



## North Halifax Grammar School – A Level Transition Work

### A Level Mathematics

Specification: Pearson Edexcel Level 3 GCE 9MA0

<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html>

Paper 1 Pure Mathematics 1    2 hours

Paper 2 Pure Mathematics 2    2 hours

Paper 3 Statistics and Mechanics    2 hours

You will be issued with the Pearson Edexcel Textbooks. Students will be expected to use a **Casio fx-991 Classwiz calculator**, a bulk order will be made for these in September if you do not already own one.

### Course Overview

Year 12	Year 13
Algebra & Functions	Algebra
Co-ordinate Geometry in the xy plane	Functions and graphs
Trigonometry	Sequences and Series including Binomial expansion
Vectors	Trigonometry
Differentiation	Parametric equations
Integration	Differentiation
Exponentials and Logarithms	Integration
Data Collection, representation and interpretation	Numerical methods
Correlation	Vectors
Probability	Regression, Correlation and Hypothesis testing
Statistical Distributions - Binomial	The Normal distribution
Hypothesis testing	Moments
Constant acceleration	Forces and Friction
Forces and Motion	Projectiles
Variable Acceleration	Kinematics

### Expectations

You will have two teachers, both will set you written homework tasks every week to be handed in on a strict schedule, Mathematics is a practice heavy subject. You will have termly progress tests which you will have to resit if you fail to reach a threshold mark.

Support is available every lunchtime with a designated Mathematics teacher to help you achieve your potential. Each class has a designated Google classroom and there is also a Year group revision classroom.



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### Useful Websites

<https://www.physicsandmathstutor.com/>

<https://www.drfrostmaths.com/>

<https://www.madasmaths.com/>

<https://www.mathsgenie.co.uk/newalevel.html>

**Algebra Transition Work to be completed - Extend questions are optional**

### Surds and rationalising the denominator

#### A LEVEL LINKS

**Scheme of work:** 1a. Algebraic expressions – basic algebraic manipulation, indices and surds

#### Key points

- A surd is the square root of a number that is not a square number, for example  $\sqrt{2}$ ,  $\sqrt{3}$ ,  $\sqrt{5}$ , etc.
- Surds can be used to give the exact value for an answer.
- $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
- $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$
- To rationalise the denominator means to remove the surd from the denominator of a fraction.
- To rationalise  $\frac{a}{\sqrt{b}}$  you multiply the numerator and denominator by the surd  $\sqrt{b}$
- To rationalise  $\frac{a}{b+\sqrt{c}}$  you multiply the numerator and denominator by  $b-\sqrt{c}$

#### Practice

1 Simplify.

a  $\sqrt{45}$

c  $\sqrt{48}$

e  $\sqrt{300}$

b  $\sqrt{125}$

d  $\sqrt{175}$

f  $\sqrt{28}$

2 Simplify.

a  $\sqrt{72} + \sqrt{162}$

c  $\sqrt{50} - \sqrt{8}$

e  $2\sqrt{28} + \sqrt{28}$

b  $\sqrt{45} - 2\sqrt{5}$

d  $\sqrt{75} - \sqrt{48}$

f  $2\sqrt{12} - \sqrt{12} + \sqrt{27}$

#### Hint

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

#### Watch out!

Check you have chosen the highest square number at the



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3 Expand and simplify.

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

#### A LEVEL LINKS

Scheme of work: AS and A level Mathematics

1a. Algebraic expressions – basic algebraic manipulation, indices and surds

### Key points

- $a^m \times a^n = a^{m+n}$
- $\frac{a^m}{a^n} = a^{m-n}$
- $(a^m)^n = a^{mn}$



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- $a^0 = 1$
- $a^{\frac{1}{n}} = \sqrt[n]{a}$  i.e. the  $n$ th root of  $a$
- $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$
- $a^{-m} = \frac{1}{a^m}$
- The square root of a number produces two solutions, e.g.  $\sqrt{16} = \pm 4$ .

