Name:

A-LEVEL MATHEMATICS COURSE INFORMATION & SUMMER ASSIGNMENT



A-level mathematics is a highly rewarding subject, greatly valued by employers and universities alike. It is also a very challenging subject, which is part of its appeal!

Contained within this booklet is an overview of what you will be studying during the first year, some key skills worksheets and an assignment to be completed over the summer break. Examples and answers to the worksheets are available on the Edexcel website. https://qualifications.pearson.com/content/dam/pdf/A%20Level/Mathematics/2017/Teaching%20and%20learning%20materials/Transition_worksheets_between_GCSE_and_AS_Mathematics.zip

The assignment is a collection of questions **designed to test your resilience, problem solving skills and mathematical ability**. Enjoy!

DEADLINE FOR COMPLETION : First lesson in September COURSE INFORMATION

TOPIC YOU WILL BE STUDYING DURING THE FIRST YEAR OF THIS COURSE:

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CORE							
LINIT 1. ALGEBRA	Index laws including negative and fractional indices						
FXPRESSIONS	Bracket expansion and factorising with quadratics and cubics						
	Surds and rationalising the denominator						
	Solving methods: factorisation completing the square and using						
	the quadratic formula						
	Using the discriminant						
	Modelling with quadratics						
UNIT 3: FOUATIONS	Solving simultaneous equations: linear and quadratic equations						
AND INFOUALITIES	Linear and guadratic inequalities						
	Regions						
UNIT 4:	Sketching graphs: cubic, quartic and reciprocal graphs						
TRANSFORMATIONS	Transformations: translations, reflections and stretches of graphs						
OF GRAPHS	and their functions, and sketching more complex functions.						
UNIT 5: STRAIGHT	Equations of straight lines including parallel and perpendicular						
LINE GRAPHS	lines						
	Modelling with straight line graphs						
UNIT 6: CIRCLES	Midpoints and perpendicular bisectors						
	The general equation of a circle						
	Intersection of circles and straight lines						
	Using circle theorems to find equations of tangents and normals						
UNIT 7: ALGEBRAIC	Polynomial long division						
METHODS	The factor theorem						
	Method of proof, including algebraic, direct and exhaustive proof,						
	and disproof by counter example						
UNIT 8: BINOMIAL	Using Pascal's Triangle and the binomial expansion formula to						
EXPANSION	quickly expand large numbers of brackets.						
	Binomial estimation to find approximate solutions using a binomial						
	expansion.						
UNIT 9:	The sine rule, cosine rule and area of any triangle						
TRIGONOMETRY	Sketch the graphs of the trigonometric functions						
	Solve trigonometric equations including trigonometric identities						
UNIT 10: VECTORS	Vector notation and manipulation						
	Solve geometric problems using vectors						

UNIT 11: CALCULUS	Differentiation to find curve gradients and rate of change of a				
	function.				
	Integration to find the exact area under a curve.				
UNIT 12:	Exponential functions and their graphs, and modelling with				
EXPONENTIALS AND	exponential functions				
LOGARITHMS Logarithms , the laws of logarithms and solving equations					
	exponentials and logarithms				

APPLIED COMPONENT: STATISTICS

UNIT 1: DATA	Sampling methods				
COLLECTION	Types of data and the large data set				
UNIT 2: MEASURES OF	Measures of central tendency including the mean and standard				
LOCATION AND	deviation, and using linear interpolation to find the median, IQR				
SPREAD	and percentile ranges.				
UNIT 3:	Box plots, cumulative frequency diagrams and histograms				
REPRESENTATIONS OF					
DATA					
UNIT 4: CORRELATION	Scatter graphs and linear regression				
UNIT 5: PROBABILITY	Calculating probabilities				
	Using probability diagrams such as Venn diagrams, sample space				
	diagrams, tree diagrams				
UNIT 6: STATISTICAL	Probability distributions				
DISTRIBUTIONS	The binomial distribution				
UNIT 7: HYPOTHESIS	One and two-tailed hypothesis testing of binomial distributions				
TESTING					

APPLIED COMPONENT: MECHANICS

UNIT 1: MODELLING	Construction and assumptions		
	Quantities and units		
UNIT 2: KINEMATICS	Displacement and velocity-time graphs		
WITH CONSTANT	The equations of motion		
ACCELERATION	Motion due to gravity		
UNIT 3: FORCES	Force diagrams		
	Forces and motion in 1D and 2D using F=ma and friction		
	Connected particles		
UNIT 4: KINEMATICS	Expressing motion as a function of time		
WITH VARIABLE	Modelling under variable acceleration using differentiation and		
ACCELERATION	integration to find displacement and velocity.		

