



A Level Mathematics

# Get Ready

**GCSE Skills Revision**

Name \_\_\_\_\_

## **This Booklet is Essential Preparation for your Course**

### **Task:**

Please complete the following questions and **bring to your first session of A Level Mathematics.**

Be prepared to hand in your solutions, showing your working. Please also write the section headings on your work to indicate which questions you are working on.

**NOTE:** *These are top end GCSE questions covering level 7 to 9 topics. We will be covering these topics during the first term in college, so give it your best attempt, but don't worry if you don't understand something.*

A Level Mathematics is far more challenging than your GCSE Mathematics course. Most of the course relies on advanced algebra and so your algebra skills from GCSE need to be strong; they are the foundation upon which we will be building right from the start.

We have provided you with this preparation booklet as we want you to be able to meet these challenges in September. If you can complete most of the questions set over the next few pages correctly you will be well prepared for the start of your course. If you are finding them difficult, or feel that you need further practice, try refreshing your memory by looking at any GCSE higher textbook, revision guide or online resources such as [www.corbettmaths.com](http://www.corbettmaths.com) or [www.mathsgenie.co.uk/gcse.html](http://www.mathsgenie.co.uk/gcse.html).

Every question in this booklet is non calculator.



Enjoy your summer. We are looking forward to seeing you in September.

## Revision booklet

Do all of these questions before you start the A level course.



### Indices:

Q1 Write in the form  $2^n$

1)  $2^5 \times 2^3$

2)  $2 \times 2^6$

3) 1

4)  $2^6 \div 2^2$

5)  $2^5 \div 2$

6)  $(2^7)^2$

Q2 Simplify

1)  $2p^2 \times 4p^5$

2)  $x^2 \times x^3 \times x^5$

3)  $12x^7 \div 2x^2$

4)  $(x^3)^4$

5)  $x^5 \div x^5$

Q3 Evaluate without a calculator

1)  $64^{\frac{1}{3}}$

2)  $25^{\frac{1}{2}}$

3)  $9^{\frac{1}{2}}$

4)  $32^{\frac{1}{5}}$

5)  $125^{\frac{1}{3}}$



Q4 Evaluate without a calculator, leaving answers as fractions

1)  $3^{-1}$

2)  $2^{-3}$

3)  $3^{-2}$

4)  $6^{-2}$

5)  $4^{-3}$

Q5 Evaluate without a calculator, leaving answers as fractions

1)  $9^{-\frac{1}{2}}$

2)  $64^{-\frac{1}{2}}$

3)  $64^{-\frac{1}{3}}$

4)  $81^{-\frac{1}{4}}$

5)  $125^{-\frac{1}{3}}$

Q6 Evaluate without a calculator.

1)  $4^{\frac{3}{2}}$

2)  $27^{\frac{2}{3}}$

3)  $9^{\frac{3}{2}}$

4)  $16^{\frac{3}{2}}$

5)  $8^{\frac{2}{3}}$

Q7 Write in the form  $x^n$

1)  $\sqrt{x}$

2)  $\frac{1}{x}$

3)  $\frac{1}{x^3}$

4)  $\frac{3}{\sqrt{x}}$

5)  $\sqrt[3]{x}$

6)  $\frac{5}{\sqrt[3]{x}}$

7)  $\sqrt{x^5}$

8)  $\frac{x^6}{x^3}$

## Algebraic Expressions:

Q1 Expand and simplify

1)  $5a + 3(a + 4)$

2)  $7(y + 2) - 3(y + 1)$

3)  $4(k - 4) - 6(2k + 7)$

Q2 Expand and simplify.

1)  $(2y + 2)(y + 6)$

2)  $(5c - 7)(2c + 3)$

3)  $(y - 5)^2$

Q3 Factorise fully

1)  $2x^3 - 4x^2$

2)  $x^2y^2 - 6xy$

3)  $xy - 4x^2$

4)  $2x^2y^2 + 6x^2y$



Q4 Factorise

1)  $2x^2 + 5x + 3$

2)  $2x^2 + 7x + 5$

3)  $2x^2 - 9x + 7$

4)  $2x^2 - 13x + 15$

5)  $2x^2 + 5x - 18$

6)  $4x^2 + 16x + 15$

Q5 Factorise

1)  $x^2 - 1$

2)  $x^2 - 25$

3)  $4x^2 - 49$

4)  $100 - 9x^2$

5)  $a^2 - b^2$

Q6 Write these expressions in the form  $(x \pm a)^2 \pm b$ . This is also known as completing the square.

1)  $x^2 + 4x - 1$

2)  $x^2 + 14x - 5$

3)  $x^2 - 6x + 3$

4)  $x^2 + 5x + 1$

5)  $2x^2 + 8x + 1$

6)  $2x^2 - 6x + 7$

### Using Completing the Square to Find Turning Points:

By writing the following in the form  $y = (x + a)^2 + b$ , where  $a$  and  $b$  are integers, write down the coordinates of the turning point of the curve.