### 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**  $4^{-3}$

**c**  $2^{-5}$

**d**  $6^{-2}$

5 Simplify.

**a**  $\frac{3x^2 \times x^3}{2x^2}$

**b**  $\frac{10x^5}{2x^2 \times x}$

**c**  $\frac{3x \times 2x^3}{2x^3}$

**d**  $\frac{7x^3y^2}{14x^5y}$

**e**  $\frac{y^2}{y^{\frac{1}{2}} \times y}$

**f**  $\frac{c^{\frac{1}{2}}}{c^2 \times c^{\frac{3}{2}}}$

6 Evaluate.

**a**  $4^{-\frac{1}{2}}$

**b**  $27^{-\frac{2}{3}}$

**c**  $9^{-\frac{1}{2}} \times 2^3$



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**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  $x$ .

**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**  $\frac{1}{\sqrt[3]{x^2}}$

**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** Write the following in the form  $ax^n$ .

**a**  $5\sqrt{x}$

**b**  $\frac{2}{x^3}$

**c**  $\frac{1}{3x^4}$

**d**  $\frac{2}{\sqrt{x}}$

**e**  $\frac{4}{\sqrt[3]{x}}$

### 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**  $x^{-4}\left(x^2+\frac{1}{x^3}\right)$

## Completing the square

### A LEVEL LINKS

**Scheme of work:** 1b. Quadratic functions – factorising, solving, graphs and the discriminants

### Key points

- Completing the square for a quadratic rearranges  $ax^2 + bx + c$  into the form  $p(x + q)^2 + r$
- If  $a \neq 1$ , then factorise using  $a$  as a common factor.



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### Practice

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

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  $4x^2 - 8x - 16$

c  $3x^2 + 12x - 9$

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  $(ax + b)^2 + c$ .

## Solving linear and quadratic simultaneous equations

### A LEVEL LINKS

Scheme of work: 1c. Equations – quadratic/linear simultaneous

### Key points

- Make one of the unknowns the subject of the linear equation (rearranging where necessary).
- Use the linear equation to substitute into the quadratic equation.
- There are usually two pairs of solutions.

### 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  $y = x - 5$

$y = x^2 - 5x - 12$



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### Rearranging equations

#### A LEVEL LINKS

**Scheme of work:** 6a. Definition, differentiating polynomials, second derivatives

**Textbook:** Pure Year 1, 12.1 Gradients of curves

### Key points

- To change the subject of a formula, get the terms containing the subject on one side and everything else on the other side.
- You may need to factorise the terms containing the new subject.

### Practice

Change the subject of each formula to the letter given in the brackets.

1  $C = \pi d$  [ $d$ ]

2  $P = 2l + 2w$  [ $w$ ]

3  $D = \frac{S}{T}$  [ $T$ ]

4  $p = \frac{q-r}{t}$  [ $t$ ]

5  $u = at - \frac{1}{2}t$  [ $t$ ]

6  $V = ax + 4x$  [ $x$ ]

7  $\frac{y-7x}{2} = \frac{7-2y}{3}$  [ $y$ ]

8  $x = \frac{2a-1}{3-a}$  [ $a$ ]

9  $x = \frac{b-c}{d}$  [ $d$ ]

10  $h = \frac{7g-9}{2+g}$  [ $g$ ]

11  $e(9+x) = 2e + 1$  [ $e$ ]

12  $y = \frac{2x+3}{4-x}$  [ $x$ ]

13 Make  $r$  the subject of the following formulae.

Aa  $A = \pi r^2$

b  $V = \frac{4}{3}\pi r^3$

c  $P = \pi r + 2r$

d  $V = \frac{2}{3}\pi r^2 h$

14 Make  $x$  the subject of the following formulae.

a  $\frac{xy}{z} = \frac{ab}{cd}$

b  $\frac{4\pi cx}{d} = \frac{3z}{py^2}$

### Extend

17 Make  $x$  the subject of the following equations.

A  $\frac{p}{q}(sx+t) = x-1$

b  $\frac{p}{q}(ax+2y) = \frac{3p}{q^2}(x-y)$