SUMMER ASSIGNMENT

QUESTION 1:



QUESTION 2: Find the value of r_1



 $Area Rectangle = 243 cm^2$

QUESTION 3: Expand $(2\sqrt{5} - 3\sqrt{2})(2\sqrt{5} + 3\sqrt{2})$

QUESTION 4: What is the quadratic equation being solved here?

$$x = \frac{-7 \pm \sqrt{109}}{6}$$

QUESTION 5: Using all the numbers 2, 4, 6 and 8 once only and any mathematical operation, make the number 25.

QUESTION 6: Solve $2^{x} = \sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{2}$

QUESTION 7:

If the mean is 79.2, what is the value of *a*?

Weight , w (kg)	Frequency
60 ≤ w < 70	13
70 ≤ w < 80	12
80 ≤ w < 90	16
90 ≤ w < 100	а

QUESTION 8:

In a sale, a TV is reduced by 20% which makes the shop a 4% profit on the original cost. What would the percentage profit have been if the TV had been sold at full price?

QUESTION 9:

Simplify $\frac{2x^3 - 2x^2 - 4x}{2x^3 - x^2 - 23x - 20}$

Expanding brackets and simplifying expressions

Practice

1	Exp	and.			Watch out!
	a c	3(2x-1) - $(3xy-2y^2)$	b	$-2(5pq + 4q^2)$	When multiplying (or
2	Deres				dividing) positive and negative numbers, if
2	Exp	$7(2\pi + 5) + 6(2\pi - 8)$	h	9(5n - 2) - 2(4n + 0)	the signs are the same
	a	7(3x+3) + 6(2x-8) 9(2x+1) - 5(6x-10)	d d	$\delta(3p-2) - \delta(4p+9)$ 2(4r-2) - (2r+5)	the answer is '+'; if the
	C	$9(33 \pm 1) - 3(03 - 10)$	u	2(4x-3) - (3x+3)	signs are different the answer is '-'
3	Exp	and.		l	
	a	3x(4x+8)	b	$4k(5k^2-12)$	
	c	$-2h(6h^2+11h-5)$	d	$-3s(4s^2-7s+2)$	
4	Exp	and and simplify.			
	a	$3(y^2 - 8) - 4(y^2 - 5)$	b	2x(x+5)+3x(x-7)	
	c	4p(2p-1) - 3p(5p-2)	d	3b(4b-3) - b(6b-9)	
5	Exp	pand $\frac{1}{2}(2y-8)$			
6	Exp	and and simplify.			
-	a	13 - 2(m + 7)	b	$5p(p^2+6p)-9p(2p-3)$	
7	The	diagram shows a rectangle.			
	Wri	te down an expression, in terms of a	x, for	the area of $3x - 5$	
	the	rectangle.	1		
	$21x^2$	w that the area of the rectangle can $2^2 - 35x$	be w	ritten as	7~
0	г	1 1 1 10			7.4
8	Exp	and and simplify. $(a + 5)$	L	$(\alpha + 7)(\alpha + 2)$	
	a	(x + 4)(x + 3) (x + 7)(x - 2)	d d	(x + 7)(x + 3) (x + 5)(x - 5)	
	c	(x + 1)(x - 2) (2x + 3)(x - 1)	u f	(x + 3)(x - 3) (2x - 2)(2x + 1)	
	τ σ	(2x + 3)(x - 1) (5x - 3)(2x - 5)	ı h	(3x-2)(2x+1) (3x-2)(7+4x)	
	5 i	(3x + 4y)(5y + 6x)	i i	$(x+5)^2$	
	k	$(2x-7)^2$	յ 1	$(4x-3y)^2$	
Ex	ten	d			
9	Exp	and and simplify $(x + 3)^2 + (x - 4)^2$			
10	Exp	and and simplify.			





