

## Welcome to A level Maths

This pack is designed to:

- Give you more information about the subject that you have chosen to study next year.
- Provide you with the opportunity to work on and embed the key skills that will help you to access the course and achieve that deeper understanding.

### **Why choose to study mathematics?**

Just as languages provide the building blocks and rules we need to communicate, maths uses its own language, made up of numbers, symbols and formulae, to explore the rules we need to measure or identify essential problems like distance, speed, time, space, change, force and quantities.

Studying maths helps us find patterns and structure in our lives. Practically, maths helps us put a price on things, create graphics, build websites, build skyscrapers and generally understand how things work or predict how they might change over time and under different conditions.

Maths is changing all the time – What will you contribute?

Maths is continually growing and changing, as mathematicians and scientists expand on what we already know to discover new theories, inventions and vaccines

Mathematicians and philosophers have debated for centuries the exact definition of maths so we can't even claim to have nailed it all of it ourselves

But we just wanted you to get the sense that there's more to it than long division...

### **What skills will I get if I study maths?**

An infinite set of skills that any employer would want their employees to have.

The studying of mathematics will allow any employee to know that you have the following skills:

- Critical thinking
- Analytical thinking
- Communication
- Teamwork
- Ability to manipulate precise and intricate ideas
- Construct logical arguments and expose illogical arguments
- Problem solving
- Quantitative reasoning
- Time management
- Independence



## So what will I be studying next year?

We will be following the AQA A level mathematics course. It is a two year course that culminates in 3 exams. Two thirds of the course is Pure Mathematics, with one third of the course Applied Mathematics (Mechanics and Statistics).

### Subject content

- A Proof
- B Algebra and functions
- C Coordinate geometry in the  $(x, y)$  plane
- D Sequences and series
- E Trigonometry
- F Exponentials and logarithms
- G Differentiation
- H Integration
- I Numerical methods
- J Vectors
- K Statistical sampling
- L Data presentation and interpretation
- M Probability
- N Statistical distributions
- O Statistical hypothesis testing
- P Quantities and units in mechanics
- Q Kinematics
- R Forces and Newton's laws
- S Moments

### Transition tasks in preparation for study.

This is now your opportunity to work on and embed the key skills that will help you to access the course and achieve that deeper understanding. These key skills will be assumed knowledge when we are teaching the A level course, and will allow you to access new topics more easily.

### Transition Work Topics

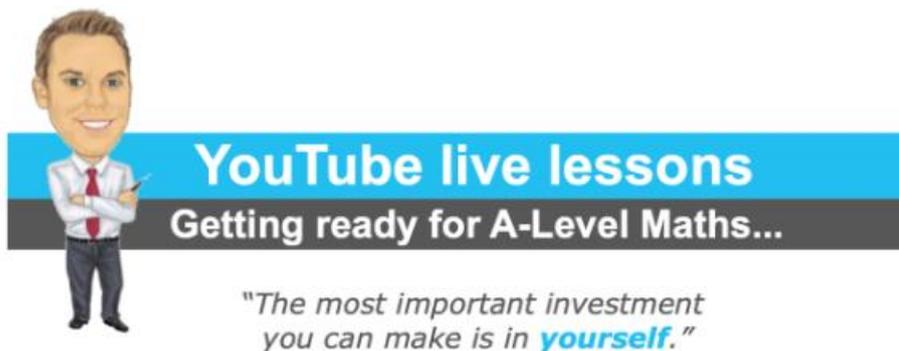
1. Simultaneous Equations
2. Expanding Brackets
3. Factorising
4. Quadratics
5. Completing the square
6. Algebraic Fractions

### Transition work tasks

1. For each topic you should first take notes from the videos. You may choose Corbett Maths or the Hegarty Maths. You do not need to do both.
2. Go through the worked examples, and complete the 'your turn' section using the same method.
3. Complete the questions provided, and then self-mark from the answers provided.
4. Complete the assessment questions for each topic, and e-mail a photo or scan of the work to [nwa@tda.education](mailto:nwa@tda.education) by 19/06/20.

### Optional tasks

To help prepare students for studying A level Maths Mr Hegarty has been running a series of live YouTube lessons. He has also made these videos available on his YouTube channel.



