

Hardenhuish School

A-Level Mathematics Transition

A-level mathematics uses many of the skills you developed at GCSE. The big difference is that you will be expected to recognise where you use these skills and apply them quickly and efficiently.

Your success at A-level Mathematics will depend on how willing you are to maintain and perfect these skills.

In order to get off to a good start you need to be prepared. This booklet will help you get ready for A-level Mathematics. Read through the advice at the start and the end of the holidays and answer all of the questions to the best of your ability. You will have a test based on these topics in the second maths lesson in September. A practice test and answers are provided in this booklet.

You should bring your marked practice test to your first maths lesson in September.

This work is compulsory for all students.

The questions are split into two sections. Section A practices key skills from GCSE Mathematics. Section B requires you to think mathematically, to reason and to spot patterns. Some questions in Section B are optional challenge questions.

A set of “MyMaths” references is provided to help you with this work. If you need the login and password for MyMaths please email Mr Cobb (pxc@hardenhuish.wilts.sch.uk) Answers to the questions can be found at the end.

Quick Links

[Section A](#)

[Section B](#)

[MyMaths References](#)

[Practice Test](#)

[Section A Answers](#)

[Practice Test Answers](#)

Skills for success

Be organised - keep your notes and work in clearly labelled folders. Make sure you know where everything is and that you can find it easily.

Make sure your notes are clear and detailed - not everything of use will be written on the board. Listen carefully to what the teacher says and note down any useful hints and tips. Your teacher will model the best way to approach problems or apply skills so you need to make sure your notes clearly show what they were doing. Re-write out any notes that are scruffy or not clear. Annotate any handouts that you are given. Read through your notes to check you have everything you need and, if not, talk to your teacher about what you think is missing.

Be precise with your notation - you may have developed some bad presentation habits at GCSE level. Look at the way the teacher models each technique and try to do things in the same way. One difference between A level and GCSE is that the way things are set out becomes far more important.

Be accurate with your answers - A level questions often have several joined parts where one answer feeds into the next. You will need to be accurate so that your answers make sense. Feeding a wrong answer in to a calculation often results in something far more difficult to work out. Learn the quick checks that your teacher uses to test the accuracy of calculations.

Plan your time effectively - You will be taught a number of new skills. You will not become fluent in these unless you practise them. It is not enough to just understand what the teacher is telling you about a technique, you must practise it to become confident in it. This is true of all skills based subjects. Make sure you have the time to do all of the homework set for the deadline you are given.

Be prepared to change the way you do things - GCSE methods are not always the quickest or most efficient way of doing things. Skills you previously learned for GCSE often need to be refined. Try not to stubbornly stick to the GCSE way of doing things.

Get help from as many places as possible - it is vitally important that you understand the work as you go along. Be honest with yourself when you don't understand something and seek help. You can get some help from your peers, online resources or your teacher. The important thing is not to allow a technique or skill to pass by without understanding it.

Learn these before starting work

Indices

$$a^0 = 1$$

$$a^{-1} = \frac{1}{a}$$

$$a^{\frac{1}{2}} = \sqrt{a}$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$$

Quadratic Equations

For $ax^2 + bx + c = 0$

Laws of indices

$$a^m \times a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^m \div a^n = a^{m-n}$$

$$\left(a^m\right)^n = a^{mn}$$

Surds

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \text{ this is known as the quadratic formula}$$

Section A - Key Skills

Do not use a calculator for these questions. Answers can be found [here](#). A set of mymaths references can be found [here](#).

1. Collecting like terms:

Simplify the following expressions

a) $x^3 + 2x^2 - 5x + 7x^2 + 3x - 4$

b) $x^4 - 3x^3 - 2x^2 + 2x^3 - 6x^2 - 4x$

c) $2ab - a^2 + 4b^2 - 2ab$

d) $3x^2 + 6xy - 12x - 2xy + 6y^2 + 8y$

2. Indices

Evaluate (i.e. work out)