Surds

Practice

1	Sin	nplify.			Hint
	a	$\sqrt{45}$	b	$\sqrt{125}$	One o
	c	$\sqrt{48}$	d	$\sqrt{175}$	numb
	e	$\sqrt{300}$	f	$\sqrt{28}$	must
	g	$\sqrt{72}$	h	$\sqrt{162}$	numb
2	Sin	nplify.			wate
	a	$\sqrt{72} + \sqrt{162}$	b	$\sqrt{45} - 2\sqrt{5}$	Chec
	c	$\sqrt{50} - \sqrt{8}$	d	$\sqrt{75} - \sqrt{48}$	chose
	e	$2\sqrt{28} + \sqrt{28}$	f	$2\sqrt{12} - \sqrt{12} + \sqrt{27}$	the st

One of the two	
numbers you	
choose at the start	
must be a square	
number.	

Watch out!

Check you have hosen the highest quare number at the start.

3 Expand and simplify. 1-

a	$(\sqrt{2}+\sqrt{3})(\sqrt{2}-\sqrt{3})$	b	$(3+\sqrt{3})(5-\sqrt{12})$
c	$(4-\sqrt{5})(\sqrt{45}+2)$	d	$(5+\sqrt{2})(6-\sqrt{8})$

4 Rationalise and simplify, if possible.

a	$\frac{1}{\sqrt{5}}$	b	$\frac{1}{\sqrt{11}}$
c	$\frac{2}{\sqrt{7}}$	d	$\frac{2}{\sqrt{8}}$
e	$\frac{2}{\sqrt{2}}$	f	$\frac{5}{\sqrt{5}}$
g	$\frac{\sqrt{8}}{\sqrt{24}}$	h	$\frac{\sqrt{5}}{\sqrt{45}}$

5 Rationalise and simplify.

a
$$\frac{1}{3-\sqrt{5}}$$
 b $\frac{2}{4+\sqrt{3}}$ **c** $\frac{6}{5-\sqrt{2}}$

Extend

6 Expand and simplify
$$(\sqrt{x} + \sqrt{y})(\sqrt{x} - \sqrt{y})$$

7 Rationalise and simplify, if possible.

a
$$\frac{1}{\sqrt{9}-\sqrt{8}}$$
 b $\frac{1}{\sqrt{x}-\sqrt{y}}$



Rules of indices

Practice

1	Evaluate. a 14 ⁰	b	3 ⁰	c	5 ⁰	d	x^0
2	Evaluate. a $49^{\frac{1}{2}}$	b	$64^{\frac{1}{3}}$	c	$125^{\frac{1}{3}}$	d	$16^{\frac{1}{4}}$
3	Evaluate. a $25^{\frac{3}{2}}$	b	$8^{\frac{5}{3}}$	c	$49^{\frac{3}{2}}$	d	$16^{\frac{3}{4}}$
4	Evaluate. a 5 ⁻²	b	4 ⁻³	с	2-5	d	6-2
5	Simplify. a $\frac{3x^2 \times x^3}{2x^2}$	b	$\frac{10x^5}{2x^2 \times x}$				
	$\mathbf{c} \frac{3x \times 2x^3}{2x^3}$	d	$\frac{7x^3y^2}{14x^5y}$		Watch out!	at	
	$\mathbf{e} \frac{y^2}{y^{\frac{1}{2}} \times y}$	f	$\frac{c^{\frac{1}{2}}}{c^2 \times c^{\frac{3}{2}}}$		any value rais the power of is 1. This is th	sed to zero	
	$\mathbf{g} = \frac{\left(2x^2\right)}{4x^0}$	h	$\frac{x^{\frac{1}{2}} \times x^{\frac{3}{2}}}{x^{-2} \times x^3}$		rule $a^0 = 1$.		
6	Evaluate.						
	a $4^{-\frac{1}{2}}$	b	$27^{-\frac{2}{3}}$	c	$9^{-\frac{1}{2}} \times 2^{3}$		
	d $16^{\frac{1}{4}} \times 2^{-3}$	e	$\left(\frac{9}{16}\right)^{-\frac{1}{2}}$	f	$\left(\frac{27}{64}\right)^{-\frac{2}{3}}$		
7	Write the following as	a single	power of <i>x</i> .				
	a $\frac{1}{x}$	b	$\frac{1}{x^7}$	c	$\sqrt[4]{x}$		
	d $\sqrt[5]{x^2}$	e	$\frac{1}{\sqrt[3]{x}}$	f	$\frac{1}{\sqrt[3]{x^2}}$		



