



*Rewarding Learning*

**General Certificate of Secondary Education  
Summer 2023**

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**GCSE Mathematics**

**MV24**

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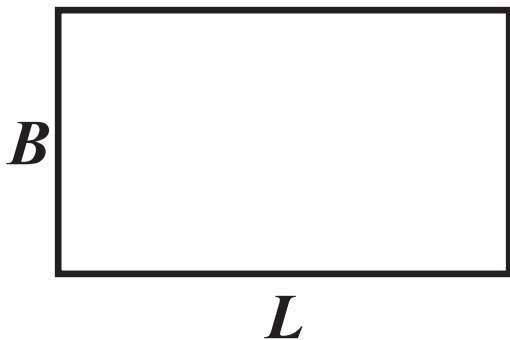
**Higher Tier  
Additional Support Materials  
(For use in Summer 2023)**

# Higher Tier Additional Support Materials (Summer 2023)

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

## Perimeter, Area and Volume

The perimeter of a polygon is the distance around the outside of the polygon.



The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$  where  $L$  is length and  $B$  is breadth.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$  where  $V$  is volume,  $L$  is length,  $B$  is breadth and  $H$  is height.

The area of a circle is  $A = \pi r^2$  where  $r$  is the radius of the circle.

The circumference (perimeter) of a circle is  $C = 2\pi r$  where  $r$  is the radius of the circle. An alternative formula is  $C = \pi d$  where  $d$  is the diameter of the circle.

## Mid point of a line

If  $(x_1, y_1)$  and  $(x_2, y_2)$  are the end points of a line, then the coordinates of the midpoint  $M$  of the line are

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

## Gradient of a line

If  $(x_1, y_1)$  and  $(x_2, y_2)$  are two points on a line, then the gradient  $m$  of the line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

# Lines

Parallel lines have the same gradient.

If a straight line has gradient  $m$ , then a line which is perpendicular to this line has a gradient  $-\frac{1}{m}$

# Geometry and Angles

There are  $180^\circ$  on a straight line.

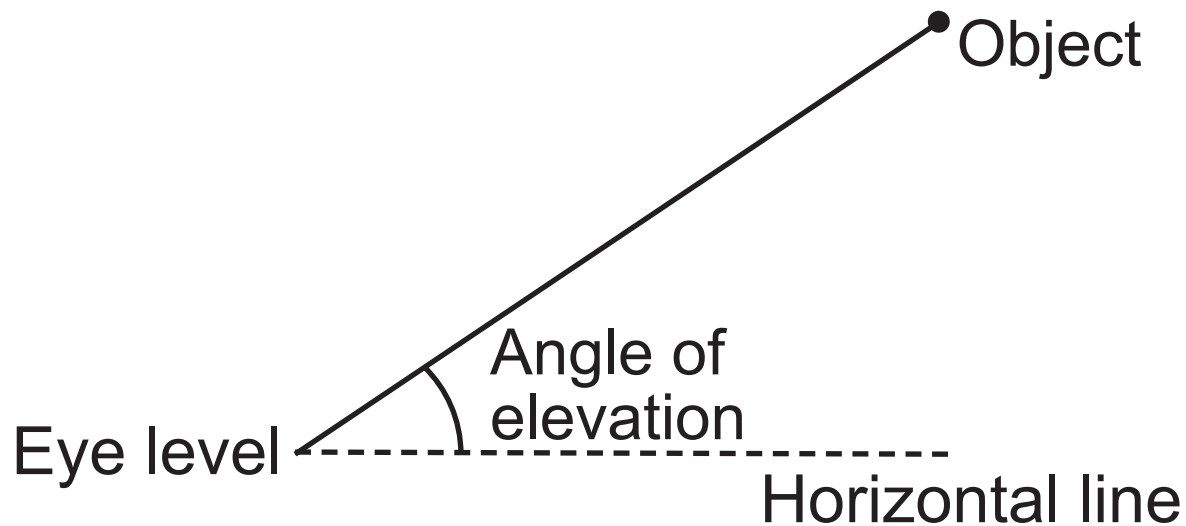
There are  $180^\circ$  inside a triangle.

An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.

The sum of all the angles inside a polygon is given by  $180(n - 2)$  where  $n$  is the number of sides in the polygon.

## Angle of elevation

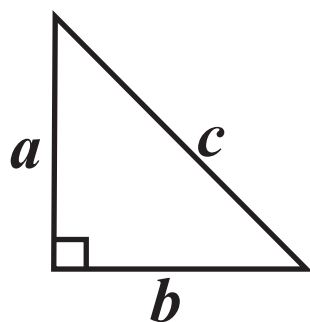
If a person stands and looks up at an object, the **angle of elevation** is the angle between the horizontal line of sight and the object.



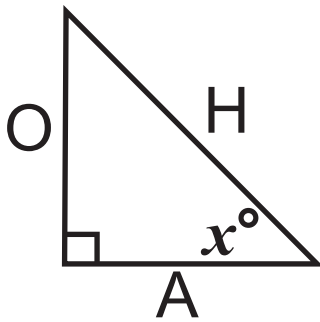
## Pythagoras' Theorem

If  $a$ ,  $b$  and  $c$  are the sides of a right angled triangle shown below, then

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



# Trigonometric ratios in right angled triangles



$$\sin x^\circ = \frac{O}{H} \quad \cos x^\circ = \frac{A}{H} \quad \tan x^\circ = \frac{O}{A}$$

## Tangent/Radius property

The tangent to a circle is perpendicular to the radius at the point of contact with the circle.

## Alternate Segment Theorem

In a circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

## Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

## **Estimate for the mean of a grouped frequency distribution**

Estimated mean = sum of (mid interval values multiplied by their frequency) divided by the sum of all the frequencies.

## **Pie Chart**

In a pie chart, the total angle that corresponds to the entire data set is  $360^\circ$

## **Probability**

The sum of the probabilities of all outcomes equals 1

## **Frequency density in histograms**

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$