a) 2^{-3}

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

c) $\left(\frac{1}{3}\right)^{-2}$

d) $\left(\frac{64}{27}\right)^{-\frac{4}{3}}$

e) $\left(6\frac{1}{4}\right)^{\frac{1}{2}}$

f) $49^{\frac{3}{2}}$

3. Laws of Indices

Simplify the following expressions

a) $7^3 \times 7^4$

b) $\frac{3^4 \times 3^6}{3^5}$

c) $(4^3)^8$

d) $\frac{2^5 \times 2^9}{(2^3)^5}$

e) $4x^3 \times 2x^5$

f) $(3a)^3$

g) $(-2p^2q^3)^4$

h) $\frac{2x^2y^3z \times 6x^4yz^3}{(9xy^4z^2)^2}$

4. Changing the subject of a formula

Make the variable shown in brackets the subject

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

b) $s = \frac{1}{2}(u + v)t$ (v)

c) $A = 2\pi r^2 + 2\pi rh$ (h)

d) $y = \frac{x+1}{x-1}$ (x)

5. Expanding brackets

Multiply out and simplify

a) $6(2x + 3)$

b) $-2x(x - 5)$

c) $2xy^2(3x - 5y)$

d) $5y(4 - 3x) - 2x(3 - 2y)$

e) $(x + 7)(x - 7)$

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

g) $(2x + y)(2 - 3y)$

h) $(3a + 4b)(5b - 2a)$

6. Factorising expressions

Factorise fully

(Hint - check your answer by expanding the brackets to see if you get back to where you started)

a) $7x + 21$ b) $3ab - 12b$ c) $7x^2y + 21x^3y^2$ d) $30xy + 6x^2 - 15x$

7. Factorising quadratic expressions

Factorise

(Hint - check your answer by expanding the brackets to see if you get back to where you started)

a) $x^2 + 9x + 20$ b) $x^2 - 12x + 35$ c) $y^2 - 2y - 63$

d) $a^2 - 6a - 16$ e) $2x^2 + 3x + 1$ f) $2x^2 + 5xy - 3y^2$

g) $x^2 - 9$ h) $9x^2 - 25y^2$ i) $16x^2 - 3$

8. Solving linear equations:

a) $2x + 5 = 19$ b) $11 + 3x = 8 - 2x$ c) $7x + 2 = 4x - 5$

d) $4(2 - x) = 3(x - 9)$ e) $14 - 3(2x + 3) = 2$

f) $\frac{1}{2}(x + 3) = 5$ g) $\frac{y}{4} + 3 = 5 - \frac{y}{3}$

h) $\frac{y-1}{2} + \frac{y+1}{3} = \frac{2y+5}{6}$ Extension: i) $2 - \frac{5}{x} = \frac{10}{x} - 1$

9. Solving quadratic equations

Solve the following equations

(Hint - check your answer by substituting your values back into the equation to verify they work)

a) $x^2 + 15x + 54 = 0$ b) $t^2 - 3t - 40 = 0$ c) $3x^2 - x - 14 = 0$

d) $7a - 6a^2 + 20 = 0$ e) $9x^2 + 12x + 4 = 0$ f) $x + 1 = \frac{6}{x}$

10. Solving quadratic equations

Solve the following equations giving your answer in surd form

a) $x^2 + 12x + 20 = 0$ b) $t^2 + 9t + 4 = 0$ c) $3x^2 - 7x = 1$

11. Surds

Write the following in the form $a\sqrt{b}$

- a) $\sqrt{44}$ b) $\sqrt{320}$ c) $\sqrt{75}$ d) $\sqrt{304}$
- e) $\sqrt{\frac{32}{25}}$ f) $\sqrt{\frac{27}{16}}$ g) $\sqrt{\frac{50}{9}}$ e) $\sqrt{\frac{496}{304}}$

12. Surds

Write each of the following as a single surd in its simplest form

- a) $4\sqrt{7} - 3\sqrt{7} + 6\sqrt{7}$ b) $4\sqrt{2} - \sqrt{50} + \sqrt{98}$ c) $\sqrt{3}(7 + 2\sqrt{3})$
- d) $(\sqrt{7} - \sqrt{3})(\sqrt{7} + \sqrt{3})$

13. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

- a) $\begin{cases} 3x + 2y = 13 \\ 2x - y = 2 \end{cases}$ b) $\begin{cases} 2x + 3y = 10 \\ 5x + 2y = 3 \end{cases}$ c) $\begin{cases} 3x + y = 7 \\ 2x - 3y = 23 \end{cases}$ d) $\begin{cases} 8x + 4y = 5 \\ 6x - 8y = 1 \end{cases}$

14. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

- a) $\begin{cases} y = x^2 - x - 6 \\ y = x + 2 \end{cases}$ b) $\begin{cases} y = 2x + 3 \\ y(5 - x) = 20 \end{cases}$

Section B - Reasoning, Patterns and Proof

Do not use a calculator for these questions. Answers can be checked with a calculator or discussed in September.

1. Common errors

Some of these solutions have incorrect working. Identify any errors and write a correct solution.

a) Solve

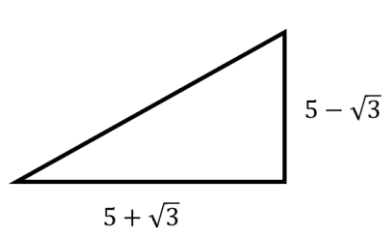
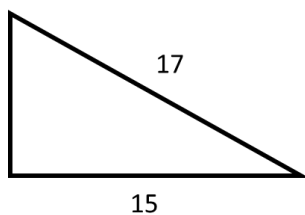
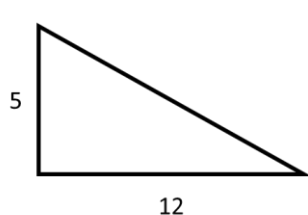
$$\begin{aligned}3(2x + 3) - 2(x - 3) &= 35 \\6x + 3 - 2x - 6 &= 35 \\4x - 3 &= 35 \\4x &= 32 \\x &= 8\end{aligned}$$

b) Simplify

$$\begin{aligned}y^2 + 2y - 6 + 2(y^2 + 5y) &= 3y^2 + 12y - 6 \\&= y^2 + 4y - 2\end{aligned}$$

2. Pythagoras

Find the area and perimeter for these right-angled triangles



3. Fractions Patterns

Fraction Subtraction

Calculate

$$\frac{1}{3} - \frac{1}{4} =$$

$$\frac{1}{4} - \frac{1}{5} =$$

$$\frac{1}{10} - \frac{1}{11} =$$

Make up another one like this

Challenge

Prove the pattern by considering

$$\frac{1}{n} - \frac{1}{n+1} =$$

Fraction Multiplication

Calculate

$$\frac{4}{5} \times \frac{6}{5} =$$

$$\frac{7}{8} \times \frac{9}{8} =$$

$$\frac{9}{10} \times \frac{11}{10} =$$

Make up another one like this

Challenge

Prove the pattern algebraically

Fraction-Fractions

Simplify these calculations

$$\frac{5}{\left(\frac{5}{2}\right)} =$$

$$\frac{4}{\left(\frac{1}{2}\right)} =$$

$$\frac{3}{\left(\frac{2}{3}\right)} =$$

$$\frac{n}{\left(\frac{1}{n}\right)} =$$

4. The Golden Ratio

$$\phi = \frac{1 + \sqrt{5}}{2}$$

Find ϕ^2 in the form $\frac{a+b\sqrt{5}}{c}$ (where a, b, c are integers)

Show that $\phi^2 = \phi + 1$

Challenge: Show that $\phi^3 = 2\phi + 1$

Reciprocals

$$\phi^{-1} = \frac{2}{1 + \sqrt{5}}$$

By rationalising the denominator find ϕ^{-1} in the form $\frac{a+b\sqrt{5}}{c}$ (where a, b, c are integers)

Show that $\phi^{-1} = \phi - 1$

Challenge: Show that $\phi^{-2} = 2 - \phi$

Practice Test

Your test will ask similar questions to this one. Answers can be found [here](#)

