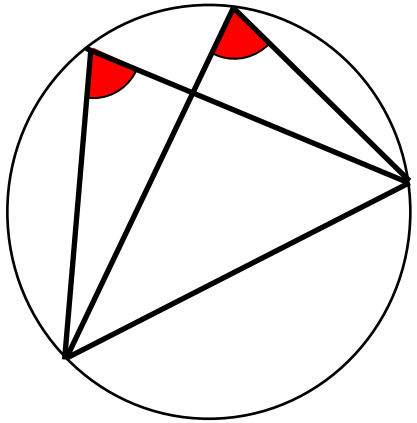
76° + y = 180°
-76 ° -76 °
y = 104°

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the **circumference** of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles (90°) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a **chord**
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the **circumference** of a circle

Exams!
You must write a reason for each stage of your working out when it comes to circle theorems, even basic facts (such as angles in a triangle sum to 180°).
You will miss out on marks if you do not put a reason.

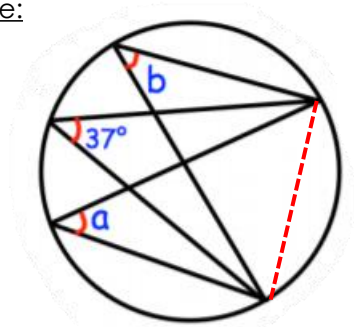
Year 10 – Maths – Unit GM6 – Circles

Angles in the Same Segment



Angles created by triangles are equal if they are in the same segment

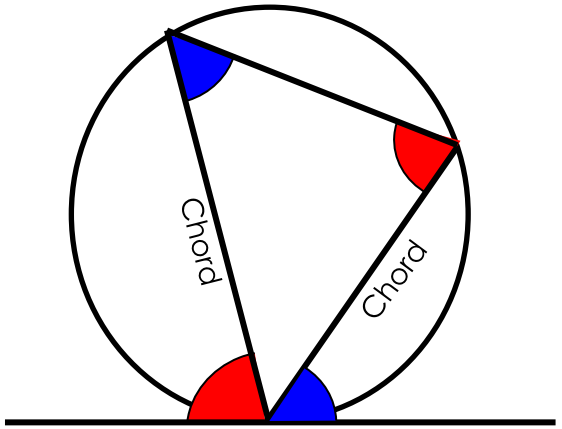
Example:



Here, these angles are all in the same segment (you can add in the line to make the segment to show it).

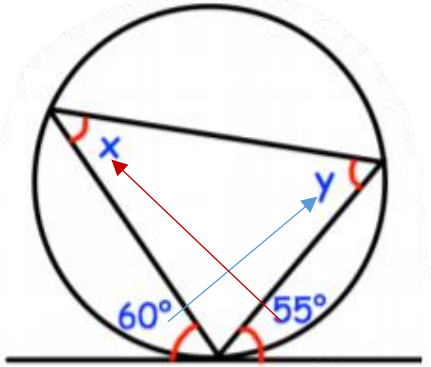
This means a = b = 37°
So: a = 37° b = 37°
Because angles in the same segment are equal

Alternate Segment Theorem



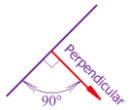
Angle between a tangent and a chord is equal to the angle at the circumference in the alternate segment

Example:

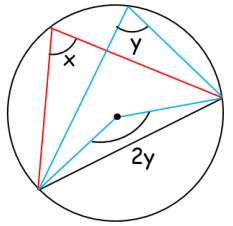


You need to recognise when to use this theorem. Here you can apply the alternate segment theorem (remember the equal angles are in **alternate** segments, follow the arrows for the equal angles).
y = 60° as angles in the alternate segment are equal

x = 55° as angles in the alternate segment are equal

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the **circumference** of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles (90°) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a **chord**
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the **circumference** of a circle

Exams!
They may ask you to prove a theorem.
Sometimes you can prove a theorem by using another theorem.
For example to prove the angles in same segment:



- First, draw in radii

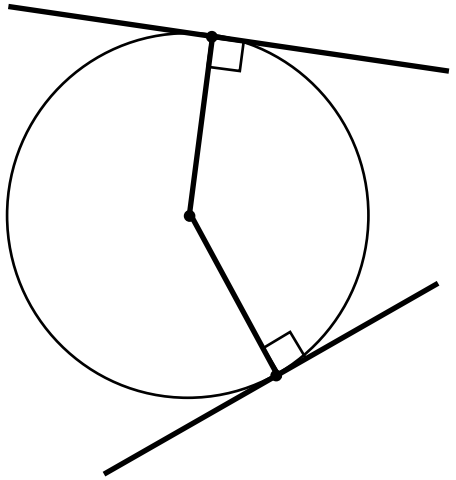
apply 'angle at centre'

=> 2x = 2y
x = y

=> Angles in same segment are equal

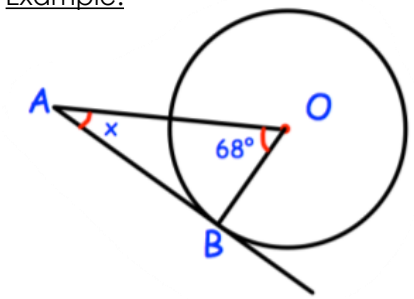
Year 10 – Maths – Unit GM6 – Circles

Tangents & Radii



The angle between the tangent and a radius is equal to 90° as they form a set of perpendicular lines

Example:

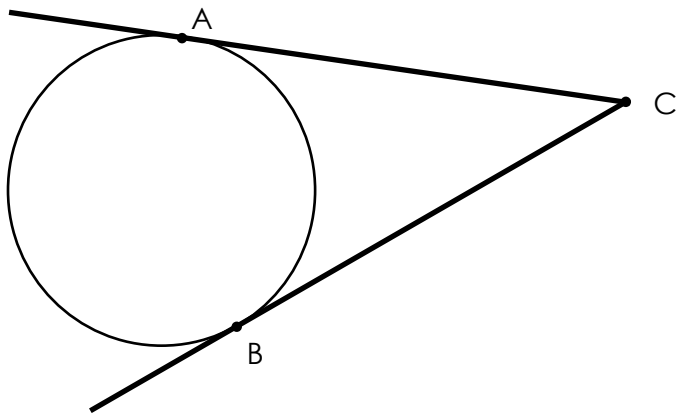


Here, the angle ABO will equal 90° as the tangent and the radius form perpendicular lines.

As angles in a triangle sum to 180°, x = 180° - 90° - 68°

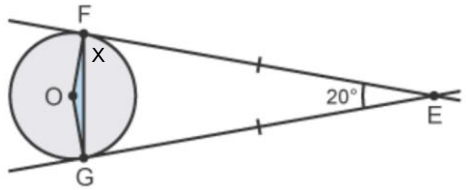
x = 22°

Lengths of Tangents



Tangents to a circle which meet at a point are equal in length (AC = AB)

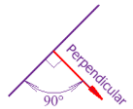
Example:



You need to calculate x, which is angle EFG.

Triangle EFG is an isosceles triangle as the lines FE and GE are equal because when two tangents to a circle meet at a point, they are equal.
Angle EFG = FGE as base angles are equal in isosceles triangles.

Angle EFG = FGE = $\frac{180° - 20°}{2}$ = 80° x = 80°

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the **circumference** of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles (90°) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a **chord**
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the **circumference** of a circle

Exams!
For some circle theorem questions they will combine different theorems. You will need to identify each theorem and state it in your working out.
You do not get these theorems in the exam so you need to learn them!

Year 10 Maths – Unit SP4 – Continuous Data

Finding the class interval that contains the median

The following grouped frequency table shows the ages of a group of people.

Ages of people	Frequency
0 - 4	4
5 - 9	5
10 - 14	8
15 - 19	4
20 - 24	2
	Total = 23

To work out the median value, first work out the **cumulative frequency column**.

Ages of people	Frequency	Cumulative Frequency
0 - 4	4	4
5 - 9	5	4 + 5 = 9
10 - 14	8	9 + 8 = 17
15 - 19	4	17 + 4 = 21
20 - 24	2	21 + 2 = 23
	Total = 23	

There are 23 data items, so to find the position of the median

$$Median = \frac{n+1}{2} = \frac{23+1}{2} = 12$$

The median value would be the **12th value** in the table.
We can then use the **cumulative frequency column** to find where this piece of data would be.

The 12th value which is the **median** would be in this category.

So, the **median** is in the class interval 10-14

Estimated mean from a grouped frequency table

When we have grouped data, we cannot find the actual mean, because we have only got a range of possible values, not the exact data. So instead, we estimate by finding the midpoint from each group.

The tables below shows the test scores of 20 students.