Rules of indices

- 8 Write the following without negative or fractional powers.
 - **a** x^{-3} **b** x^{0} **c** $x^{\frac{1}{5}}$ **d** $x^{\frac{2}{5}}$ **e** $x^{-\frac{1}{2}}$ **f** $x^{-\frac{3}{4}}$

9	Wri	te the following in the	form a	ax^n .		
	a	$5\sqrt{x}$	b	$\frac{2}{x^3}$	c	$\frac{1}{3x^4}$
	d	$\frac{2}{\sqrt{x}}$	e	$\frac{4}{\sqrt[3]{x}}$	f	3

Extend

10 Write as sums of powers of *x*.

a
$$\frac{x^5 + 1}{x^2}$$
 b $x^2 \left(x + \frac{1}{x} \right)$ **c** $x^{-4} \left(x^2 + \frac{1}{x^3} \right)$



edexcel **Factorising expressions**

Practice

1	Fac	torise.		
	a	$6x^4y^3 - 10x^3y^4$	b	$21a^3b^5 + 35a^5b^2$
	c	$25x^2y^2 - 10x^3y^2 + 15x^2y^3$		
2	Fac	torise		
	a	$x^2 + 7x + 12$	b	$x^2 + 5x - 14$
	c	$x^2 - 11x + 30$	d	$x^2 - 5x - 24$
	e	$x^2 - 7x - 18$	f	$x^2 + x - 20$
	g	$x^2 - 3x - 40$	h	$x^2 + 3x - 28$

3 Factorise

a	$36x^2 - 49y^2$	b	$4x^2 - 81y^2$
c	$18a^2 - 200b^2c^2$		

4 Factorise

a	$2x^2 + x - 3$	b	$6x^2 + 17x + 5$
c	$2x^2 + 7x + 3$	d	$9x^2 - 15x + 4$
e	$10x^2 + 21x + 9$	f	$12x^2 - 38x + 20$

5 Simplify the algebraic fractions.

a
$$\frac{2x^2 + 4x}{x^2 - x}$$

b $\frac{x^2 + 3x}{x^2 + 2x - 3}$
c $\frac{x^2 - 2x - 8}{x^2 - 4x}$
d $\frac{x^2 - 5x}{x^2 - 25}$
e $\frac{x^2 - x - 12}{x^2 - 4x}$
f $\frac{2x^2 + 14x}{2x^2 + 4x - 70}$

a
$$\frac{9x^2 - 16}{3x^2 + 17x - 28}$$

b $\frac{2x^2 - 7x - 15}{3x^2 - 17x + 10}$
c $\frac{4 - 25x^2}{10x^2 - 11x - 6}$
d $\frac{6x^2 - x - 1}{2x^2 + 7x - 4}$

Extend

7 Simplify
$$\sqrt{x^2 + 10x + 25}$$

8 Simplify
$$\frac{(x+2)^2 + 3(x+2)^2}{x^2 - 4}$$

Hint

Take the highest common factor outside the bracket.



edexcel Completing the square

Practice

1	Write the following quadratic expressions in the form $(x + p)^2 + d^2$					
	a	$x^2 + 4x + 3$	b	$x^2 - 10x - 3$		
	c	$x^2 - 8x$	d	$x^2 + 6x$		
	e	$x^2 - 2x + 7$	f	$x^2 + 3x - 2$		

