



# Formulae for A-level Mathematics

## AS Mathematics (7356) A-level Mathematics (7357)

v1.2 First issued August 2017

For the new specifications for first teaching from September 2017.

This booklet of formulae is required for all AS and A-level Mathematics exams.

There is a larger booklet of formulae and statistical tables for all AS and A-level Further Mathematics exams.

Further copies of this booklet are available from: Telephone: 0844 209 6614 Fax: 01483 452819 or download from the AQA website www.aqa.org.uk

Copyright © 2017 AQA and its licensors. All rights reserved.

Copyright

AQA retains the copyright on all its publications. However, registered centres of AQA are permitted to copy material from this booklet for their own **internal use**, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by AQA.

AQA Education (AQA) is a registered charity (number 1073334) and a company limited by guarantee registered in England and Wales (number 3644723). Our registered address is AQA, Devas Street, Manchester M15 6EX

www.mymathscloud.com

## Contents

	Page
Pure mathematics	4
Mechanics	6
Probability and statistics	6

www.mymathscloud.com

## **Pure mathematics**

## **Binomial series**

$$(a+b)^{n} = a^{n} + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^{2} + \dots + \binom{n}{r}a^{n-r}b^{r} + \dots + b^{n} \quad (n \in \mathbb{N})$$
  
where  $\binom{n}{r} = {}^{n}C_{r} = \frac{n!}{r!(n-r)!}$   
 $(1+x)^{n} = 1 + nx + \frac{n(n-1)}{1.2}x^{2} + \dots + \frac{n(n-1)\dots(n-r+1)}{1.2\dots r}x^{r} + \dots \quad (|x| < 1, n \in \mathbb{Q})$ 

## **Arithmetic series**

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n[2a+(n-1)d]$$

## **Geometric series**

$$S_n = \frac{a(1-r^n)}{1-r}$$
$$S_{\infty} = \frac{a}{1-r} \text{ for } |r| < 1$$

## Trigonometry: small angles

For small angle  $\theta$ , measured in radians:

$$\sin \theta \approx \theta$$
$$\cos \theta \approx 1 - \frac{\theta^2}{2}$$
$$\tan \theta \approx \theta$$

## Trigonometric identities

$$\sin (A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\cos (A \pm B) = \cos A \cos B \mp \sin A \sin B$$
$$\tan (A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B} \qquad (A \pm B \neq (k + \frac{1}{2})\pi)$$

www.mymathscloud.com



## Differentiation

$\mathbf{f}(\mathbf{x})$	$\mathbf{f}'(\mathbf{x})$
tanx	$\sec^2 x$
cosecx	$-\csc x \cot x$
secx	sec <i>x</i> tan <i>x</i>
$\cot x$	$-\cos ec^2 x$
$\frac{\mathbf{f}(x)}{\mathbf{g}(x)}$	$\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$

## Differentiation from first principles

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

## Integration

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$
$$\int \frac{f'(x)}{f(x)} dx = \ln|f(x)| + c$$
$$f(x) \qquad \int f(x) dx$$
$$\tan x \qquad \ln|\sec x| + c$$
$$\cot x \qquad \ln|\sin x| + c$$

## Numerical solution of equations

The Newton-Raphson iteration for solving f(x) = 0:  $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ 

## **Numerical integration**

The trapezium rule: 
$$\int_{a}^{b} y \, dx \approx \frac{1}{2} h\{(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})\}$$
, where  $h = \frac{b-a}{n}$ 



## Mechanics

### **Constant acceleration**

 $s = ut + \frac{1}{2}at^{2}$   $s = ut + \frac{1}{2}at^{2}$   $s = ut + \frac{1}{2}at^{2}$   $s = vt - \frac{1}{2}at^{2}$  v = u + at  $s = \frac{1}{2}(u + v)t$   $v^{2} = u^{2} + 2as$   $s = ut + \frac{1}{2}at^{2}$   $s = vt - \frac{1}{2}at^{2}$   $s = vt - \frac{1}{2}at^{2}$   $s = vt - \frac{1}{2}at^{2}$   $s = \frac{1}{2}(u + v)t$  $s = \frac{1}{2}(u + v)t$ 

## **Probability and statistics**

#### Probability

$$\mathsf{P}(A \cup B) = \mathsf{P}(A) + \mathsf{P}(B) - \mathsf{P}(A \cap B)$$
$$\mathsf{P}(A \cap B) = \mathsf{P}(A) \times \mathsf{P}(B|A)$$

#### **Standard deviation**

$$\sqrt{\frac{\Sigma(x-\overline{x})^2}{n}} = \sqrt{\frac{\Sigma x^2}{n} - \overline{x}^2}$$

### **Discrete distributions**

Distribution of X	P(X=x)	Mean	Variance
Binomial $B(n, p)$	$\binom{n}{x} p^x (1-p)^{n-x}$	np	<i>np</i> (1 – <i>p</i> )

## **Sampling distributions**

For a random sample of *n* observations from N( $\mu$ ,  $\sigma^2$ ):

$$\frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}} \sim \mathsf{N}(0, 1)$$

#### End of formulae