Marks scored	Frequency	Mid-point	Frequency × Mid-point
0 - 9	3	$\frac{0+9}{2} = 4.5$	$3 \times 4.5 = 13.5$
10 - 19	5	$\frac{10+19}{2} = 14.5$	$5 \times 14.5 = 72.5$
20 - 29	8	$\frac{20+29}{2} = 24.5$	$8 \times 24.5 = 196$
30 - 39	4	$\frac{30+39}{2} = 34.5$	$4 \times 34.5 = 138$
	n = 20		Total = 420

We don't know the exact scores of these three students, so we estimate that they each scored 4.5

So the total for those three students is 13.5.
We repeat this for each row of the table and finally add up the total estimated scores for all 20 students.

Finally the mean is calculated by dividing the total scores by the number of students (total frequency)

$$\frac{420}{20} = 21$$

So the estimated mean score is 21.

Keyword/Skill	Definition/Tips
Continuous	Continuous data can have an infinite number of possible values within a selected range
Quantitative	Quantitative data that can be counted (discrete), quantitative date that can be measured (continuous)
Qualitative	Information that describes something
Average	A calculated 'central value' of a set of numbers
Mean	The mean amount is the total amount split evenly
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle we average them.
Mode	The number which appears most often in a set of numbers
Range	The difference between the highest and lowest values
Frequency	How often something happens.
Data	A collection of facts, such as numbers, words, measurements, observations or even just descriptions of things.
Univariate Data	Univariate means "one variable" (one type of data).

Finding the modal class from a grouped frequency table

The following grouped frequency table shows the heights of some shrubs.

Height of shrub, h (cm	Frequency
$0 < x \leq 50$	9
$50 < x \leq 100$	13
$100 < x \leq 150$	12
$150 < x \leq 200$	7

The **modal class** is the class that has the highest frequency. In this case the modal class is:
$50 < x \leq 100$

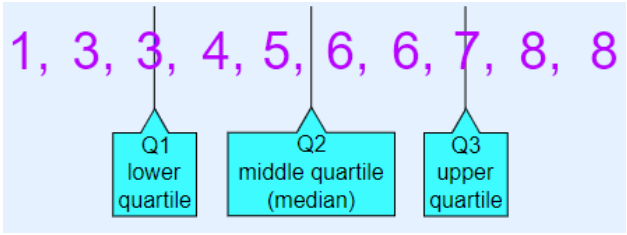
Year 10 Maths – Unit SP4 – Continuous Data

Quartiles

Quartiles are the values that divide a list of numbers into quarters:

- Put the list of numbers **in order**
- Then cut the list into **four equal parts**
- The Quartiles are at the "cuts"

Example: 1, 3, 3, 4, 5, 6, 6, 7, 8, 8
The numbers are already in order, cut the list into quarters:



In this case Quartile 2 is half way between 5 and 6:
Q2 = (5+6)/2 = **5.5**

And the result is:
•Quartile 1 (Q1) = **3 (Lower Quartile)**
•Quartile 2 (Q2) = **5.5 (Median)**
•Quartile 3 (Q3) = **7 (Upper Quartile)**

Range

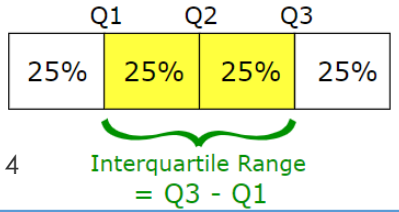
The difference between the largest and smallest piece of data

Interquartile Range (IQR)

The IQR "Interquartile Range" is the spread of the middle 50% of data.

As it is only the middle 50% the IQR is **less likely to be affected by outliers**. Whereas the range (which is the spread of all the data) would be affected by outliers.

To calculate it just **subtract Quartile 1 from Quartile 3**.
Using the example from the quartiles:
Q3 = 7
Q1 = 3 So the interquartile range is 4

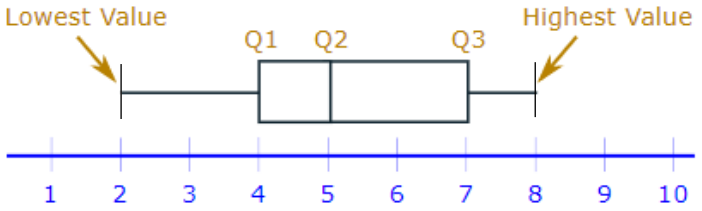


Box Plot

A **box plot** shows a visual representation of the **median** and **quartiles** of a set of **data**.

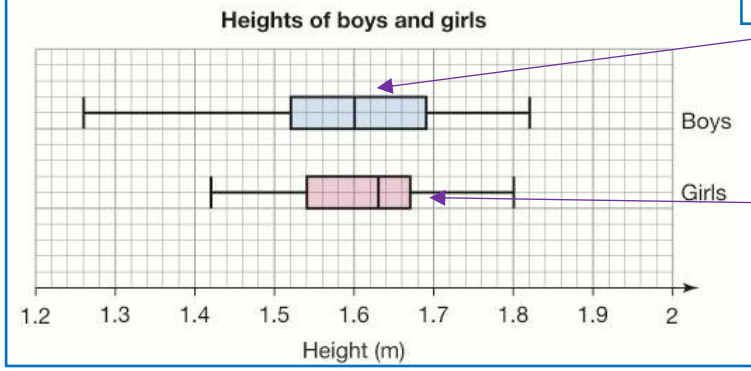
To draw a box plot, the following information is needed:

- minimum value
- **lower quartile**
- median
- **upper quartile**
- maximum value



Making Comparisons

The box plot summarise the heights of samples of 14 and 14 year old boys and girls



The median is labelled as Q2, use a ruler to read the value

Median height of girls = 1.63m
Median height of boys 1.60m

On average, the girls are taller than boys.

The IQR is the UQ subtract the LQ, read Q3 & Q1 then do Q3 – Q1

IQR for girls = 1.67 – 1.54 = 0.13m
IQR for boys = 1.69 – 1.52 = 0.17m

The IQR for the boys is greater than the girls, the girls heights are more **consistent** than the boys

Keyword/Skill	Definition/Tips
Sample	A group from the population that we are testing .
Population	The whole group from where the sample is taken, i.e. a whole year group.
Discrete	Discrete data can only have a finite or limited number of possible values. (Whole numbers)
Continuous	Continuous data can have an infinite number of possible values within a selected range. (Can include decimal numbers).
Quantitative	Quantitative data that can be counted (discrete), quantitative date that can be measured (continuous)
Mode	The number which appears most often in a set of numbers
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle, we find the average them.
Range	The difference between the highest and lowest values.
Outlier	A point that "lies outside" (is much smaller or larger than) most of the other values in the dataset.
IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is **consistent**.

Other Topics/Units this could appear in:

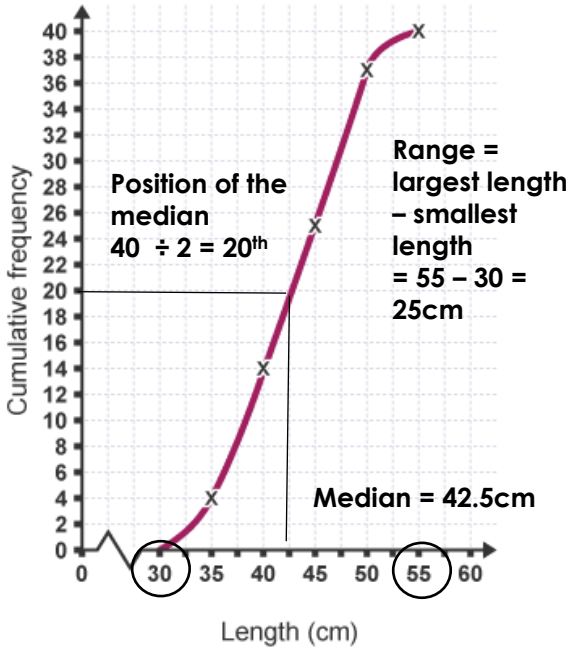
- A Level Statistics- Data Collection

Year 10 Maths – Unit SP4 – Continuous Data

Cumulative Frequency Graphs

A **cumulative frequency diagram** creates a running total of the amounts within a table.

A cumulative frequency diagram is drawn by plotting the **upper class boundary** with the cumulative frequency.