[https://www.youtube.com/playlist?list=PLxHVbXhSvleR5tntP2FxYBJCoY5-pD\\_Z8](https://www.youtube.com/playlist?list=PLxHVbXhSvleR5tntP2FxYBJCoY5-pD_Z8)

## 1 – Note taking

You will need to take notes from one of the following sources. Corbett Maths videos are freely available. If you have a Hegarty Maths login from Y11, then you may prefer to use that.

**Corbett Maths video:** <https://youtu.be/phlus4x0UqM>

**Hegarty Maths video:** 193 – Simultaneous equations by elimination 4

## 2 – Worked Examples

Read through the Worked Examples, then use the same method and layout to attempt the 'Your turn'.

### Worked Example 1:

#### Example:

$$\textcircled{1} \quad 4x + 5y = 33$$

$$\textcircled{2} \quad 3x + 2y = 16$$

$\textcircled{1} \times 3$ :

$$\textcircled{3} \quad 12x + 15y = 99$$

$\textcircled{2} \times 4$ :

$$\textcircled{4} \quad 12x + 8y = 64$$

$$\textcircled{3} - \textcircled{4}: \quad \begin{array}{l} 7y = 35 \\ y = 5 \end{array}$$

Sub  $y = 5$  into  $\textcircled{2}$ :

$$\begin{array}{l} 3x + 10 = 16 \\ 3x = 6 \\ x = 2 \end{array}$$

#### Your turn:

$$2x + 5y = 24$$

$$3x + 4y = 29$$

### Worked Example 2:

#### Example:

The sum of two numbers is 73 and the difference is 11.

$$\textcircled{1} \quad x + y = 73$$

$$\textcircled{2} \quad x - y = 11$$

$$\textcircled{1} + \textcircled{2}: \quad \begin{array}{l} 2x = 84 \\ x = 42 \end{array}$$

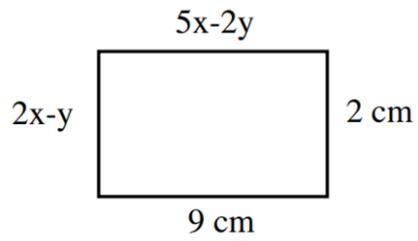
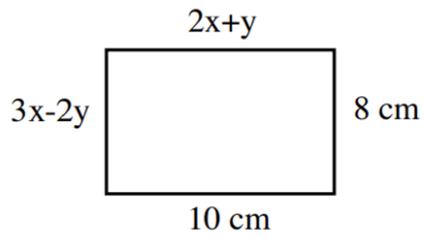
Sub  $x = 42$  into  $\textcircled{1}$ :

$$\begin{array}{l} 42 + y = 73 \\ y = 31 \end{array}$$

#### Your turn:

The sum of two numbers is 21 and the difference is 7.

**Worked Example 3:**



$$(1) 2x + y = 10$$

$$(2) 3x - 2y = 8$$

$$2x(1): (3) 4x + 2y = 20$$

$$(2)+(3): 7x = 28$$

$$x = 4$$

$$\text{Sub } x=4 \text{ into 1: } y=2$$

### 3 – Practice

Complete the three tasks, and use the answers to mark your work after.

#### Task 1:

Question 3: Solve the following simultaneous equations by using elimination.