1)  $y = x^2 - 8x + 20$

2)  $y = x^2 - 10x - 1$

3)  $y = x^2 + 4x - 6$

4)  $y = 2x^2 - 12x + 8$

## Solving Linear Equations

Q1 Solve

1)  $6x + 12 = 48$

2)  $9 - 2x = 17$

3)  $6 + \frac{x}{4} = 9$

4)  $8 = 3 - \frac{x}{2}$

Q2 Solve

1)  $3x = 12 + x$

2)  $2x - 27 = 5x$

3)  $4x - 6 = 8 - 3x$

4)  $2x + 9 = 3 - x$

Q3 Solve, leaving answers as fractions as appropriate

1)  $\frac{2x}{3} + 1 = 5$

2)  $\frac{5(x-4)}{9} = 10$

3)  $\frac{2x+4}{5} = x$

4)  $\frac{x-2}{3} = \frac{x}{5}$



Q4 Solve the simultaneous equations, leaving answers as fractions as appropriate.

1)  $4x - 5y = 5$   
 $2x - 3y = 2$

2)  $6x - 2y = 9$   
 $3x + 4y = 12$

3)  $6x - 5y = -7$   
 $3x + 4y = 16$

## Fractions

Q1 Evaluate and simplify **without a calculator**

1)  $\frac{2}{3} \times \frac{4}{5}$

2)  $\frac{2}{5} \times \frac{2}{3}$

3)  $\frac{2}{3} \times 15$

4)  $\frac{2}{7} \div \frac{3}{8}$

5)  $\frac{5}{6} \div \frac{1}{2}$

6)  $9 \div \frac{3}{4}$

Q2 Evaluate and simplify **without a calculator**

1)  $\frac{2}{3} + \frac{4}{5}$

2)  $\frac{2}{5} - \frac{2}{3}$

3)  $\frac{2}{9} + \frac{1}{3}$

4)  $\frac{5}{6} - \frac{3}{8}$

Q3 Simplify

1)  $\frac{x}{3} + \frac{x}{2}$

2)  $\frac{4x}{5} - \frac{x}{2}$

3)  $\frac{5}{x+1} + \frac{4}{x-3}$

4)  $\frac{4}{y+1} - \frac{5}{y+2}$

Q4 Simplify

1)  $\frac{x}{3} \times \frac{x}{2}$

2)  $\frac{4x}{5} \div \frac{x}{2}$

3)  $\frac{4x}{3y} \div \frac{x}{2y}$

4)  $\frac{4}{y+1} \times \frac{5}{y+2}$



## Inequalities

Q1 Solve

1)  $3x - 10 < 29$

2)  $\frac{x}{4} + 10 \geq 13$

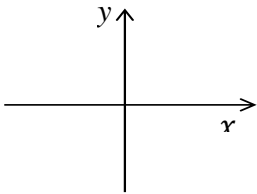
3)  $2 - 3x \leq 20$

4)  $9x + 1 < 2x + 22$

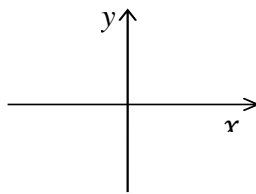
## Graphs

Sketch the following graphs

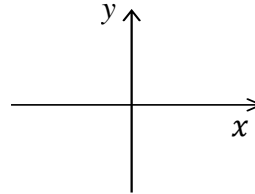
1)  $y = x^2$



2)  $y = x^3$



3)  $y = \frac{1}{x}$



## Equations of Straight Lines

Q1 State the gradient and y-intercept of the following lines. You may have to rearrange them first into the form  $y = mx + c$ .

1)  $y = 2x - 3$

2)  $y = 5 - 4x$

3)  $3x - 2 - y = 0$

Q2 Find the gradient of the line through each pair of points.

1) (3, 4) and (5, 10)

2) (3, 5) and (5, 1)

3) (-1, 8) and (1, 2)

Q3 Find the midpoint of each pair of points.

1) (4, 7) and (6, 11)

2) (-3, 4) and (5, 8)

3) (1, 0) and (7, 5)





Q4 Find the equation of the straight line passing through the given point and with the stated gradient:

1) Through (2,1) with gradient 3

2) Through (-2,3) with gradient 5

3) Through (3, 5) with gradient perpendicular to 7    4) Through (-3, -7) with gradient perpendicular to  $\frac{-7}{12}$

## Solving Quadratic Equations

Q1 Solve

1)  $(x + 3)(x - 7) = 0$

2)  $(2x - 3)(4x + 5) = 0$

3)  $(3x + 1)^2 = 0$

4)  $(3-x)(x - 5) = 0$

Q2 Solve these equations by factorising.