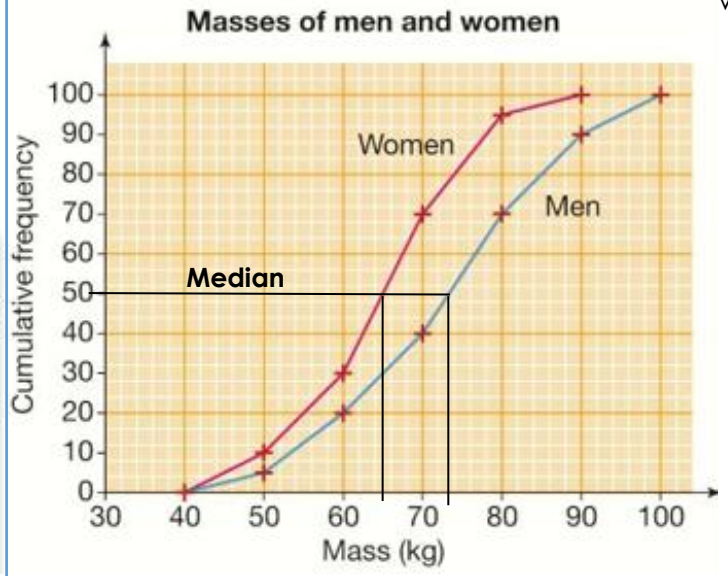


The upper class boundaries for this table are 35, 40, 45, 50 and 55.

Length (cm)	Frequency	Cumulative frequency
30 ≤ l < 35	4	4
35 ≤ l < 40	10	14 (4 + 10 = 14)
40 ≤ l < 45	11	25 (4 + 11 = 25)
45 ≤ l < 50	12	37 (25 + 12 = 37)
50 ≤ l < 55	3	40 (37 + 3 = 40)

Making Comparisons

*When making comparisons use an **average** or **spread** to back up your statement!*



2) Range of women's masses = 90 – 40 = 50kg
Range of men's masses = 100 – 40 = 60kg

*The men's masses **vary** more than the women's masses*

These cumulative frequency graphs summarise the masses of samples of 100 men and 100 women.

Finding the median mass for 100 women. Position of the median is 100 ÷ 2 = 50 so find the mass of the 50th person. Read from 50 on the cumulative frequency axis to the value on the mass axis.

1) Median mass of women = 65kg
Median mass of men = 73kg

*On **average**, the women are lighter than men*

Range of masses = largest mass (read from the final point) subtract the mass from where the line starts

Exam Tips!

- *Be sure to label the axis "cumulative frequency" not just "frequency"*
- *Note how the graphs don't have to start at origin*
- *Smooth curve going to through all the points – use a pencil!*
- *When making a comparison, write a statement and back it up with evidence from the graph (comparing the medians or IQR in context of the question!)*

Keyword/Skill	Definition/Tips
Sample	A group from the population that we are testing .
Population	The whole group from where the sample is taken, i.e. a whole year group.
Discrete	Discrete data can only have a finite or limited number of possible values. (Whole numbers)
Continuous	Continuous data can have an infinite number of possible values within a selected range. (Can include decimal numbers).
Quantitative	Quantitative data that can be counted (discrete), quantitative date that can be measured (continuous)
Mode	The number which appears most often in a set of numbers
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle, we find the average them.
Range	The difference between the highest and lowest values.
Outlier	A point that "lies outside" (is much smaller or larger than) most of the other values in the dataset.
IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is **consistent**.

Other Topics/Units this could appear in:

- A Level Statistics- Data Collection

Year 10 Maths – Unit SP5 – Set Theory & Logic

Set Notation

A set is a collection of numbers (or objects). We call the numbers in the set, elements of that set. We have notation that is related to sets.
Example:

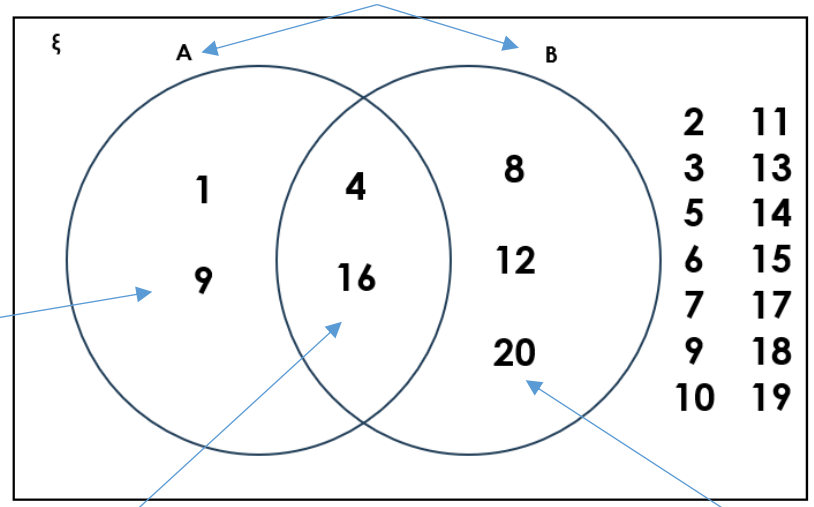
ξ = $\{Numbers\ 1\ to\ 20\ inclusive\}$ These would be all the integers from 1 up to and including 20. We call this the universal set; it is usually denoted with **ξ.**
A = $\{Square\ Numbers\}$ - $1, 4, 9, 16$ we do not need anymore, as the universal set only includes the numbers 1 – 20.
B = $\{Multiples\ of\ 4\}$ - $4, 8, 12, 16, 20$ again we do not need anymore because of the universal set.

A ∪ **B** - ∪ means union. This would be the combination of **A** and **B**. **A** ∪ **B =** $\{1, 4, 8, 9, 12, 16, 20\}$
A ∩ **B** - ∩ means intersection. This is the elements only in **A AND B** (the overlap). **A** ∩ **B =** $\{4, 16\}$ 4 and 16 appear in both **A** and **B.**
A' – means complement. This is everything not in A. We include the numbers that are also not in B but in the universal set.
A' = $\{2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20\}$

Venn Diagrams

A Venn diagram is a tool used to sort data into groups. If the data is in both groups, it is placed in the overlap of the circles (the intersection). Venn diagrams can be used to calculate probability. Let's use the same example as the one above.
Example:
ξ = $\{Numbers\ 1\ to\ 20\ inclusive\}$
A = $\{Square\ Numbers\}$
B = $\{Multiples\ of\ 4\}$

It is important to label each circle in your Venn diagram.

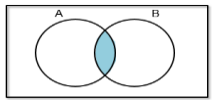
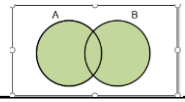
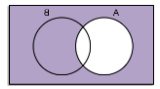


The numbers that are only in **A** go in this section

The numbers that are not in **A** or **B** but are still in the universal set **ξ** go outside the circles.

The numbers that are in both sets **A** and **B** go in this section

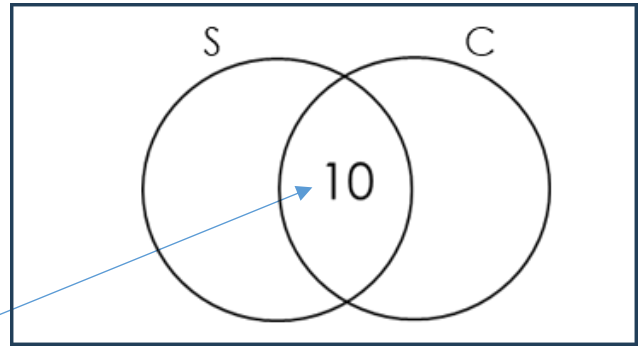
The numbers that are only in **B** go in this section

Keyword/Skill	Definition/Tips
Venn Diagram	The relationship between a group of different things.
Set	A collection of objects named elements
Empty set	It has no elements and is written as ∅.
Universal Set	A universal set has all the elements and is written as ξ.
Intersection	This is where two sets overlap  $A \cap B$ This means **A and B.**
Union	This is two or more sets together.  $A \cup B$ This means **A or B.**
Compliment	This is the region that is not included.  A' This means **not A.**
Probability	The chance of an event happening.
P(A)	This means probability of event A
P (A')	This means probability of NOT A.
Independent	If an outcome is independent, the outcome of one does not affect the other.
Dependent	When an event can be affected by the outcome of another.
Mutually Exclusive.	Mutually exclusive events can not happen at the same time. (E.G. Rolling a 1 and rolling a 3 with one roll of a dice.)
Conditional Probability	When one event has happened which has an affect on another. (If a blue bead has already been picked and not replaced, what would be the probability of picking a blue bead now?).
Percentage	Percentage questions must add up to 100. Use this to check your answer.

Year 10 Maths – Unit SP5 – Set Theory & Logic

You will need to be able to complete Venn diagrams based on information given.
Example:
A gym runs two fitness classes, spinning and circuits.
On Saturday 100 people visited the gym.
18 people attended the spinning class.
10 people attended both classes.
56 people did not attend either class.