(a)  $2x + 2y = 14$   
 $5x - 3y = 19$

(b)  $2x + 3y = 1$   
 $7x + 2y = -22$

(c)  $5x + 3y = 22$   
 $2x + 4y = 20$

(d)  $5x - 6y = 28$   
 $4x - 4y = 24$

(e)  $3x + 2y = 7$   
 $2x + 9y = 43$

(f)  $3x + 3y = -6$   
 $4x - 4y = -24$

(g)  $3x + 8y = 31$   
 $5x + 3y = 31$

(h)  $7x - 15y = 2.5$   
 $3x - 2y = 5.5$

(i)  $3x + 2y = 53$   
 $2x + 5y = 72$

(j)  $5x - 3y = 18$   
 $2x + 4y = 54$

(k)  $2x + 9y = 11$   
 $9x + 3y = -63$

(l)  $2x - 4y = 4$   
 $5x - 3y = 24$

(m)  $3x + 3y = 42$   
 $2x + 4y = 38$

(n)  $6x + 2y = -2$   
 $4x - 3y = 29$

(o)  $4x - 4y = 8$   
 $5x - 3y = 18$

(p)  $4x + 3y = 9$   
 $5x + 2y = 13$

(q)  $4x - 2y = 18$   
 $2x - 3y = 15$

(r)  $5x + 2y = 38$   
 $2x - 3y = 19$

#### Task 2:

Question 4: Solve the following simultaneous equations by rearranging and then using elimination.

(a)  $x = 10 - y$   
 $2x + y = 17$

(b)  $x - 4 = y$   
 $x + 3y = 12$

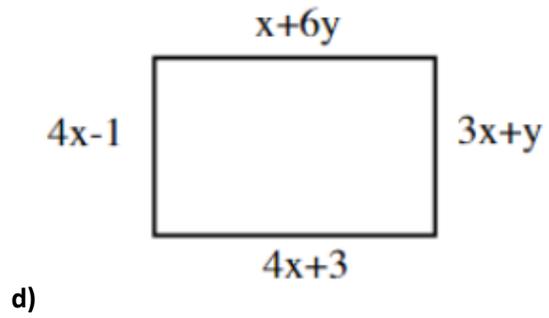
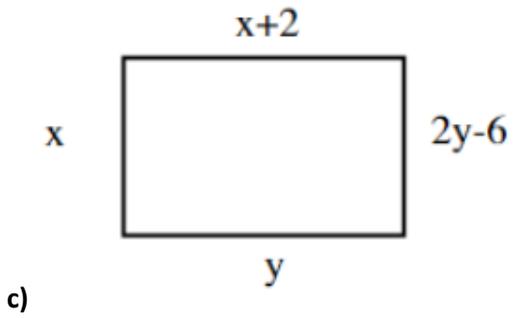
(c)  $2x + 6y = 4$   
 $x = 12 + 2y$

(d)  $3x = 10 + 5y$   
 $3y = 52 - 4x$

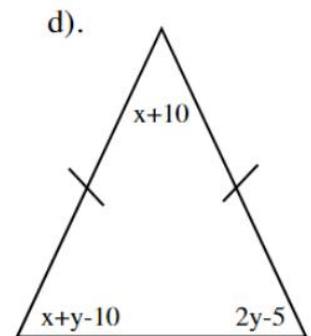
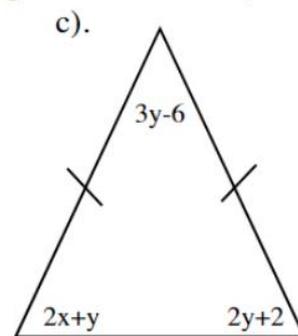
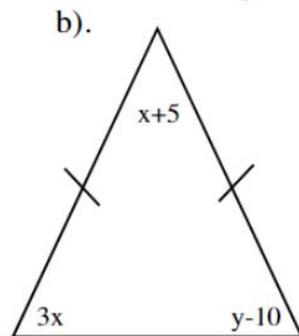
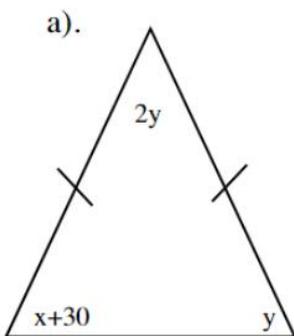
(e)  $2x + y - 18 = 0$   
 $3y = 7x + 80$

(f)  $6x + 2y + 6 = 0$   
 $7x - 5y - 93 = 10$

Task 3:



16). Find the values of  $x$  and  $y$  in each of these **isosceles** triangles. Hence find the size of each angle. (Diagrams not to scale).



