

Year 12 Maths Introduction Booklet

In Year 12 we offer three maths courses: 'Maths' which is the traditional AS Level, 'Further Maths' which extends to topics needed for maths, engineering or scientific degree courses and 'Use of Maths' which applies maths to real life skills and careers rather than abstract problems. Shortly before October half-term you will all be assessed and depending on the outcome of this assessment, and also the quality of your work up until this point, we may recommend that you take the Use of Mathematics option even if you originally opted for AS Mathematics. The questions included in this booklet will give you some idea of the background skills required for the 3 different courses and you should complete the relevant sections.

Course Structures:

AS Maths	Use of Maths
<ul style="list-style-type: none">• Core 1 – 33.33%• Core 2 – 33.33%• Statistics 1 – 33.33% <p>Each unit has a 90 minute exam at the end of year 12.</p>	<ul style="list-style-type: none">• Algebra – 33.33%• Data Analysis – 33.33%• Decision Maths – 33.33% <p>Each unit has a 60 minute exam at the end of year 12.</p>
AS Further Maths	
<ul style="list-style-type: none">• Further Pure 1 – 33.33%• Decision 1 – 33.33%• Decision 2 – 33.33% <p>Each unit has a 90 minute exam at the end of year 12</p>	

All students are expected to arrive at lessons with their own file paper (preferably squared) and a ring binder divided into sections in which to keep a tracking sheet, class notes, informal homework and formal assessments. It is your responsibility to keep this folder well organised and up to date.

For Maths a **Casio** calculator is required for all units (except Core 1) and we strongly recommend at least the **FX-83 GT Plus / FX-85 GT Plus** or the more advanced **Casio FX-991ES Plus**.

For Use of Maths a calculator is **required** for every module and we only recommend the **Casio FX-991ES Plus**.

Section 1: Use of Maths, Maths and Further Maths

Algebraic Manipulation

1) Factorise completely:

i) $6x^2 + 2$

ii) $9x^2y - 3xy$

iii) $5x^2y - 4y^2 - 3xy$

iv) $\frac{x^2}{2} - \frac{x^3}{4}$

2) Factorise completely

i) $x^2 + 4x + 3$

ii) $x^2 - 7x + 12$

iii) $x^2 - x - 12$

iv) $x^2 - y^2$

3) Rearrange the following to make the letter in the bracket the subject

i) $v = u + at$ (u)

ii) $w = \frac{4v+u}{3}$ (v)

iii) $x = \frac{1}{2}(y + z)$ (y)

iv) $5a + 3b = \frac{2}{3}(3b - 2a)$ (a)

Solving Equations (Linear)

4) Solve:

i) $7 - 2x = -1$

ii) $3x + 5 = 5 - 2x$

iii) $3(2x - 1) = 5(3x - 15)$

iv) $4(2x - 3) - 3(3x - 10) = 11$

5) Solve:

i) $\frac{x}{3} + \frac{x}{4} = 14$

ii) $\frac{2}{x-1} = \frac{3}{2x+4}$

iii) $\frac{2x-1}{3} - \frac{x+1}{4} = 4$

iv) $\frac{2}{3x} = \frac{1}{x} - \frac{1}{x+1}$

Solving Equations (Quadratic)

6) Factorise and solve:

i) $x^2 - 5x + 6 = 0$

ii) $x^2 - 5x - 6 = 0$

iii) $x^2 - y^2 = 0$

iv) $25x^2 - 9y^2 = 0$

7) Complete the square and solve:

i) $x^2 + 6x + 6 = 0$

ii) $x^2 - x - 2 = 0$

iii) $x^2 - 4x - 5 = 0$

iv) $x^2 + 3x - 28 = 0$

8) Using the quadratic formula, solve the following equations leaving your answers in surd form:

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

i) $x^2 + x - 1 = 0$

ii) $4x^2 - 7x - 4 = 0$

iii) $3x(2x + 1) = 1$

iv) $\frac{2x+3}{x-1} = \frac{x}{4}$

Straight Line Graphs

9) For each of the following equations state the gradient and the y-intercept:

a) $y = 3x + 2$

b) $y = -2x - 5$

c) $3y = 6x - 5$

Section 2: Maths and Further Maths

d) $y + x + 3 = 0$

e) $2y + 2x = 1$

f) $\frac{3x+4}{5} = 7$

10) For each of the following equations

i) State the equation of the line that is parallel and passes through the given point

ii) State the equation of the perpendicular line that passes through the given point

a) $y = 5x + 2$ (2,3)

b) $3y = 7x - 5$ (-6,-8)

c) $y + x - 3 = 0$ (9,1)

d) $2y + x = 1$ (-2,-2)

e) $\frac{3x+4}{5} = -2$ (11,1)