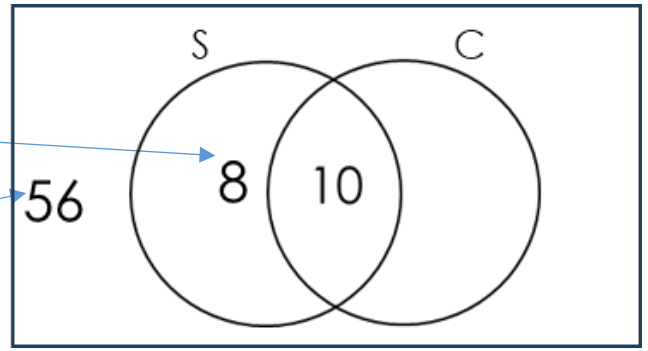
We will first represent this on a Venn diagram.

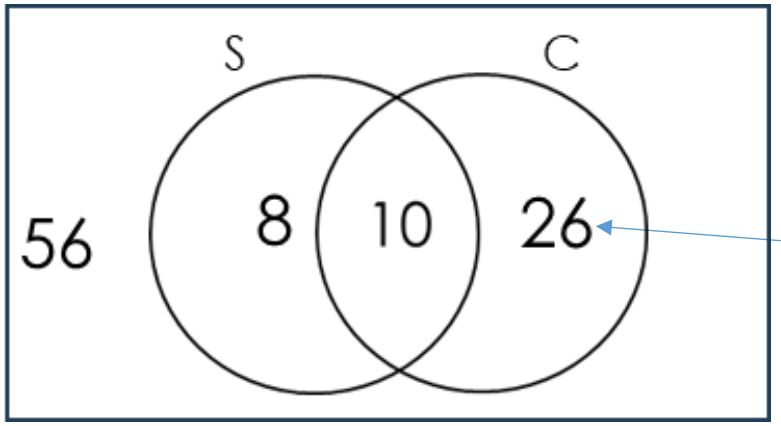


Try to start with the overlap first. 10 attended both so 10 goes in the middle.

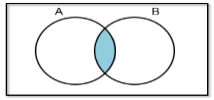
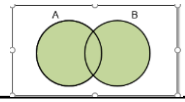
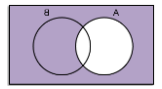
18 people attended the spinning class.
There are already 10 people in the spinning circle (the overlap).
18 – 10 = 8

We can put 56 on the outside as none of those attended a class





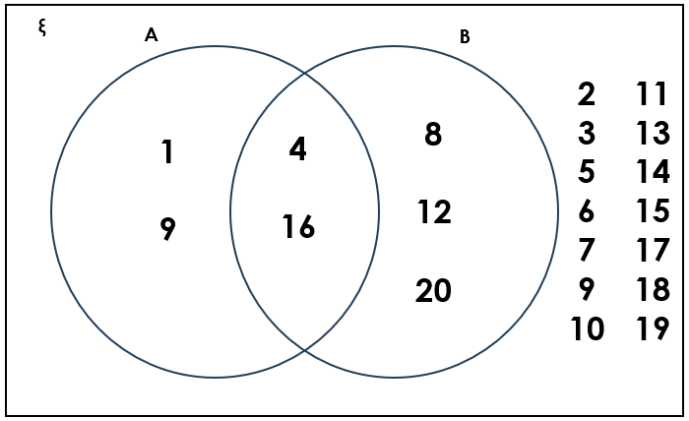
We just need the last section. To calculate that, we know the whole Venn diagram should add up to 100.
We have 56 + 8 + 10 = 74
100 – 74 = 26
26 needs to go into the section just for C. The Venn diagram is now complete. To check, add the numbers and it should add together to make 100.

Keyword/Skill	Definition/Tips
Venn Diagram	The relationship between a group of different things.
Set	A collection of objects named elements
Empty set	It has no elements and is written as ∅.
Universal Set	A universal set has all the elements and is written as ξ.
Intersection	This is where two sets overlap  $A \cap B$ This means **A and B**.
Union	This is two or more sets together.  $A \cup B$ This means **A or B**.
Compliment	This is the region that is not included.  A' This means **not A**.
Probability	The chance of an event happening.
P(A)	This means probability of event A
P (A')	This means probability of NOT A.
Independent	If an outcome is independent, the outcome of one does not affect the other.
Dependent	When an event can be affected by the outcome of another.
Mutually Exclusive.	Mutually exclusive events can not happen at the same time. (E.G. Rolling a 1 and rolling a 3 with one roll of a dice.)
Conditional Probability	When one event has happened which has an affect on another. (If a blue bead has already been picked and not replaced, what would be the probability of picking a blue bead now?).
Percentage	Percentage questions must add up to 100. Use this to check your answer.

Year 10 Maths – Unit SP5 – Set Theory & Logic

Probability with Venn Diagrams

You need to be able to find probability from Venn diagrams. They can ask for a probability using words or by using set notation.



Example:

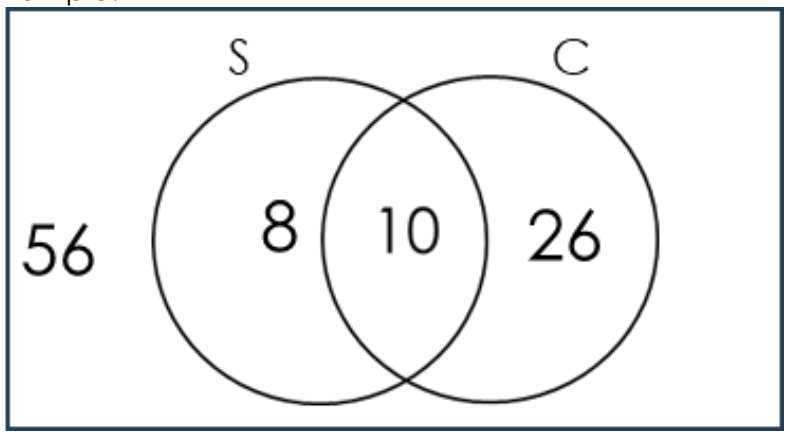
What is the probability of picking a number in **A** and **B**? (This would be the same as $P(A \cap B)$).
There are 2 numbers in **A** and **B**, out of 20 numbers in total.
Probability is usually written as a fraction (it can be a decimal or a percentage too).
Probability of **A** and **B** is $\frac{2}{20}$.

What is the probability of picking a number in **A** or **B**? (This is the same as $P(A \cup B)$).

There are 7 numbers in **A** or **B**, out of 20 numbers in total.
The probability is $\frac{7}{20}$.

Sometimes you will need to add together numbers for a probability.

Example:



Find $P(S \cup C)$
This is the probability of a person attending a 'spinning or circuit' class.
For this we need to add together 8, 10 and 26.

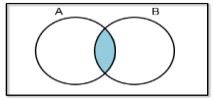
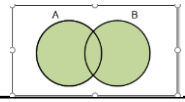
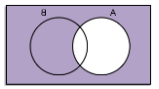
$$8 + 10 + 26 = 44$$

Out of the whole Venn diagram (100).

$$P(S \cup C) = \frac{44}{100}$$

Find C'
This is everything that is not C (all numbers not in the C circle).

$$\frac{8+56}{100} = \frac{64}{100}$$

Keyword/Skill	Definition/Tips
Venn Diagram	The relationship between a group of different things.
Set	A collection of objects named elements
Empty set	It has no elements and is written as ∅.
Universal Set	A universal set has all the elements and is written as ξ.
Intersection	This is where two sets overlap  $A \cap B$ This means **A and B**.
Union	This is two or more sets together.  $A \cup B$ This means **A or B**.
Compliment	This is the region that is not included.  A' This means **not A**.
Probability	The chance of an event happening.
P(A)	This means probability of event A
P (A')	This means probability of NOT A.
Independent	If an outcome is independent, the outcome of one does not affect the other.
Dependent	When an event can be affected by the outcome of another.
Mutually Exclusive.	Mutually exclusive events can not happen at the same time. (E.G. Rolling a 1 and rolling a 3 with one roll of a dice.)
Conditional Probability	When one event has happened which has an affect on another. (If a blue bead has already been picked and not replaced, what would be the probability of picking a blue bead now?).
Percentage	Percentage questions must add up to 100. Use this to check your answer.