**Answers 1:**

(a)  $x=5$   
 $y=2$

(b)  $x=-4$   
 $y=3$

(c)  $x=2$   
 $y=4$

(d)  $x=8$   
 $y=2$

(e)  $x=-1$   
 $y=5$

(f)  $x=-4$   
 $y=2$

(g)  $x=5$   
 $y=2$

(h)  $x=2.5$   
 $y=1$

(i)  $x=11$   
 $y=10$

(j)  $x=9$   
 $y=9$

(k)  $x=-8$   
 $y=3$

(l)  $x=6$   
 $y=2$

(m)  $x=9$   
 $y=5$

(n)  $x=2$   
 $y=-7$

(o)  $x=6$   
 $y=4$

(p)  $x=3$   
 $y=-1$

(q)  $x=3$   
 $y=-3$

(r)  $x=8$   
 $y=-1$

**Answers 2:**

(a)  $x=7$   
 $y=3$

(b)  $x=6$   
 $y=2$

(c)  $x=8$   
 $y=-2$

(d)  $x=10$   
 $y=4$

(e)  $x=-2$   
 $y=22$

(f)  $x=4$   
 $y=-15$

**Answers 3:**

- c).  $x = 2, y = 4$       d).  $x = 3, y = 2$
- 16). a).  $x = 15^\circ, y = 45^\circ$       angles  $45^\circ, 45^\circ, 90^\circ$
- b).  $x = 25^\circ, y = 85^\circ$       angles  $75^\circ, 75^\circ, 30^\circ$
- c).  $x = 14^\circ, y = 26^\circ$       angles  $54^\circ, 54^\circ, 72^\circ$
- d).  $x = 40^\circ, y = 35^\circ$       angles  $65^\circ, 65^\circ, 50^\circ$

#### 4 - Assessment

1) Solve the simultaneous equations:

$$2x - 4y = 19$$

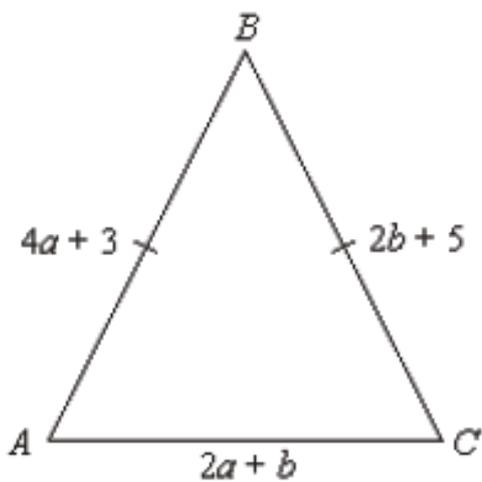
$$3x + 5y = 1$$

2) Solve the simultaneous equations:

$$2y = x + 10$$

$$y = 2x - 7$$

3)



The perimeter of the triangle is 32cm. Find the values of  $a$  and  $b$ .

## 1 – Note taking

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**Corbett Maths video:** [https://youtu.be/\\_2NvkxBchm8](https://youtu.be/_2NvkxBchm8)

**Hegarty Maths video:** 166 - Expand triple brackets

## 2 – Worked Examples

Read through the Worked Examples, then use the same method and layout to attempt the 'Your turn'.

**Worked Example 1:**

Example:

$$(x+1)^3$$

$$(x+1)(x+1) =$$

X	x	1
x	$x^2$	x
1	x	1

$$= x^2 + 2x + 1$$

$$\text{so } (x+1)(x+1)(x+1) = (x^2+2x+1)(x+1)$$

X	$x^2$	$2x$	1
x	$x^3$	$2x^2$	x
1	$x^2$	$2x$	1

$$= x^3 + 3x^2 + 3x + 1$$

Your turn:

$$(x-1)^3$$

X		

X			

Worked Example 2:

Example:

$$(2x+1)(x-2)(x+3)$$

$$(2x+1)(x-2) =$$

X	x	-2	
2x	$2x^2$	$-4x$	
1	x	-2	

$$= 2x^2 - 3x - 2$$

$$\text{so } (2x+1)(x-2)(x+3) = (2x^2-3x-2)(x+3)$$

X	$2x^2$	$-3x$	$-2$	
x	$2x^3$	$-3x^2$	$-2x$	
3	$6x^2$	$-9x$	$-6$	

$$= 2x^3 + 3x^2 - 11x - 6$$

Your turn:

$$(a+2)(2a-3)(a-4)$$

X			

X				

### 3 – Practice

Complete the three tasks, and use the answers to mark your work after.

