GCSE Mathematics Formula Booklet

Foundation

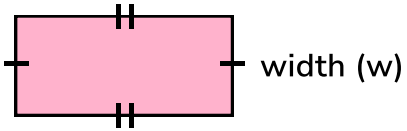
Higher

THIRD SPACE LEARNING

Area

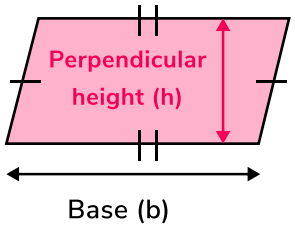
Rectangle

Area = length x width

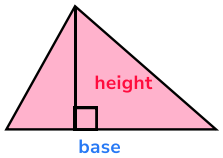


Parallelogram

Area = base x perpendicular height

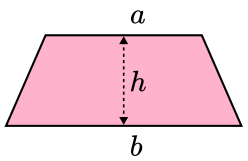


Triangle



Area = $\frac{1}{2}$ x base x height

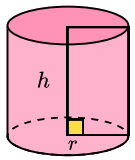
Trapezium



Area = $\frac{1}{2}(a+b)h$

Surface Area

Cylinder



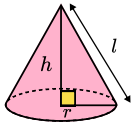
r = radius, h = height

Surface area = $2\pi rh + 2\pi r^2$

Cone

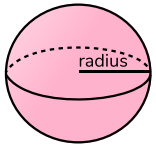
Curved surface area = πrl

Total surface area = $\pi rl + \pi r^2$



Sphere

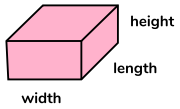
Surface area = $4\pi r^2$



Volume

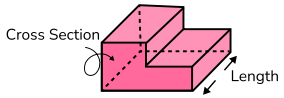
Cuboid

Volume = length x width x height

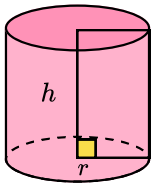


Prism

Volume = area of cross section x length



Cylinder

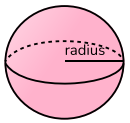


r = radius, h = height

Volume = $\pi r^2 h$

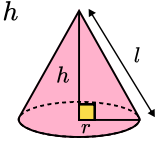
Sphere

Volume = $\frac{4}{3}\pi r^3$



Cone

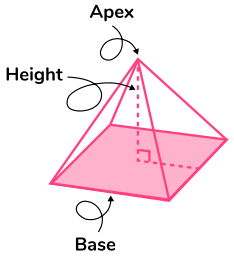
Volume = $\frac{1}{3}\pi r^2 h$



Pyramid

Volume = $\frac{1}{3}Bh$

B = area of base, h = height

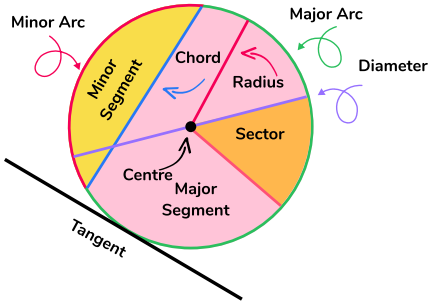


Circles

r = radius, d = diameter

Area = πr^2

Circumference = πd or $2\pi r$



Arc length = $\frac{\theta}{360} \times \pi d$

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

THIRD SPACE LEARNING

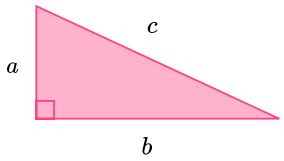
Pythagoras

Note: Right angled triangles only

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

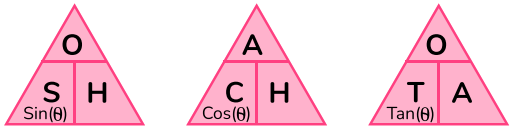
c is the **hypotenuse**
(The longest side)

a and b are the shorter sides.



Trigonometry

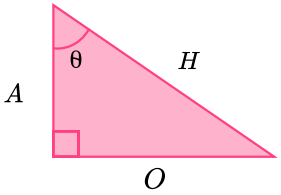
Note: Right angled triangles only



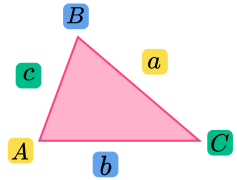
$\text{Sin}\,\theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$

$\text{Cos}\,\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

$\text{Tan}\,\theta = \frac{\text{Opposite}}{\text{Adjacent}}$



Further Trigonometry



Area of a triangle

Area = $\frac{1}{2}abSin(C)$

Sine Rule

To find a side:

$$\frac{a}{Sin\,A} = \frac{b}{Sin\,B} = \frac{c}{Sin\,C}$$

To find an angle:

$$\frac{Sin\,A}{a} = \frac{Sin\,B}{b} = \frac{Sin\,C}{c}$$

Cosine Rule

To find a side:

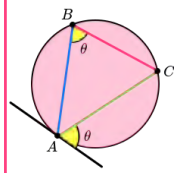
$$a^2 = b^2 + c^2 - 2bcCos(A)$$

To find an angle:

$$CosA = \frac{b^2 + c^2 - a^2}{2bc}$$

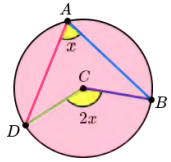
Circle Theorems

Alternate segment theorem



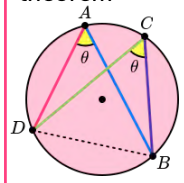
The angle that lies between a tangent and a chord is equal to the angle subtended by the same chord in the alternate segment.