2 Write the following quadratic expressions in the form $p(x+q)^2 + r$

a	$2x^2 - 8x - 16$	b	$4x^2 - 8x - 16$
с	$3x^2 + 12x - 9$	d	$2x^2 + 6x - 8$

3 Complete the square.

a	$2x^2 + 3x + 6$	b	$3x^2 - 2x$
c	$5x^2 + 3x$	d	$3x^2 + 5x + 3$

Extend

4 Write $(25x^2 + 30x + 12)$ in the form $(ax + b)^2 + c$.



edexcel **Solving** quadratic equations

Solving quadratic equations by factorisation

1 Solve

a	$6x^2 + 4x = 0$	b	$28x^2 - 21x = 0$
c	$x^2 + 7x + 10 = 0$	d	$x^2 - 5x + 6 = 0$
e	$x^2 - 3x - 4 = 0$	f	$x^2 + 3x - 10 = 0$
g	$x^2 - 10x + 24 = 0$	h	$x^2 - 36 = 0$
i	$x^2 + 3x - 28 = 0$	j	$x^2 - 6x + 9 = 0$
k	$2x^2 - 7x - 4 = 0$	l	$3x^2 - 13x - 10 = 0$

2 Solve

3

a	$x^2 - 3x = 10$	b	$x^2 - 3 = 2x$	Hint
c	$x^2 + 5x = 24$	d	$x^2 - 42 = x$	
e	x(x+2) = 2x + 25	f	$x^2 - 30 = 3x - 2$	Get all terms
g	$x(3x+1) = x^2 + 15$	h	3x(x-1) = 2(x+1)	of the equation.

Solving quadratic equations by completing the square

So	lve by completing the square.		
a	$x^2 - 4x - 3 = 0$	b	$x^2 - 10x + 4 = 0$
c	$x^2 + 8x - 5 = 0$	d	$x^2 - 2x - 6 = 0$
e	$2x^2 + 8x - 5 = 0$	f	$5x^2 + 3x - 4 = 0$

4 Solve by completing the square.

a (x-4)(x+2) = 5

- **b** $2x^2 + 6x 7 = 0$
- **c** $x^2 5x + 3 = 0$

Hint

Get all terms onto one side of the equation.

Solving quadratic equations by using the formula

- 5 Solve, giving your solutions in surd form. **a** $3x^2 + 6x + 2 = 0$ **b** $2x^2 - 4x - 7 = 0$
- 6 Solve the equation $x^2 7x + 2 = 0$

Give your solutions in the form $\frac{a \pm \sqrt{b}}{c}$, where *a*, *b* and *c* are integers.

7 Solve $10x^2 + 3x + 3 = 5$ Give your solution in surd form.

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Hint
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Get all terms onto one side of the equation.



edexcel Sketching quadratic graphs

Practice

- Sketch the graph of $y = -x^2$. 1
- 2 Sketch each graph, labelling where the curve crosses the axes. **a** y = (x+2)(x-1) **b** y = x(x-3) **c** y = (x+1)(x+5)
- Sketch each graph, labelling where the curve crosses the axes. 3 **a** $y = x^2 - x - 6$ **b** $y = x^2 - 5x + 4$ **c** $y = x^2 - 4$ **d** $y = x^2 + 4x$ **e** $y = 9 - x^2$ **f** $y = x^2 + 2x - 3$
- Sketch the graph of $y = 2x^2 + 5x 3$, labelling where the curve crosses the axes. 4

Extend

- 5 Sketch each graph. Label where the curve crosses the axes and write down the coordinates of the turning point.
 - **a** $y = x^2 5x + 6$ **b** $y = -x^2 + 7x 12$ **c** $y = -x^2 + 4x$
- Sketch the graph of $y = x^2 + 2x + 1$. Label where the curve crosses the axes and write down the 6 equation of the line of symmetry.



edexcel Solving linear simultaneous equations

Practice

Solve these simultaneous equations.

2 3x + y = 7 $1 \qquad 4x + y = 8$ x + y = 53x + 2y = 5**3** 4x + y = 34 3x + 4y = 7x - 4y = 53x - y = 115 2x + y = 116 2x + 3y = 11x - 3y = 93x + 2y = 4y = x - 48 y = 2x - 32x + 5y = 435x - 3y = 119 2y = 4x + 510 2x = y - 29x + 5y = 228x - 5y = -1111 3x + 4y = 812 3y = 4x - 72x - y = -132y = 3x - 413 3x = y - 114 3x + 2y + 1 = 02y - 2x = 34y = 8 - x

Extend

15 Solve the simultaneous equations 3x + 5y - 20 = 0 and $2(x + y) = \frac{3(y - x)}{4}$.



edexcel ::: Solving linear and quadratic simultaneous equations

Practice

Solve these simultaneous equations.