#### Task 1:

Question 1: Expand and simplify

- (a)  $(x + 3)(x + 2)(x + 1)$     (b)  $(x + 2)(x + 2)(x + 5)$     (c)  $(x + 3)(x - 2)(x + 1)$   
(d)  $(x - 1)(x - 2)(x + 7)$     (e)  $(x - 2)(x - 3)(x - 4)$     (f)  $(x - 6)(x + 1)(x - 2)$   
(g)  $(2x + 1)(x + 3)(x + 1)$     (h)  $(3x - 2)(x + 5)(x - 1)$     (i)  $(5x + 3)(x - 1)(x + 2)$   
(j)  $x(x - 3)(2x + 5)$     (k)  $(3x + 5)(3x + 2)(x - 10)$

#### Task 2:

Question 2: Expand and simplify

- (a)  $(x + 2)^3$     (b)  $(x + 5)^3$     (c)  $(x - 3)^3$   
(d)  $(x - 5)^3$     (e)  $(x + 1)(x + 3)^2$     (f)  $(x - 5)(x - 4)^2$   
(g)  $(2x + 3)^3$     (h)  $(4 - x)^3$     (i)  $(5 - 2x)^3$   
(j)  $(x + 2)(3 - x)^2$     (k)  $x(x + 6)^2$

#### Task 3:

Question 1: Given  $(x + 3)(x + a)(x + 7) = x^3 + 15x^2 + 71x + 105$ , find a.

Question 2: Given  $(ax + 1)(x - 3)(x + b) = 2x^3 - 3x^2 - 8x - 3$ , find a and b.

**Answers 1:**

- (a)  $x^3 + 6x^2 + 11x + 6$
- (b)  $x^3 + 9x^2 + 24x + 20$
- (c)  $x^3 + 2x^2 - 5x - 6$
- (d)  $x^3 + 4x^2 - 19x + 14$
- (e)  $x^3 - 9x^2 + 26x - 24$
- (f)  $x^3 - 7x^2 + 4x + 12$
- (g)  $2x^3 + 9x^2 + 10x + 3$
- (h)  $3x^3 + 10x^2 - 23x + 10$
- (i)  $5x^3 + 8x^2 - 7x - 6$
- (j)  $2x^3 - x^2 - 15x$
- (k)  $9x^3 - 69x^2 - 200x - 100$

**Answers 2:**

- (a)  $x^3 + 6x^2 + 12x + 8$
- (b)  $x^3 + 15x^2 + 75x + 125$
- (c)  $x^3 - 9x^2 + 27x - 27$
- (d)  $x^3 - 15x^2 + 75x - 125$
- (e)  $x^3 + 7x^2 + 15x + 9$
- (f)  $x^3 - 13x^2 + 56x - 80$
- (g)  $8x^3 + 36x^2 + 54x + 27$
- (h)  $64 - 48x + 12x^2 - x^3$
- (i)  $125 - 150x + 60x^2 - 8x^3$
- (j)  $x^3 - 4x^2 - 3x + 18$
- (k)  $x^3 + 12x^2 + 36x$

**Answers 3:**

Question 1:  $a=5$

Question 2:  $a=2$  and  $b=1$

1) Expand and simplify:

$$(2w - 3)^3$$

2) Expand and simplify:

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

3)

Given  $(x + a)^2(x - 2) = x^3 + bx^2 + 12x - 72$ , find a and b

## 1 – Note taking

You will need to take notes from one of the following sources. Corbett Maths videos are freely available. If you have a Hegarty Maths login from Y11, then you may prefer to use that.

**Corbett Maths video:** <https://www.youtube.com/watch?v=MtHEk6Yy6N4>

**Hegarty Maths video:** 228 - Factorise quadratic expressions 6

## 2 – Worked Examples

Read through the Worked Examples, then use the same method and layout to attempt the 'Your turn'.

**Worked Example :**

**Example:**

$$14a^2 + 33a - 5$$

Step 1: Put the squared and constant terms into the grid.