Year 10 Maths – Unit GM7 – Advanced Drawing, Measuring & Constructing

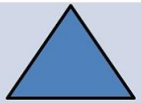
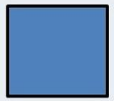
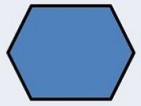
Interior Angles

For the **sum** of interior angles in a polygon we can use this formula:

$$sum\ of\ interior\ angles = 180(n-2)$$

Where n is the number of sides

Examples

	3	(3 – 2) × 180° = 180°
	4	(4 –2) × 180° = 2 × 180° = 360°
	5	(5 –2) × 180° = 3 × 180° = 540°
	6	(6 – 2) × 180° = 4 × 180° = 720°

For **one** interior angle in a **regular** polygon

$$\text{angle} = \frac{180(n-2)}{n}$$

Example

Calculate the size of an interior angle of a regular pentagon:

$$\text{Pentagon = 5 sides} = \frac{180(5-2)}{5} = 108°$$

Exterior Angles

To find an exterior angle = $\frac{360}{n}$ n= number of sides

Example



The exterior angle y would be $\frac{360}{6}$ = 60°

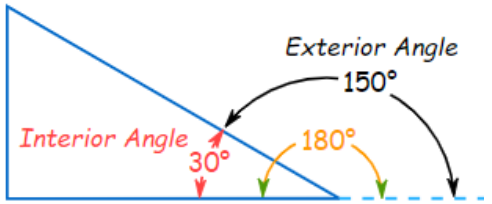
You may be asked to work out how many sides a shape has given the size of it's exterior angles.

Example

A regular polygon has exterior angles of 24°.
Work out how many sides the shape has.

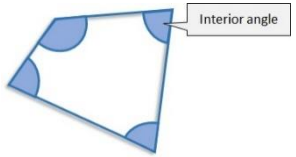
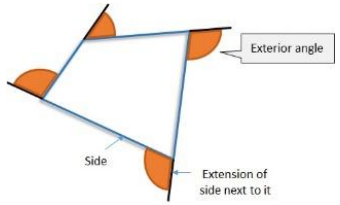
360 ÷ 24 = 15 sides

Remember
Interior angle + exterior angle in Regular polygons = 180°
(They sit on a straight line.)



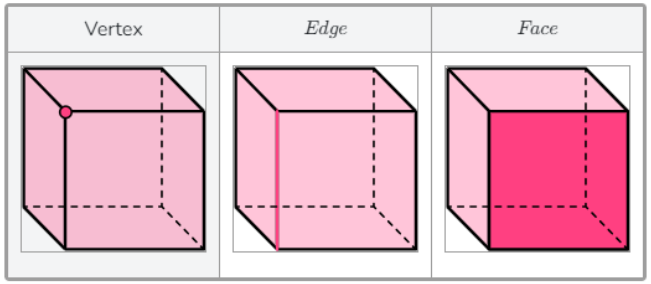
Exams!

- You will gain 2 marks for just having to work out an interior or exterior angle of a given polygon.
- A question that requires application of interior/exterior angles knowledge will be worth up to 4/5 marks.

Keyword/ Skill	Definition/tip
Angle	The amount of turning between two lines meeting at a point.
Polygon	A 2D shape with straight sides.
Interior angles	An angle inside a shape, between two joined sides. 
Exterior angles	The angle between any side of a shape and a line extended from the next side. 
Regular polygon	Has all equal length sides and all equal sized angles.
Irregular polygon	Has differing sized lengths and angles.

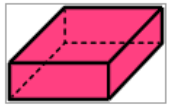
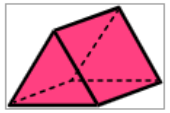
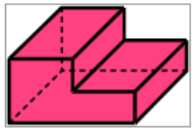
Other topics/Units this could appear in:
Circle theorem
Congruence and geometric proof

Year 10 Maths – Unit GM7 – Advanced Drawing, Measuring & Constructing

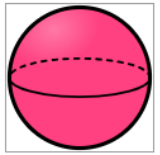
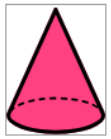
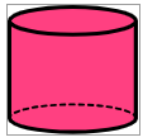
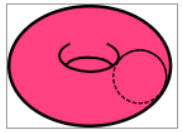


Some of the most famous polyhedra are called the **Platonic solids** named after the Greek philosopher and Mathematician, Plato. Each of the Platonic solids are considered to be regular 3D polyhedra.
The number of faces determines the name of the polyhedron:

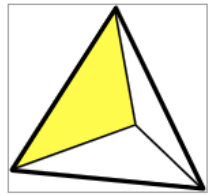
Polyhedra – flat faces, straight edges and sharp vertices

	Tetrahedron	*Cuboid*	*Triangular prism*	*L-shaped prism*	*Dodecahedron*
Image					
Vertices	4	8	6	12	20
Edges	6	12	9	18	30
Faces	4	6	5	8	12

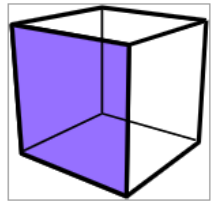
Non-polyhedra – **don't have** flat faces, straight edges and sharp vertices

	Sphere	*Cone*	*Cylinder*	*Frustum*	*Taurus*
Image					
Vertices	0	1	0	0	0
Edges	0	1	2	2	0
Faces	1	2	3	3	1

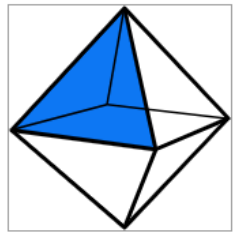
Tetrahedron
4 vertices
6 edges
4 faces
Each face is an equilateral triangle



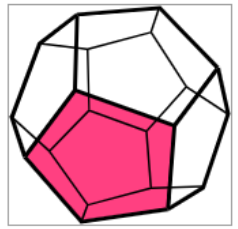
Cube
8 vertices
12 edges
6 faces
Each face is a square



Octahedron
6 vertices
12 edges
8 faces
Each face is an equilateral triangle



Dodecahedron
20 vertices
30 edges
12 faces
Each face is a regular pentagon



Icosahedron
12 vertices
30 edges
20 faces
Each face is an equilateral triangle



Keyword/Skill	Definition/Tips
Faces	Flat surface of a 3D shape
Edges	The outside lines of a 3D shape (the lines must be straight)
Vertices	Where two or more **edges** come together at a point (corner). Singular term is vertex
Polyhedron Plural - Polyhedra	3d shapes with flat faces, straight edges and sharp vertices.
Properties of Solids	You need to say how many **faces, edges and vertices** the 3D shape has.

Euler's Polyhedra Formula

$$V - E + F = 2$$

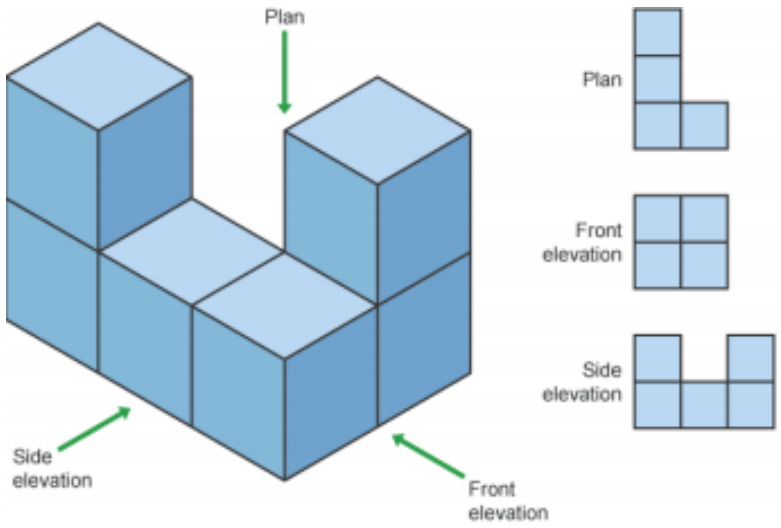
Where F is the number of faces
V is the number of vertices
E is the number of edges

Other Topics/Units this could appear in:

- Surface Area & Volume
- Simplifying Expressions
- Similarity in 2D & 3D
- Plans & Elevations

Year 10 Maths – Unit GM7 – Advanced Drawing, Measuring & Constructing

Plans and Elevations



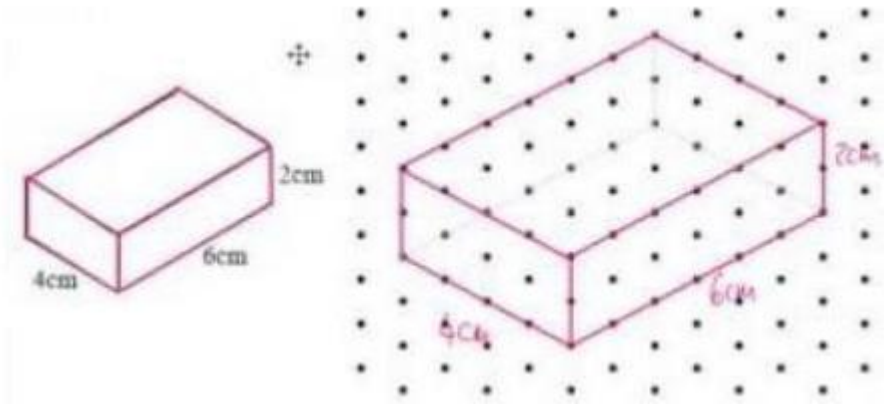
Plan
The view from above.