You may NOT use a calculator

1. Expand and simplify

(a) $4x(3x - 2) - x(2x + 5)$ (b) $(2x + 3)(2x - 1)$ (c) $(a - 12)^2$

2. Factorise

(a) $x^2 - 7x$ (b) $x^2 + 9x - 36$ (c) $y^2 - 64$ (d) $25y^3 - 9y$

3. Simplify

(a) $\frac{4x^3y}{8x^2y^3}$ (b) $\frac{3x+2}{3} + \frac{4x-1}{6}$

4. Solve the following equations

(a) $\frac{h-1}{4} + \frac{3h}{5} = 4$ (b) $x^2 - 8x = 0$ (c) $k^2 - 7k - 18 = 0$ (d) $p^2 + 4p = 12$

5. Write each of the following as single powers of x and/or y

(a) $\frac{1}{x^4}$ (b) $(x^2y)^3$ (c) $\frac{x^5}{x^{-2}}$

6. Work out the values of the following, giving your answers as fractions where appropriate

(a) 4^{-2} (b) 10^0 (c) $\left(\frac{8}{27}\right)^{\frac{1}{3}}$

7. Solve the simultaneous equations

$$\begin{aligned} 3x - 5y &= -11 \\ 5x - 2y &= 7 \end{aligned}$$

8. Rearrange the following equations to make x the subject

(a) $v^2 = u^2 + 2ax$ (b) $V = \frac{1}{3}\pi x^2h$ (c) $y = \frac{x+2}{x+1}$

9. Solve $x^2 + 4x + 1 = 0$, giving your solutions in surd form

10. Solve $5x^2 - x - 1 = 0$, giving your solutions in surd form

MyMaths References

The following <https://www.mymaths.co.uk/> paths will help you prepare for your A level course.

Indices	Number ➔ Powers and Integers ➔ Indices part 1 Number ➔ Powers and Integers ➔ Indices part 2
Factorising	Algebra ➔ Use of Symbols ➔ Simplifying 2 Algebra ➔ Use of Symbols ➔ Factorise linear equations
Algebraic Fractions	Algebra ➔ Use of Symbols ➔ Cancelling Algebraic fractions Algebra ➔ Use of Symbols ➔ Adding Algebraic Fractions Algebra ➔ Use of Symbols ➔ Multiplying Algebraic Fractions
Changing the subject of a formula	Algebra ➔ Formulae ➔ Rearranging 1 Algebra ➔ Formulae ➔ Rearranging 2
Quadratic Equations	Algebra ➔ Quadratics ➔ Quadratic Equations Algebra ➔ Quadratics ➔ Quadratic Formula Algebra ➔ Quadratics ➔ Completing the Square
Simultaneous Equations	Algebra ➔ Simultaneous Equations ➔ Simultaneous Equations 2 Algebra ➔ Simultaneous Equations ➔ Simultaneous Equations 3 Algebra ➔ Simultaneous Equations ➔ Quadratic Simultaneous Equations

Section A Answers

1. Collecting like terms:

Simplify the following expressions

a) $x^3 + 29x^2 - 2x - 4$ b) $x^4 - x^3 - 8x^2 - 4x$

c) $4b^2 - a^2$ d) $3x^2 + 4xy - 12x + 6y^2 + 8y$

2. Indices

Evaluate (i.e. work out)

a) $\frac{1}{8}$ b) 5 c) 9 d) $\frac{81}{256}$ e) $\frac{5}{2}$ f) 343

3. Laws of Indices

Simplify the following expressions

a) 7^7 b) 3^5 c) 4^{24} d) 2^{-1} e) $8x^8$ f) $27a^3$

g) $16p^8q^{12}$ h) $\frac{4x^4}{27y^4}$

4. Changing the subject of a formula

Make the variable shown in brackets the subject

a) $a = \frac{v-u}{t}$

b) $v = \frac{2s}{t} - u$ or $v = \frac{2s-ut}{t}$

c) $h = \frac{A-2\pi r^2}{2\pi r}$

d) $x = \frac{y+1}{y-1}$

5. Expanding brackets

Multiply out and simplify

a) $12x + 18$ b) $-2x^2 + 10x$ c) $6x^2y^2 - 10xy^3$ d) $20y - 11xy - 6x$

e) $x^2 - 49$ f) $2x^2 + 7x - 15$ g) $4x + 2y - 6xy - 3y^2$ h) $20b^2 + 7ab - 6a^2$