X		
	$14a^2$	
		$-5$

Step 2: Multiply the square and constant coefficients.

$$14 \times -5 = (-70)$$

Step 3: List pairs of numbers that multiply to make this number, and add to make the linear coefficient.

$1 \times -70$	$7 \times -10$	$35 \times -2$
$2 \times -35$	$10 \times -7$	$70 \times -1$
$5 \times -14$	$14 \times -5$	

Step 4: Put this pair into the answer section of the grid and solve.

X	$7a$	$-1$
$2a$	$14a^2$	$-2a$
$5$	$35a$	$-5$

$$(2a+5)(7a-1)$$

**Your turn:**

$$3b^2 + 7b - 6$$

Step 1: Put the squared and constant terms into the grid.

X		

Step 2: Multiply the square and constant coefficients.

Step 3: List pairs of numbers that multiply to make this number, and add to make the linear coefficient.

Step 4: Put this pair into the answer section of the grid and solve.

X		

### 3 – Practice

Complete the three tasks, and use the answers to mark your work after.

#### Task 1:

(a)  $6x^2 + 13x + 6$

(b)  $9x^2 + 9x + 2$

(c)  $6x^2 + 13x + 2$

(d)  $8x^2 + 41x + 5$

(e)  $9x^2 + 6x + 1$

(f)  $8x^2 + 26x + 15$

(g)  $8x^2 + 29x + 15$

(h)  $10x^2 + 9x + 2$

(i)  $9x^2 + 27x + 20$

(j)  $10x^2 + 17x + 7$

(k)  $12x^2 + 13x + 3$

(l)  $15x^2 + 32x + 16$

#### Task 2:

(a)  $9x^2 - 12x - 5$

(b)  $4x^2 - 4x - 3$

(c)  $4x^2 - 11x + 6$

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

(e)  $10x^2 - 91x + 9$

(f)  $4x^2 + 25x - 56$

(g)  $6x^2 - 35x + 49$

(h)  $6x^2 - 7x - 10$

(i)  $8x^2 + 10x - 3$

(j)  $15x^2 + 31x + 10$

(k)  $12x^2 + 5x - 3$

(l)  $20x^2 - 23x + 6$

#### Task 3:

Question 1: A quadratic expression,  $3x^2 + ax + 10$ , can be factorised.  
Find all possible values for a.  
a can be positive or negative.

Question 2: A quadratic expression,  $4x^2 + bx - 12$ , can be factorised.  
Find all possible values for b.  
b can be positive or negative.

**Answers 1:**

(a)  $(3x + 2)(2x + 3)$

(b)  $(3x + 1)(3x + 2)$

(c)  $(6x + 1)(x + 2)$

(d)  $(8x + 1)(x + 5)$

(e)  $(3x + 1)(3x + 1)$

(f)  $(4x + 3)(2x + 5)$

(g)  $(8x + 5)(x + 3)$

(h)  $(5x + 2)(2x + 1)$

(i)  $(3x + 4)(3x + 5)$

(j)  $(10 + 7)(x + 1)$

(k)  $(3x + 1)(4x + 3)$

(l)  $(5x + 4)(3x + 4)$

**Answers 2:**

(a)  $(3x - 5)(3x + 1)$

(b)  $(2x - 3)(2x + 1)$

(c)  $(4x - 3)(x - 2)$

(d)  $(3x - 2)(2x - 1)$

(e)  $(10x - 1)(x - 9)$

(f)  $(4x - 7)(x + 8)$

(g)  $(2x - 7)(3x - 7)$

(h)  $(6x + 5)(x - 2)$

(i)  $(2x + 3)(4x - 1)$

(j)  $(5x + 2)(3x + 5)$

(k)  $(4x + 3)(3x - 1)$

(l)  $(4x - 3)(5x - 2)$

**Answers 3:**

Question 1: -31, -17, -13, -11, 11, 13, 17, 31

Question 2: -47, -22, -13, -8, -2, 2, 8, 13, 22, 47

1) Factorise  $2b^2 + 17b + 30$

2) Factorise  $80f^2 - 6f - 9$

3)

A quadratic expression,  $2x^2 - x + c$ , can be factorised.  
Find three possible values for  $c$ .