11) For each of the following pairs of equations, solve for x and y:

a) $6x + 2y = 10$

$4x + y = 7$

b) $2x + 3y = 28$

$3x = 9 + y$

$$\begin{aligned} \text{d)} \quad & 3x - 2y = 13 \\ & x - y = 5 \end{aligned}$$

$$\begin{aligned} \text{c)} \quad & 2x = 15 - 3y \\ & 5x - y = 4 \end{aligned}$$

12) Find the coordinate(s) where the following pairs of lines intersect:

$$\begin{aligned} \text{a)} \quad & y = x^2 + 2x + 3 \\ & y = x + 9 \end{aligned}$$

$$\begin{aligned} \text{c)} \quad & y = -x^2 - 5x + 1 \\ & y = -x - 4 \end{aligned}$$

$$\begin{aligned} \text{b)} \quad & y = 2x^2 - 2x + 3 \\ & y = 2x + 3 \end{aligned}$$

$$\begin{aligned} \text{d)} \quad & y = x^3 \\ & y = x^2 \end{aligned}$$

Algebraic Fractions

13) Cancel the following fraction to their lowest terms:

$$\text{i)} \quad \frac{abc^2}{a^2bc}$$

$$\text{iv)} \quad \frac{x-4}{4-x}$$

$$\text{ii)} \quad \frac{18p^4q^2}{27q^2}$$

$$\text{v)} \quad \frac{2x^3+2x^2y}{x^2-y^2}$$

$$\text{iii)} \quad \frac{3x^2-5x-2}{(x-2)(x+1)}$$

$$\text{vi)} \quad \frac{16x^2+16x}{24x^3+24x^2}$$

14) Simplify:

$$\text{i)} \quad \frac{ab^2}{4c^2d} \times \frac{2cd}{ab}$$

$$\text{iii)} \quad \frac{3ab^2}{5b^3c} \div \frac{9a^2b}{15b^2c^2}$$

$$\text{ii)} \quad \frac{mn}{2} \div \frac{mn}{4}$$

$$\text{iv)} \quad \frac{6}{a+b} \times \frac{a^2-b^2}{2}$$

15) Express each of these as a single fraction in its simplest form:

$$\text{i)} \quad \frac{m}{n} + \frac{n}{m}$$

$$\text{iv)} \quad 5 + \frac{31}{3y}$$

$$\text{ii)} \quad \frac{x}{yz} + \frac{z}{xy}$$

$$\text{v)} \quad \frac{3}{a+1} + \frac{5}{a+3}$$

$$\text{iii)} \quad \frac{6}{y+1} - \frac{7}{y^2-1}$$

$$\text{vi)} \quad \frac{x}{a-x} - \frac{y}{a-y}$$

Section 3: Further Maths

16) Solve, where possible, the following quadratics:

i) $2x^2 + 12x = 14$ b) $3x^2 + 10x + 1 = 0$

c) $4x^2 + 4x + 1 = 0$ d) $3x^2 + 2x + 1 = 0$

17) Simplify:

i) $\sqrt{80}$ b) $\sqrt{32} - \sqrt{18}$ c) $\sqrt{6} \times \sqrt{3}$

d) $(4 + \sqrt{3})(4 - \sqrt{3})$ e) $(5 - \sqrt{2})(1 - \sqrt{3})$

18) Rationalise the denominators:

i) $\frac{2}{\sqrt{3}}$ b) $\sqrt{\frac{3}{5}}$ c) $\frac{2\sqrt{3}}{5+\sqrt{2}}$

19) Make x the subject of these:

i) $\frac{1}{x} = \frac{1}{a} + \frac{1}{b}$ b) $p = \frac{2r-x}{3s}$

c) $ax + b = cx - d$ d) $\frac{ax}{2} + \frac{3}{a} = 1$

e) $\frac{a}{x} + \frac{2}{3x} = \frac{a}{2x-1}$ f) $\sqrt{\frac{2a}{\sqrt{4x-1}}} = a$

g) $\sqrt{x\left(\frac{a}{x} + x\right)} = \frac{2}{a^2} + x$ h) $\frac{x}{2a} + \frac{b}{x} = 1$

20) There are n sweets in a bag. 6 of the sweets are orange. The rest of the sweets are yellow. Hannah takes a random sweet from the bag and eats it. Hannah then takes another random sweet from the bag and eats it. The probability that Hannah eats two orange sweets is $\frac{1}{3}$.

Show that $n^2 - n - 90 = 0$