1)  $x^2 + 5x + 4 = 0$

2)  $x^2 + 7x + 12 = 0$

3)  $4x^2 - 6x = 0$

Q3 Solve these equations by using the quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  You don't need a calculator.

1)  $5x^2 + 7x + 2 = 0$

2)  $2x^2 - 9x + 7 = 0$

## Linear and Quadratic Simultaneous Equations

Solve the following simultaneous equations.

**1**  $x^2 + y^2 = 34$   
 $x - y = 2$

**2**  $x^2 + y^2 = 17$   
 $y = x - 3$

**3**  $x^2 + xy = 12$   
 $3x + y = 10$

**4**  $x^2 - 4x + y^2 = 21$   
 $y = 3x - 21$

## Functions:

1. The function  $f$  is such that  $f(x) = 5x + 2$

Find (a)  $f(3)$

(b)  $f(7)$

(c)  $f(-4)$

(d)  $f(-2)$

(e)  $f(-0.5)$

(f)  $f(0.3)$

2. The function  $f$  is such that  $f(x) = x^2 - 4$

Find (a)  $f(4)$

(b)  $f(6)$

(c)  $f(-2)$

(d)  $f(-6)$

(e)  $f(-0.2)$

(f)  $f(0.9)$

3. Find an expression for  $fg(x)$  for each of these functions:

(a)  $f(x) = x - 1$  and  $g(x) = 5 - 2x$

(b)  $f(x) = 2x + 1$  and  $g(x) = 4x + 3$

4. Functions  $f$  and  $g$  are such that

$f(x) = x^2$  and  $g(x) = 5 + x$

Find (i)  $fg(x)$

(ii)  $gf(x)$

5. Find the inverse function,  $f^{-1}(x)$ , of the following functions:

(a)  $f(x) = 3x - 1$

(b)  $f(x) = 2x + 3$

(c)  $f(x) = 1 - 2x$

(d)  $f(x) = x^2 + 5$

## Forming Equations:

- 1) Find 3 consecutive even numbers so that their sum is 108.
- 2) The perimeter of a rectangle is 79 cm. One side is three times the length of the other. Form an equation and hence find the length of each side.
- 3) Two girls have 72 photographs of celebrities between them. Anna gives 11 to the Beth and finds that she now has half the number Beth has.  
Form an equation, letting  $n$  be the number of photographs Anna had at the **beginning**.  
Hence find how many each has **now**.

## Problem Solving

1. Two numbers have a product of 44 and a mean of 7.5 Use an algebraic method to find the numbers. You must show all your working.

2. Caleb either walks to school or travels by bus. The probability that he walks to school is 0.75. If he walks to school, the probability that he will be late is 0.3. If he travels to school by bus, the probability that he will be late is 0.1. Work out the probability that he will not be late.

3. Arthur and Florence are going to the theatre. Arthur buys 6 adult tickets and 2 child tickets and pays £39. Florence buys 5 adult tickets and 3 child tickets and pays £36.50. Work out the costs of both adult and child tickets.

4. Colin has made a mistake in his 'simplifying surds' homework. Explain his error and give the correct answer.

$$4\sqrt{3} \times 5\sqrt{12} = 20\sqrt{36}$$

## **RAG**

Complete a RAG rating for the key topics from this booklet.

RED: I really need help with this

AMBER: I do not fully understand this, but I am getting there.

GREEN: I've got this sorted.

<b>Topic</b>	<b>Red</b>	<b>Amber</b>	<b>Green</b>
Indices			
Algebraic Expressions:			
Using Completing the Square to Find Turning Points:			
Solving Linear Equations			
Fractions			
Inequalities			
Graphs			
Equations of Straight Lines			
Solving Quadratic Equations			
Linear and Quadratic Simultaneous Equations			
Functions			
Forming Equations			
Solving Problems			

Do this in pencil first and then in pen once your work has been marked

## Reading List

As a student who is choosing to study Mathematics at A Level, it is logical to assume that you have an interest in the subject.

With that said, the following books may be of interest to you.

***50 Mathematical Ideas You Really Need to Know*** (Tony Crilly)

***Alex's Adventures in Numberland*** (Alex Bellos)

***Cabinet of Mathematical Curiosities*** (Ian Stewart)

***The Calculus Wars*** (Jason Socrates Bardi)

***The Code Book*** (Simon Singh)

***The Curious Incident of the Dog in the Night-time*** by Mark Haddon

***How Many Socks Make a Pair?: Surprisingly Interesting Maths*** (Rob Eastway)

***Hello World: How to be Human in the Age of the Machine*** (Hannah Fry)

***Humble Pi: A Comedy of Maths Errors*** (Matt Parker)

***The Life-Changing Magic of Numbers*** (Bobby Seagull)

***The Num8er My5teries*** (Marcus du Sautoy)