6. Factorising expressions

Factorise fully

(Hint - check your answer by expanding the brackets to see if you get back to where you started)

a) $7(x + 3)$ b) $3b(a - 4)$ c) $7x^2y(1 + 3xy)$ d) $3x(10y + 2x - 5)$

7. Factorising quadratic expressions

Factorise

(Hint - check your answer by expanding the brackets to see if you get back to where you started)

a) $(x + 4)(x + 5)$ b) $(x - 5)(x - 7)$ c) $(y - 9)(y + 7)$
d) $(a - 8)(a + 2)$ e) $(2x + 1)(x + 1)$ f) $(2x + y)(x - 3y)$
g) $(x - 3)(x + 3)$ h) $(3x + 5y)(3x - 5y)$ i) $(4x + \sqrt{3})(4x - \sqrt{3})$

8. Solving linear equations:

a) $x = 7$ b) $x = -\frac{3}{5}$ c) $x = -\frac{7}{3}$

d) $x = 5$ e) $x = \frac{7}{6}$

f) $x = 7$ g) $y = \frac{24}{7}$

h) $y = 2$ Extension: i) $x = 5$

9. Solving quadratic equations

Solve the following equations

(Hint - check your answer by substituting your values back into the equation to verify they work)

a) $x = -6$ or -9 b) $x = 8$ or -5 c) $x = \frac{7}{3}$ or -2

d) $x = \frac{5}{2}$ or $-\frac{4}{3}$ e) $x = -\frac{2}{3}$ f) $x^2 + x = 6$, then $x^2 + x - 6 = 0$, so $x = 2$ or -3

10. Solving quadratic equations

Solve the following equations giving your answer in surd form

a) $x = -2$ or -10 b) $x = \frac{-9 \pm \sqrt{65}}{2}$ c) $x = \frac{(7 \pm \sqrt{61})}{6}$

11. Surds

Write the following in the form $a\sqrt{b}$

- a) $2\sqrt{11}$ b) $8\sqrt{5}$ c) $5\sqrt{3}$ d) $4\sqrt{19}$
- e) $\frac{4\sqrt{2}}{5}$ f) $\frac{3\sqrt{3}}{4}$ g) $\frac{5\sqrt{2}}{3}$ e) $\sqrt{\frac{31}{19}}$ or $\frac{\sqrt{589}}{19}$

12. Surds

Write each of the following as a single surd in its simplest form

- a) $7\sqrt{7}$ b) $6\sqrt{2}$ c) $6 + 7\sqrt{3}$ d) 4

13. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

- a) $x = \frac{17}{7}, y = \frac{20}{7}$ b) $x = -1, y = 4$ c) $x = 4, y = -5$ d) $x = \frac{1}{2}, y = \frac{1}{4}$

14. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

- a) $x = 4, y = 6$ or $x = -2, y = 0$ b) $x = \frac{5}{2}, y = 8$ or $x = 1, y = 5$

ANSWERS TO PRACTICE TEST

1) a) $10x^2 - 13x$ b) $4x^2 + 4x - 3$ c) $a^2 - 24a + 144$

2) a) $x(x - 7)$ b) $(x + 12)(x - 3)$ c) $(y + 8)(y - 8)$ d) $y(5y - 3)(5y + 3)$

3) a) $\frac{x}{2y^2}$ b) $\frac{10x + 3}{6}$

4) a) $h = 5$ b) $x = 0$ or $x = 8$ c) $k = 9$ or $k = -2$ d) $p = -6$ or $p = 2$

5) a) x^4 b) x^6y^3 c) x^7

6) a) $\frac{1}{16}$ b) 1 c) $\frac{2}{3}$

7) $x = 3, y = 4$

8) a) $x = \frac{v^2 - u^2}{2a}$ b) $x = \sqrt{\frac{3V}{\pi h}}$ c) $x = \frac{2 - y}{y - 1}$

9) $x = \frac{-4 \pm \sqrt{12}}{2}$ $(= -2 \pm \sqrt{3})$

10) $x = \frac{1 \pm \sqrt{21}}{10}$