Front Elevation
The view from the front of the solid.

Side Elevation
The view from The side of the solid.

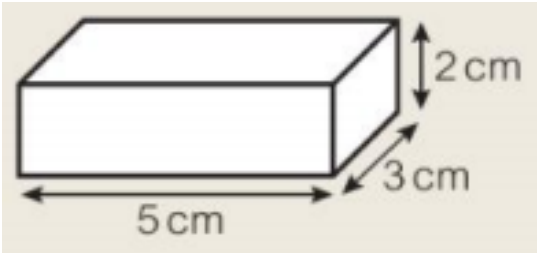
Isometric Drawing

A representation of a solid where all of the dimensions are drawn to scale.

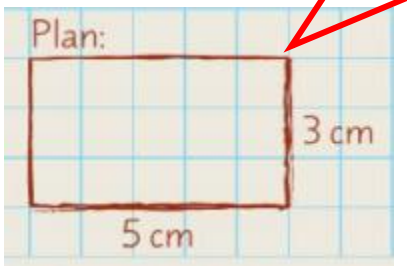


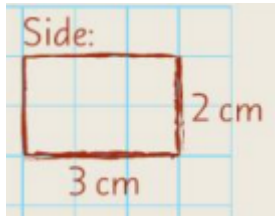
Worked Exam Question

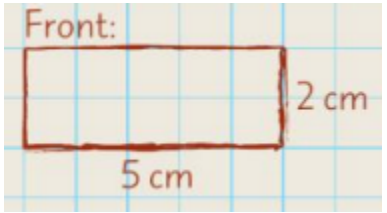
Draw the plan, the front elevation and the side elevation of this cuboid on the grid below.



Use a ruler.
Measure accurately.
Label Lengths.



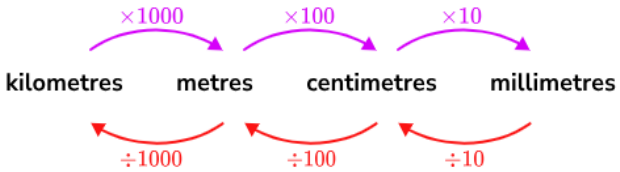




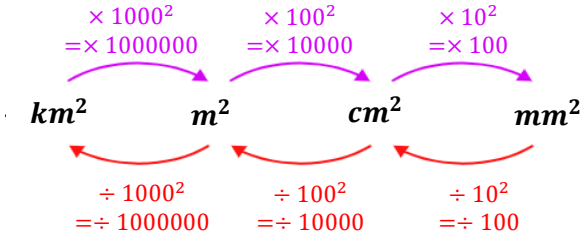
Keyword/Skill	Definition/Tips
Elevations	Different views of an object, e.g. Side elevation – view from the side. Or front elevation – view from the front.
Plan	A drawing of something as viewed from above.

Converting between 2D and 3D units of measurements

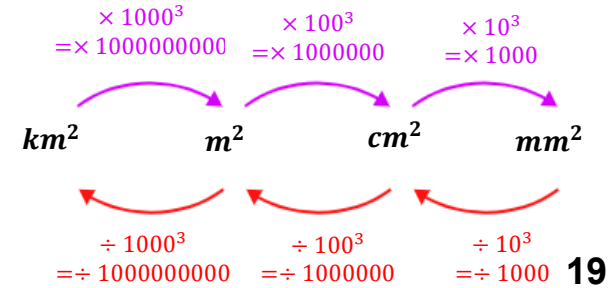
Metric units of LENGTH



Metric units of AREA



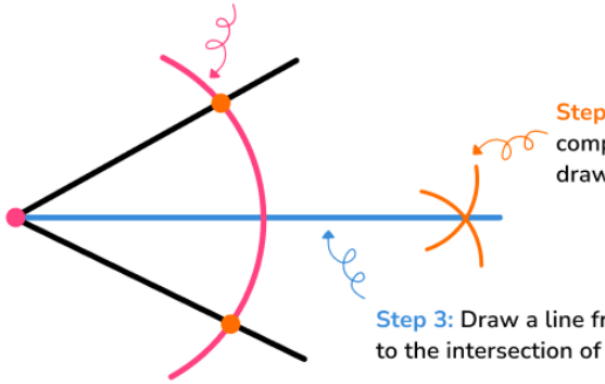
Metric units of VOLUME



Year 10 Maths – Unit GM7 – Advanced Drawing, Measuring & Constructing

Constructions

Angle bisector

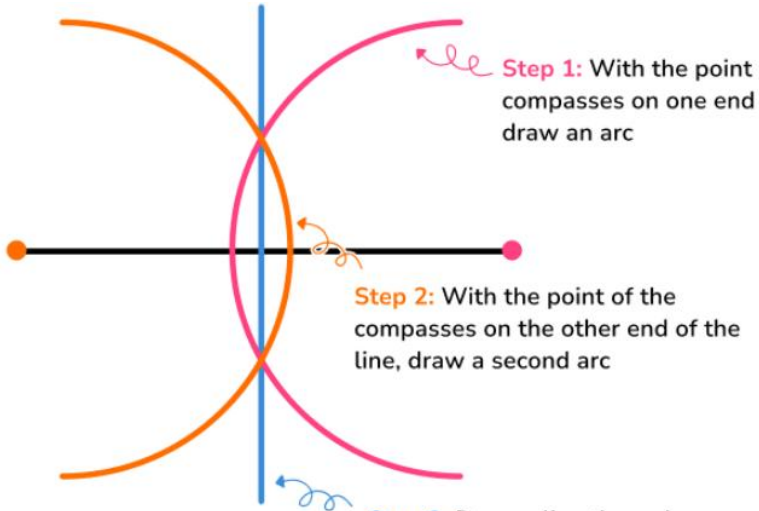


Step 1: With the point of the compasses on the vertex, draw a curve

Step 2: With the point of the compasses on each intersection, draw two further curves

Step 3: Draw a line from the vertex to the intersection of the arcs

Perpendicular bisector

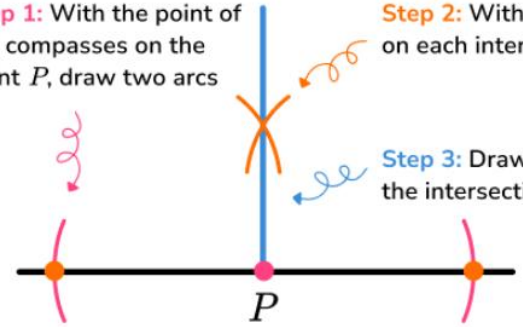


Step 1: With the point of the compasses on one end of the line, draw an arc

Step 2: With the point of the compasses on the other end of the line, draw a second arc

Step 3: Draw a line through the two intersections

Perpendicular from a point on a line

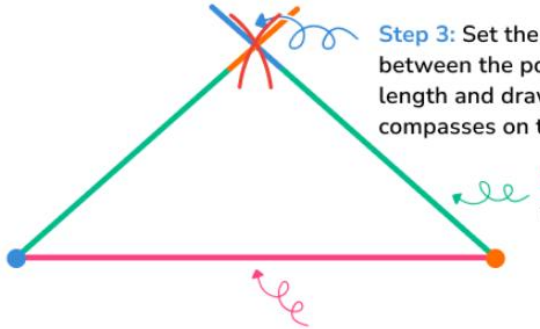


Step 1: With the point of the compasses on the point P, draw two arcs

Step 2: With the point of the compasses on each intersection, draw two further arcs

Step 3: Draw a line from point through the intersection of the arcs

Triangle given all three sides



Step 2: Set the compasses so that the distance between the point and the pencil is the second given length and draw an arc with the point of the compasses on one end of the original line

Step 3: Set the compasses so that the distance between the point and the pencil is the final given length and draw an arc with the point of the compasses on the other end of the original line

Step 4: Draw the lines to make the triangle

Step 1: Draw a line using one of the given lengths

Other Topics/Units this could appear in:

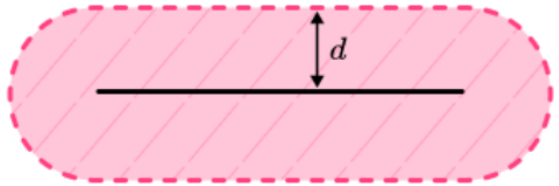
- Circles, Arcs and Sectors Bearings
- Plans and elevations
- Constructions
- Surface Area & Volume – cylinders, cones, spheres & frustums
- Similarity in 2D & 3D
- Circle Geometry
- Circle Theorems

Year 10 Maths – Unit GM7 – Advanced Drawing, Measuring & Constructing

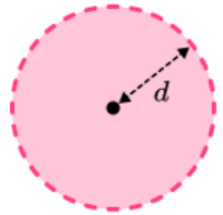
Loci

The **locus** of points (plural loci) is a set of points that follow a given rule.
When given that rule, or set of rules, we need to be able to draw the area that satisfies that rule.

