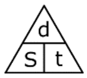
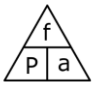
Formulae for GCSE – Higher tier

Percentages	
Compound interest / Growth and Decay	$\left(1 \pm \frac{\%}{100}\right)^n \times original$
Original amount (reverse percentage)	$\frac{new\ amount}{(1 \pm \frac{\%}{100})}$
Percentage change (percentage increase or decrease)	$\frac{difference}{original} \times 100$
Percentage score	$\frac{score}{total\ available} \times 100$

Angles in Polygons	
Sum of interior angles of a polygon	$180(n-2)$
Relationship between interior and exterior angles of a polygon	$interior + exterior = 180°$
Exterior angle of a polygon	$\frac{360°}{n}$
Number of sides of a polygon	$\frac{360°}{exterior\ angle}$

Pythagoras and Trigonometry	
Pythagoras' theorem: find the hypotenuse	$c = \sqrt{a^2+b^2}$
Pythagoras' theorem: find a non-hypotenuse	$a = \sqrt{c^2-b^2}$
Trigonometry: Mnemonic to help choose the correct ratio	S O H C A H T O A
Trigonometry: Sine ratio	$Sin\ \theta = \frac{opp}{hyp}$ $\theta = sin^{-1}\left(\frac{opp}{hyp}\right)$
Trigonometry: Cosine ratio	$Cos\ \theta = \frac{adj}{hyp}$ $\theta = cos^{-1}\left(\frac{adj}{hyp}\right)$
Trigonometry: Tangent ratio	$Tan\ \theta = \frac{opp}{adj}$ $\theta = tan^{-1}\left(\frac{opp}{adj}\right)$
Cosine rule: find a side	$a^2 = b^2+c^2-2bcCosA$
Cosine rule: find an angle	$CosA = \frac{b^2+c^2-a^2}{2bc}$
Sine rule: find a side	$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$
Sine rule: find an angle	$\frac{sinA}{a} = \frac{sinB}{b} = \frac{sinC}{c}$
Area of a triangle (trigonometry)	$A = \frac{1}{2}abSinC$

Statistics	
The angle for 1 person or thing	$\frac{360°}{\sum frequency}$
Position of the median value	**Odd** $\frac{n+1}{2}$ **Even** $\frac{n}{2}, \frac{n}{2}+1$
Frequency density (histogram)	$\frac{frequency}{class\ width}$
Interquartile range	$upper\ quartile - lower\ quartile$ $UQ-LQ$

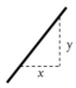
Compound Measures	
Speed	$\frac{distance}{time}$ 
Pressure	$\frac{force}{area}$ 
Density	$\frac{mass}{volume}$ 

Rules of Indices	
Multiplying	$a^m \times a^n = a^{m+n}$
Dividing	$\frac{a^m}{a^n} = a^{m-n}$
Raising to another power	$(a^m)^n = a^{mn}$
Anything to the power of zero	$n^0 = 1$
Negative index	$a^{-m} = \frac{1}{a^m}$
Unit fractional index	$a^{\frac{1}{n}} = \sqrt[n]{a}$
Any fractional index	$a^{\frac{m}{n}} = (\sqrt[n]{a})^m$

Sequences	
Nth term: Linear (arithmetic) sequence	$U_n = dn + (a-d)$ $a = first\ term$ $d = difference$
Nth term: Geometric sequence	$U_n = ar^{n-1}$ $a = first\ term$ $r = common\ ratio$

Unit Conversion

Unit Conversion	
Converting between lengths: cm and m	$cm \xrightarrow{\div 100} m$, $m \xrightarrow{\times 100} cm$
Converting between areas: cm^2 and m^2	$cm^2 \xrightarrow{\div 10000} m^2$, $m^2 \xrightarrow{\times 10000} cm^2$
Converting between volumes: cm^3 and m^3	$cm^3 \xrightarrow{\div 1000000} m^3$, $m^3 \xrightarrow{\times 1000000} cm^3$

Equations and Graphs	
Equation of a straight line	$y = mx + c$
Gradient	$\frac{diff.\ in\ y}{diff.\ in\ x}$ 
Midpoint of a line (between 2 points)	$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
Equation of a circle	$x^2 + y^2 = r^2$
Quadratic formula	$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

How to learn the formulae

You need to know all of these formulae for your maths exams. To learn them effectively try these ideas:

1. Look, Cover, Write, Check, Correct
    a. Look at the formulae then cover it
    b. Try to say or write the formulae
    c. Check to see if you were tight
    d. Correct those you get wrong
2. Get someone else to test you
3. Flashcards
    a. Write the name on one side and the formula on the other
    b. Go through the cards looking at one side and trying to remember the other

Electronic flashcards of the formulae are at:

mathsduck.co.uk/formulae

Remember:
- You will learn the formulae best by testing yourself
- Little and often is better than fewer longer sessions

Area and Volume	
Area of a square/rectangle	$A = bh$
Area of a triangle	$A = \frac{bh}{2}$
Area of a parallelogram	$A = bh$
Area of a trapezium	$A = \frac{1}{2}(a+b)h$
Circumference of a circle	$C = \pi D$ or $C = 2\pi r$
Area of a circle	$Area = \pi r^2$
Surface area of a cylinder	$2\pi r^2 + \pi dh$
Surface area of a sphere	$4\pi r^2$
Surface area of a cone	$\pi r^2 + \pi rl$
Surface area of a frustum	$\pi r^2 + \pi R^2 + \pi(R+r)l$
Volume of a cube/cuboid	$V = bhl$
Volume of a triangular prism	$V = \frac{bh}{2}l$
Volume of a cylinder	$V = \pi r^2 h$
Volume of a pyramid	$V = \frac{1}{3}(base\ area \times height)$
Volume of a cone	$V = \frac{1}{3}(\pi r^2 h)$
Volume of a sphere	$V = \frac{4}{3}(\pi r^3)$
Arc length	$\frac{\theta}{360} \times \pi d$
Sector area	$\frac{\theta}{360} \times \pi r^2$
Area of a segment	$area\ of\ sector - area\ of\ triangle$
Enlarged perimeter	$original\ perimeter \times S.F$
Enlarged area	$original\ area \times (S.F)^2$
Enlarged volume	$original\ volume \times (S.F.)^3$