

# FORMULAE/REVISION HINTS FOR SECTION A

## NUMBER AND ALGEBRA

### Basic arithmetic

**Order of precedence** is best remembered by **BODMAS** (i.e. brackets, order, division, multiplication, addition, subtraction). Multiplication and division must be completed before addition and subtraction.

A **bracket** means multiplication. For example,  $3(2 + 5) = 3 \times 7 = 21$

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### Fractions

Here's a quick reminder of some fractions:  $\frac{11}{3} = 3\frac{2}{3}$ ,  $2\frac{2}{5} = \frac{12}{5}$ ,  $\frac{1}{5} + \frac{2}{3} = \frac{3+10}{15} = \frac{13}{15}$ ,

$\frac{2}{3} \times \frac{5}{7} = \frac{2 \times 5}{3 \times 7} = \frac{10}{21}$ ,  $\frac{3}{5} \div \frac{7}{10} = \frac{3}{5} \times \frac{10}{7} = \frac{3 \times 2}{1 \times 7} = \frac{6}{7}$ ,  $2\frac{3}{5} \times \frac{3}{4} \div \frac{1}{5} = \frac{13}{5} \times \frac{3}{4} \times \frac{5}{1} = \frac{13 \times 3 \times 1}{1 \times 4 \times 1} = \frac{39}{4} = 9\frac{3}{4}$

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### SI units

The basic seven units used in the SI system are listed below with their symbols.

Quantity	Unit	Symbol	
Length	metre	m	(1 m = 100 cm = 1000 mm)
Mass	kilogram	kg	(1 kg = 1000 g)
Time	second	s	
Electric current	ampere	A	
Thermodynamic temperature	Kelvin	K	(K = °C + 273)
Luminous intensity	candela	cd	
Amount of substance	mole	mol	

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## Prefixes and their meaning

Prefix	Name	Meaning	
G	giga	multiply by $10^9$	i.e. $\times 1\,000\,000\,000$
M	mega	multiply by $10^6$	i.e. $\times 1\,000\,000$
k	kilo	multiply by $10^3$	i.e. $\times 1000$
m	milli	multiply by $10^{-3}$	i.e. $\times \frac{1}{10^3} = \frac{1}{1000} = 0.001$
$\mu$	micro	multiply by $10^{-6}$	i.e. $\times \frac{1}{10^6} = \frac{1}{1\,000\,000} = 0.000001$
n	nano	multiply by $10^{-9}$	i.e. $\times \frac{1}{10^9} = \frac{1}{1\,000\,000\,000} = 0.000\,000\,001$
p	pico	multiply by $10^{-12}$	i.e. $\times \frac{1}{10^{12}} = \frac{1}{1\,000\,000\,000\,000} = 0.000\,000\,000\,001$

## Basic operations in algebra

$a + a + a + a = 4a$  For example, if  $a = 3$ , then  $3 + 3 + 3 + 3 = 4 \times 3 = 12$

$5b$  means  $5 \times b$  For example, if  $b = 2$ , then  $5b = 5 \times 2 = 10$

$3a + 4b + a - 7b = 3a + a + 4b - 7b = 4a - 3b$

$5abcd = 5 \times a \times b \times c \times d$

For example, if  $a = 3$ ,  $b = -2$ ,  $c = 1$  and  $d = -4$ , then  $5abcd = 5 \times 3 \times -2 \times 1 \times -4 = 120$

$(a)(c)(d)$  means  $a \times c \times d$  For example,  $(2)(5)(4)$  means  $2 \times 5 \times 4 = 40$

$ab = ba$  If  $a = 2$  and  $b = 3$  then  $2 \times 3$  is exactly the same as  $3 \times 2$ , i.e. 6

$b^2 = b \times b$  For example, if  $b = 2$ , then  $2^2 = 2 \times 2 = 4$

$a^3 = a \times a \times a$  For example, if  $a = -2$ , then  $(-2)^3 = -2 \times -2 \times -2 = -8$

## Decimals

14.786 = 14.79, correct to 4 significant figures  
= 14.8, correct to 1 decimal place

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### Laws of indices

$$a^m \times a^n = a^{m+n} \qquad \frac{a^m}{a^n} = a^{m-n} \qquad (a^m)^n = a^{m \times n}$$
$$a^{\frac{m}{n}} = \sqrt[n]{a^m} \qquad a^{-n} = \frac{1}{a^n} \qquad a^0 = 1$$

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### Brackets

$$3a(b - 2a) = 3ab - 6a^2 \quad \text{and} \quad (2x - y)(x + 3y) = 2x^2 + 6xy - xy - 3y^2 = 2x^2 + 5xy - 3y^2$$

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### Factorization

$$2ab^2 - 6a^2b + 10a^3b^4 = 2ab(b - 3a + 5a^2b^3)$$

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### Quadratic formula

$$\text{If } ax^2 + bx + c = 0 \text{ then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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### Definition of a logarithm

$$\text{If } y = a^x \text{ then } x = \log_a y$$

### Laws of logarithms

$$\log(A \times B) = \log A + \log B$$

$$\log\left(\frac{A}{B}\right) = \log A - \log B \qquad \log A^n = n \times \log A$$

$$\text{If } 2^x = 11, \log_{10}(2^x) = \log_{10} 11, x \log_{10} 2 = \log_{10} 11 \text{ and } x = \frac{\log_{10} 11}{\log_{10} 2} = \mathbf{3.459}$$

$$\text{If } 5 = 3e^{-2t}, \frac{5}{3} = e^{-2t}, \ln\left(\frac{5}{3}\right) = \ln(e^{-2t}), \ln\left(\frac{5}{3}\right) = -2t \text{ and } t = -\frac{1}{2} \ln\left(\frac{5}{3}\right) = \mathbf{-0.2554}$$

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### Exponential series

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \quad (\text{valid for all values of } x)$$