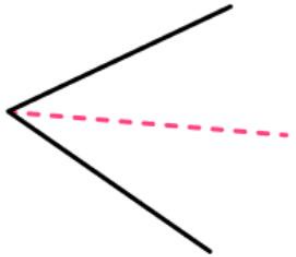
The locus of points within a given distance, d, of a line.



The locus of points that are a given distance, d, from a point.



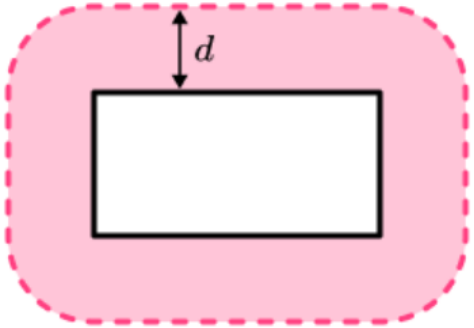
The locus of points equidistant between two lines (angle bisector).



The locus of points equidistant between two points (perpendicular bisector).



The locus of points a given distance, d, from a polygon.



Other Topics/Units this could appear in:

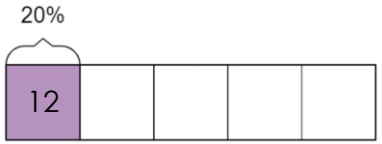
- Circles, Arcs and Sectors Bearings
- Plans and elevations
- Constructions
- Surface Area & Volume – cylinders, cones, spheres & frustums
- Similarity in 2D & 3D
- Circle Geometry
- Circle Theorems

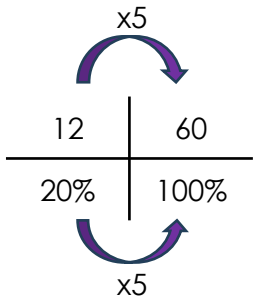
Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

Reverse Percentages

If we know part of a number, we can work out the number.

If 20% of a number is 12, what is the number?





To calculate a percentage: $original \times multiplier = new$

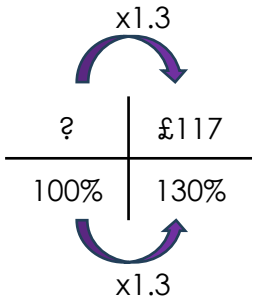
In questions like this, you need to decide if you have the original amount or the new amount.

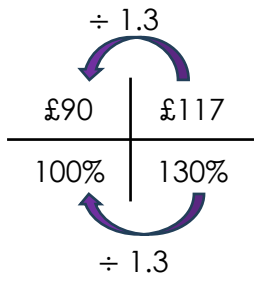
Bobby bought a pair of trainers.

He sold them for £117 and made a 30% profit.

How much did he originally pay for the trainers?

30% profit means a 30% increase. 100% + 30% = 130%





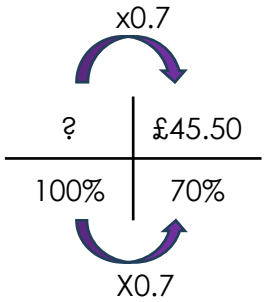
To return to the original whole: $original = \frac{new}{multiplier}$

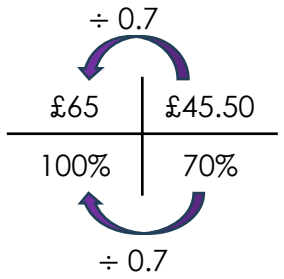
A jacket is reduced by 30% in a sale.

The sale price of the jacket is £45.50.

Work out the original price.

30% sale means a 30% decrease. 100% - 30% = 70%





My mathematical journey

What do I need to remember from before?

- Percentage multipliers (NP8, NP10)
- Proportional reasoning (NP10)
- Cartesian graphs (A6, A9, A10)
- Manipulating algebra (A5, A10)

What will I learn about in this unit?

- Reverse percentages
- Simple interest
- Direct and inverse proportion
- Compound units
- Combining ratios

Where does this lead?

- Compound interest (NP16)
- Proportion with squares, cubes and roots (NP16)
- Instantaneous and average rates of change (A16)
- Areas under graphs (A16)

Keyword/Skill	Definition/Tips
p.a.	Per annum, Latin for 'every year'.
Interest	An increase in money.
Depreciation	A decrease in money.
Direct proportion	As one amount increases, the other increases at the same rate.
k	The constant of proportionality, which is the rate of change.
$\propto$	Is proportional to.
Inverse proportion	As one amount increases, the other decreases at the same rate.
Density	A measure of how spread-out particles in an object are.
Pressure	A measure of how spread out a force is.
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Compound units	A measure combining two other measures.

Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

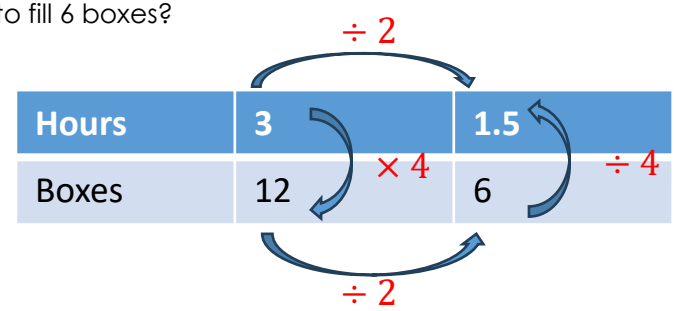
Direct Proportion

If y is directly proportional to x, we represent the relationship as follows $y \propto x$

Then, $y = kx$, where k is the constant of proportionality.

Solving Numerically Using Ratio Tables

It takes 3 hours to fill 12 boxes with food. How long does it take to fill 6 boxes?



You can use any of the relationships shown in the table above to find the answer, 1.5 hours.

Solving Algebraically

a is directly proportional to b.
a = 27 when b = 9 Find the value of a when b = 5

$a \propto b$
$a = kb$

Substitute the values for a and b from the question to find k
$27 = k \times 9$
$3 = k$
Rewrite and substitute k into the equation to solve
$a = 3b$
$a = 3 \times 5$
$a = 15$ when $b = 5$

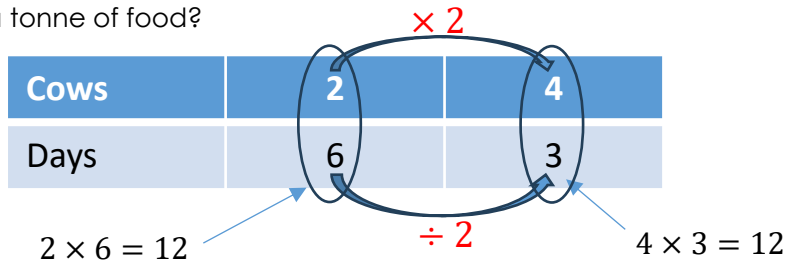
Inverse Proportion

If y is indirectly proportional to x, we represent the relationship as follows $y \propto \frac{1}{x}$

Then, $y = \frac{k}{x}$, where k is the constant of proportionality.

Solving Numerically Using Ratio Tables

2 cows eat a tonne of food in 6 days. How long would it take 4 cows to eat a tonne of food?



You can use any of the relationships shown in the table above to find the answer, 3 days.

Solving Algebraically

y is inversely proportional to x
y = 6 when x = 5. Find the value of y when x = 10

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

Substitute the values for x and y from the question to find k.
$6 = \frac{k}{5}$
$30 = k$
Rewrite and substitute k into the equation to solve
$y = \frac{30}{x}$

$y = \frac{30}{10}$
$y = 3$

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Compound units	A measure combining two other measures.

Simple Interest

You can save money in a savings account with a bank or building society. The bank or building society gives you interest – a percentage of extra money on top of your original investment. For simple interest, work out the percentage.
Keep adding it on

A £200 loan earns 15% **simple** interest over 5 years. How much will be owed at the end of the 5 years?