1	$y = 2x + 1$ $x^2 + y^2 = 10$	2	$y = 6 - x$ $x^2 + y^2 = 20$
3	$y = x - 3$ $x^2 + y^2 = 5$	4	$y = 9 - 2x$ $x^2 + y^2 = 17$
5	$y = 3x - 5$ $y = x^2 - 2x + 1$	6	$y = x - 5$ $y = x^2 - 5x - 12$
7	$y = x + 5$ $x^2 + y^2 = 25$	8	$y = 2x - 1$ $x^2 + xy = 24$
9	$y = 2x$ $y^2 - xy = 8$	10	2x + y = 11 $xy = 15$

Extend

11 x - y = 1 $x^2 + y^2 = 3$ **12** y - x = 2 $x^2 + xy = 3$



Linear inequalities

Practice

1	Sol	ve these inequalities.				
	a	4x > 16	b	$5x-7 \leq 3$	c	$1 \ge 3x + 4$
	d	5 - 2x < 12	e	$\frac{x}{2} \ge 5$	f	$8 < 3 - \frac{x}{3}$
2	Sol	ve these inequalities.				
	a	$\frac{x}{5} < -4$	b	$10 \ge 2x + 3$	c	7 - 3x > -5
3	Sol	ve				
	a	$2 - 4x \ge 18$	b	$3 \le 7x + 10 < 45$	c	$6-2x \ge 4$
	d	4x + 17 < 2 - x	e	4-5x < -3x	f	$-4x \ge 24$
4	Sol	ve these inequalities.				
	a	3t + 1 < t + 6		b $2(3n-1)$	$\geq n+5$	5
5	Sol	ve.				
	a	3(2-x) > 2(4-x) + 4	4	b $5(4-x) >$	- 3(5	(x) + 2

Extend

6 Find the set of values of x for which 2x + 1 > 11 and 4x - 2 > 16 - 2x.



Quadratic inequalities

Practice

- 1 Find the set of values of x for which $(x + 7)(x 4) \le 0$
- 2 Find the set of values of x for which $x^2 4x 12 \ge 0$
- **3** Find the set of values of *x* for which $2x^2 7x + 3 < 0$
- 4 Find the set of values of x for which $4x^2 + 4x 3 > 0$
- 5 Find the set of values of x for which $12 + x x^2 \ge 0$

Extend

Find the set of values which satisfy the following inequalities.

- $\mathbf{6} \qquad x^2 + x \le \mathbf{6}$
- 7 x(2x-9) < -10
- 8 $6x^2 \ge 15 + x$



The cosine rule

Practice

- 6 Work out the length of the unknown side in each triangle. Give your answers correct to 3 significant figures.
- b a 14 cm 10 cm 40159 5 cm 7 cm d 5.5 cm с 95 55 mm 40 mm 6 cm 7 Calculate the angles labelled θ in each triangle. Give your answer correct to 1 decimal place. b a 9 cm 33 mm 38 mm cm 12 cm h 36 mm d c 7.2 cm 7.5 cm 8 cm 7.6 cm 13 cm 11.3 cm 8
 - a Work out the length of WY.Give your answer correct to 3 significant figures.
 - **b** Work out the size of angle WXY. Give your answer correct to 1 decimal place.





The sine rule

b

d

d

Practice

9 Find the length of the unknown side in each triangle. Give your answers correct to 3 significant figures.







10Calculate the angles labelled θ in each triangle.Give your answer correct to 1 decimal place.



c









The area of a triangle

Practice

12 Work out the area of each triangle. Give your answers correct to 3 significant figures.



13 The area of triangle XYZ is 13.3 cm². Work out the length of XZ.

Hint:

Rearrange the formula to make a side the subject.



Extend

- 14 Find the size of each lettered angle or side. Give your answers correct to 3 significant figures.
 - a





For each one, decide whether to use the cosine or sine rule.









c

The area of a triangle

d





15 The area of triangle ABC is 86.7 cm². Work out the length of BC. Give your answer correct to 3 significant figures.