Angle at the centre theorem



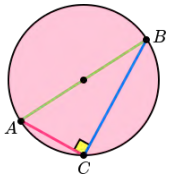
The angle at the centre is twice the angle at the circumference.

Angles in the same segment theorem



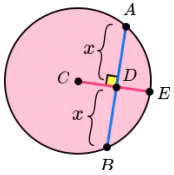
Angles in the same segment are equal.

Angles in a semicircle



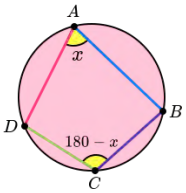
The angle in a semicircle is 90 degrees.

Chord of a circle



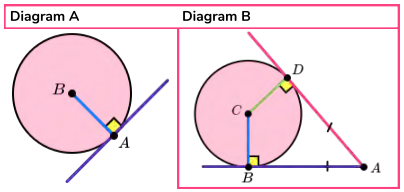
The perpendicular from the centre of a circle to a chord bisects the chord (splits the chord into two equal parts).

Cyclic quadrilateral



The opposite angles in a cyclic quadrilateral total 180 .

Angle at the centre theorem



A. The angle between a tangent and radius is 90 degrees.

B. Tangents which meet at the same point are equal in length.

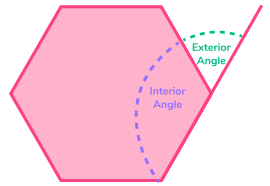
Angles in a Polygon

Exterior angle = $\frac{360}{n}$

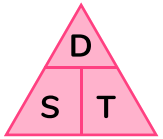
n = number of sides

Interior angle + Exterior angle = 180°

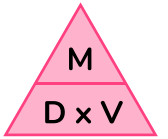
Sum of interior angles = $(n-2) \times 180$



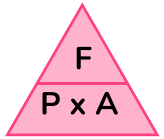
Compound Measures



Distance = Speed x Time
Speed = Distance ÷ Time
Time = Distance ÷ Speed



Mass = Density x Volume
Density = Mass ÷ Volume
Volume = Mass ÷ Density



Force = Pressure x Area
Pressure = Force ÷ Area
Area = Force ÷ Area

THIRD SPACE LEARNING

Straight Lines

Gradient

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

Equation of a line

$$y = mx + c$$

m = Gradient, c = y intercept

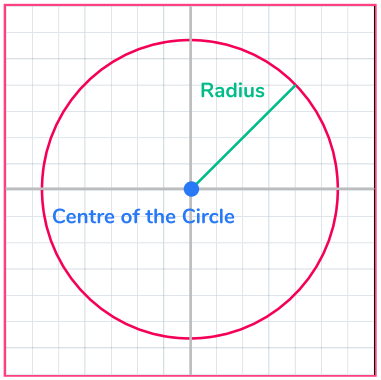
Midpoint of 2 points (x_1, y_1) and (x_2, y_2)

$$(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$$

Gradient of perpendicular to line $y = mx + c$

$$-\frac{1}{m}$$

Equation of a Circle



$$x^2 + y^2 = r^2$$

r = radius

Centre = (0,0)

Percentage Change

$$\text{Percentage change} = (\frac{\text{Difference}}{\text{Original}}) \times 100$$

Compound Growth & Decay

The amount after n years (or days, etc), where percentage rate of change is r is

$$\text{Starting amount} \times (1 \pm \frac{r}{100})^n$$

Quadratics

Quadratic equation

$$ax^2 + bx + c$$

Quadratic Formula

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

Completing the square

$$(x + p)^2 + q$$

$$x^2 \pm bx \pm c = (x \pm \frac{b}{2})^2 - (\frac{b}{2})^2 \pm c$$

Direct and Inverse Proportion

If x is directly proportional to y^n then

$$x \propto y^n \quad \text{so} \quad x = ky^n$$

If x is inversely proportional to y^n then

$$x \propto \frac{1}{y^n} \quad \text{so} \quad x = \frac{k}{y^n}$$

Probability

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A \text{ given } B)P(B)$$

Pie Charts

The angle to draw for each sector is

$$\text{Angle} = \frac{\text{Frequency}}{\text{Total}} \times 360°$$

Histogram

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

Stratified Sample

$$\text{Account in sample} = \frac{\text{Group number}}{\text{Total}} \times \text{Sample size}$$

Kinematics

s = displacement

u = initial velocity

v = final velocity

a = acceleration

t = time

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(u + v)t$$

$$v^2 = u^2 + 2as$$

$$s = vt - \frac{1}{2}at^2$$