Work out 15% of £200 = £30
£30 x 5 years = £150
£200 + £150 = £350

Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

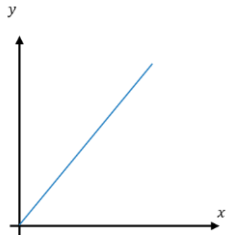
Direct Proportion

As one increases, the other increases at the same rate.

y is proportional to x

$y \propto x$

$y = kx$



$\times k$	x		
	y		

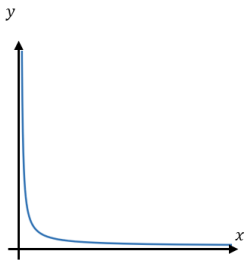
Inverse Proportion

As one increases, the other decreases at the same rate.

y is proportional to the reciprocal of x

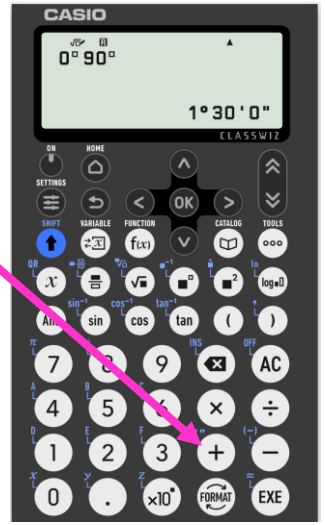
$y \propto \frac{1}{x}$

$y = \frac{k}{x}$



x	$\times$	$\times$
y		
	k	k

We can work with time on our calculator using SHIFT and this button.
We enter time in the form HOURS° MINUTES° SECONDS°



We can type in 90 minutes and use FORMAT to convert it to

1 hour and 30 minutes

or 1.5 hours

or $1\frac{1}{2}$ hours

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$$Density = \frac{mass}{volume}$$

$$Pressure = \frac{force}{area}$$

$$Speed = \frac{distance}{time}$$

Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

Density

Density is a measure of the amount of mass an object has per unit volume.

Density is a compound measure – made up of two other measures.

Its units are a combination of mass and volume.

$$\text{Density} = \frac{\text{mass (kg)}}{\text{volume (m}^3\text{)}} \quad (\text{kg/m}^3)$$

We can use any units of mass and volume: g/cm^3, tonnes/km^3, …

Mass (kg)		
Volume (m^3)		1

To calculate density, we can use the formula or a ratio table. On a ratio table, the density appears when the volume is 1 (mass per unit volume).

A copper pipe has a mass of 450g.
It has a volume of 50cm^3.
What is its density?

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}} \quad (\text{g/cm}^3)$$

$$= \frac{450\text{ g}}{50\text{ cm}^3}$$

$$= 9\text{ g/cm}^3$$

÷ 50

Mass (g)	450	9
Volume (cm^3)	50	1

÷ 50

9 g/cm^3

Both representations show the same thing!

Working out Mass

A block of metal has a density of 8 g/cm^3 and volume of 56 cm^3.
Work out its mass.

× 56

Mass (g)		8
Volume (cm^3)	56	1

× 56

Using the ratio table, you can work out the mass is 448g.

Working out Volume

A block of metal has a density of 7.2 g/m^3 and mass of 1800g.
Work out its volume.

Mass (g) ÷ 7.2	1800	7.2 ÷ 7.2
Volume (m^3)		1

Remember you can work vertically as well as horizontally with ratio table.
The volume will be 250cm^3

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Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

Pressure

Pressure is a compound measure of force per unit area.

Its units are a combination of force and area.

$$\text{Pressure} = \frac{\text{force (N)}}{\text{area (m}^2\text{)}} \quad (\text{N/m}^2)$$

To calculate pressure, we can use the formula or a ratio table.
On a ratio table, the pressure appears when the area is 1 (force per unit area).

$$\text{Pressure} = \frac{\text{force (N)}}{\text{area (m}^2\text{)}} \quad (\text{N / m}^2)$$

Force (N)		
Area (m^2)		1

Keyword/Skill	Definition/Tips
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To calculate pressure, we can use the formula or a ratio table.
I push with a force of 5 N over an area of 0.5 m^2.
What pressure do I apply?

$$\text{Pressure} = \frac{\text{force (N)}}{\text{area (m}^2\text{)}} \quad (\text{N/m}^2)$$

$$= \frac{5}{0.5}$$

$$= 10 \text{ N/m}^2$$

		× 2 →	
Force (N)	5		10
Area (m^2)	0.5		1
		× 2 →	

10 N/m^2

Both representations show the same thing!

Working out Force

An object applies a pressure of 15 N/cm^2 to an area of 20 cm^2.
Work out the force.

		× 20 →	
Force (N)			15
Area (cm^2)	20		1
		× 20 →	

Using the ratio table, you can work out the mass is 300N.

Working out Area

An object applies a force of 171 N with a pressure of 4.5N/m^2.
Work out the area.

Force (N) ÷ 4.5 →	171		4.5 ÷ 4.5 →
Area (m^2)			1

Remember you can work vertically as well as horizontally with ratio table.
The volume will be 38cm^2.

Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

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Compound units	A measure combining two other measures.

Speed

Speed is a compound measure of distance per unit time.

Its units are a combination of distance and time.

(miles per hour, m/s, m/min, km/h, miles/day, …)

$$\text{Speed (m/s)} = \frac{\text{distance (m)}}{\text{time (s)}}$$

To calculate speed, we can use a formula or a ratio table.
On a ratio table, the speed appears when the time is 1 (distance per unit time).

$$\text{Speed (m / s)} = \frac{\text{distance (m)}}{\text{time (s)}}$$

Distance (m)		
Time (s)		1

To calculate speed, we can use the formula or a ratio table.
A journey from Manchester to Birmingham is 100 miles over a time of 2 hours.
What is the average speed for the journey?

$$\text{Speed (miles/hour)} = \frac{\text{distance (m)}}{\text{time (h)}}$$

$$= \frac{100}{2}$$

$$= 50 \text{ miles per hour}$$

	÷ 2	
Distance (m)	100	50
Time (h)	2	1
	÷ 2	

50 mph

Both representations show the same thing!

Working out Distance

A bus has an average speed of 40km/h. It drives for 6 hours. What is the distance it drives?

	× 6	
Distance (km)		40
Time (h)	6	1
	× 6	

Using the ratio table, you can work out the distance is 240km.

Working out Time

A helicopter travels 800 miles and travels at an average speed of 160mph.
How long would this journey take

	÷ 160		÷ 160
Distance (km)	800	160	
Time (h)		1	

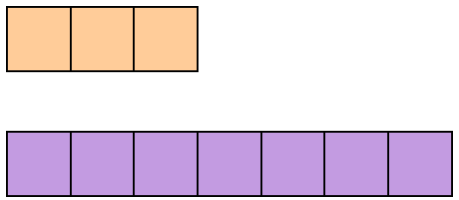
Remember you can work vertically as well as horizontally with ratio table.
The time will be 5 hours.

Year 10 – Maths – Unit NP13 – Advanced Proportion & Rates of Change

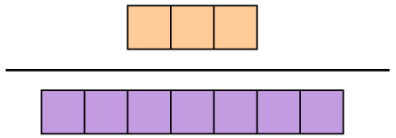
Ratio as Fractions

There are lots of fraction relationships hidden in a ratio.

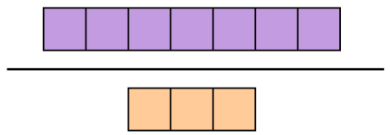
$a : b = 3 : 7$



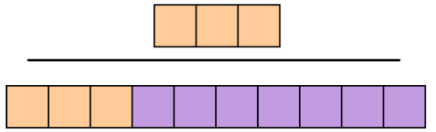
a is $\frac{3}{7}$ of b



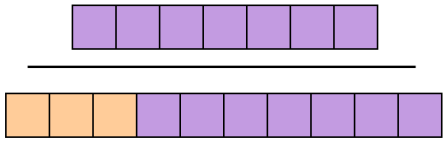
b is $\frac{7}{3}$ of a



a is $\frac{3}{10}$ of the total



b is $\frac{7}{10}$ of the total



Combining Ratios

If we want to combine ratios that seem not to 'match', we must scale them first.

Red : Yellow is 2 : 3.
Red : Blue is 6 : 7.

Write the ratio Red : Yellow : Blue

	R	Y	B
× 3	2	3	× 3
	6	9	7

$R : Y : B = 6 : 9 : 7$

Sometimes, you will need to scale both ratios to combine them.

Red : Yellow is 3:2.
Yellow : Blue is 3:7.

Write the ratio Red : Yellow : Blue
Yellow is the common one, we need a common multiple of 2 and 3.
We will use 6 (as it is the lowest common multiple).

	R	Y	B	
× 3	3	2		
× 2		3	× 3 7	× 2
	9	6	14	

$R : Y : B = 9 : 6 : 14$