Welcome to A Level Further Mathematics

Simplify the following expressions.

What are the common misconceptions?

$$x(x+2)-2(x-4)$$

$$7-\frac{8+10n}{2}$$

$$3n-7-(-n-6)$$

Paper 1: Pure Mathematics 1 (*Paper code: 9MA0/01)

Paper 2: Pure Mathematics 2 (*Paper code: 9MA0/02)

Each paper is:

2-hour written examination

33.33% of the qualification

100 marks

Content overview

- Chapter 1 – Algebraic Expressions
- Chapter 2 – Quadratics
- Chapter 3 – Equations and Inequalities
- Chapter 4 – Graphs and Transformations
- Chapter 5 – Straight Line Graphs
- Chapter 6 – Circles
- Chapter 7 – Algebraic Methods
- Chapter 8 – The Binomial Expansion
- Chapter 9 – Trigonometric Ratios
- Chapter 10 – Trigonometric Identities and Equations
- Chapter 11 – Vectors
- Chapter 12 – Differentiation
- Chapter 13 – Integration
- Chapter 14 – Exponentials and Logarithms

Assessment overview

- Paper 1 and Paper 2 may contain questions on any topics from the Pure Mathematics content.
- Students must answer all questions.
- Calculators can be used in the assessment.

Paper 3: Statistics and Mechanics (*Paper code: 9MA0/03)

2-hour written examination

33.33% of the qualification

100 marks

Content overview

Section A: Statistics

- Topic 1 – Statistical sampling
- Topic 2 – Data presentation and interpretation
- Topic 3 – Probability
- Topic 4 – Statistical distributions
- Topic 5 – Statistical hypothesis testing

Section B: Mechanics

- Topic 6 – Quantities and units in mechanics
- Topic 7 – Kinematics
- Topic 8 – Forces and Newton's laws
- Topic 9 – Moments

Assessment overview

- Paper 3 will contain questions on topics from the Statistics content in Section A and Mechanics content in Section B.
- Students must answer all questions.
- Calculators can be used in the assessment.

Paper 1: Core Pure Mathematics 1 (*Paper code: 9FM0/01)

Paper 2: Core Pure Mathematics 2 (*Paper code: 9FM0/02)

Each paper is:

1 hour and 30 minutes written examination

25% of the qualification

75 marks

Content overview

Proof, Complex numbers, Matrices, Further algebra and functions, Further calculus, Further vectors, Polar coordinates, Hyperbolic functions, Differential equations

Assessment overview

- Paper 1 and Paper 2 may contain questions on any topics from the Pure Mathematics content.
- Students must answer all questions.
- Calculators can be used in the assessment.

Further Mathematics Optional Papers (*Paper codes: 9FM0/3A-3D, 9FM0/4A-4D)

Each paper is:

Written examination: 1 hour and 30 minutes

25% of the qualification

75 marks

Content overview

Students take **two** options from the following eight:

Option 1 Papers	**Option 2 Papers**
3A: Further Pure Mathematics 1	4A: Further Pure Mathematics 2
3B: Further Statistics 1	4B: Further Statistics 2
3C: Further Mechanics 1	4C: Further Mechanics 2
3D: Decision Mathematics 1	4D: Decision Mathematics 2

There are restrictions on which papers can be taken together.

Students choose a pair of options, either:

- any two Option 1 papers, or
- a matching pair of Option 1 and Option 2 papers

This makes a total of ten different option pairs.

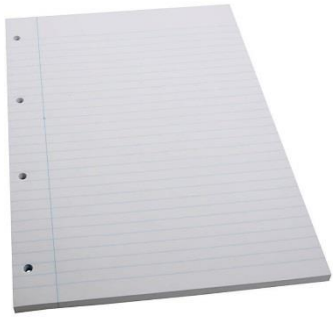
Assessment overview

- Students must answer all questions.
- Calculators can be used in the assessment.

What should I bring to lessons?

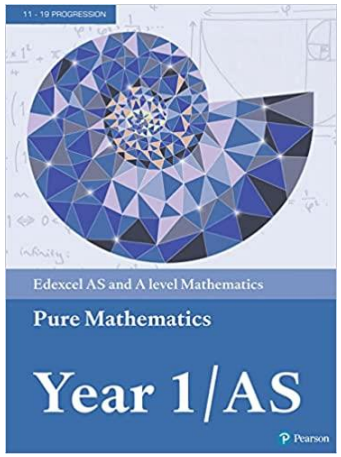
Pens and pencils.

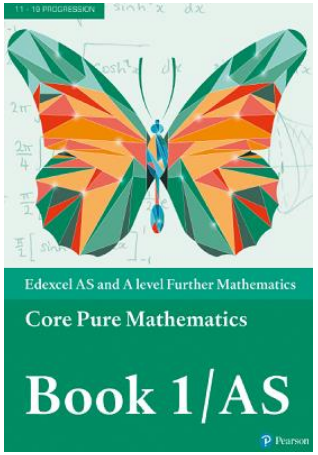
You will not need a protractor or compass.



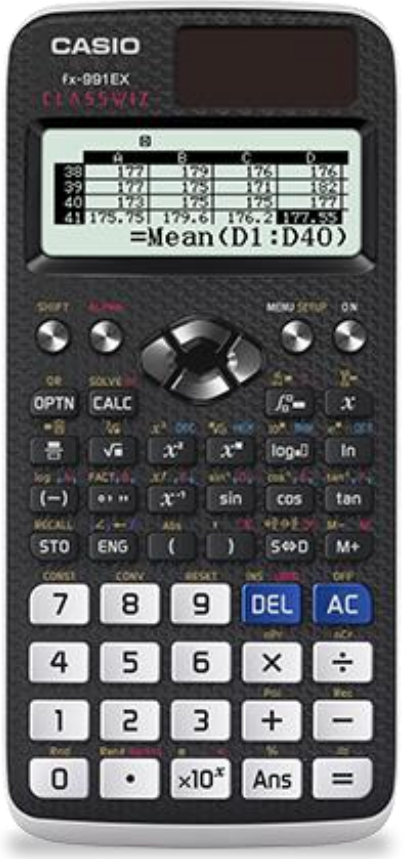
Exercise books

Keep your notes well organised.
Use separate books for different teachers/courses.
Squared paper may be useful for drawing graphs.





You will be issued with **textbooks** in September. You are expected to bring these to every lesson.

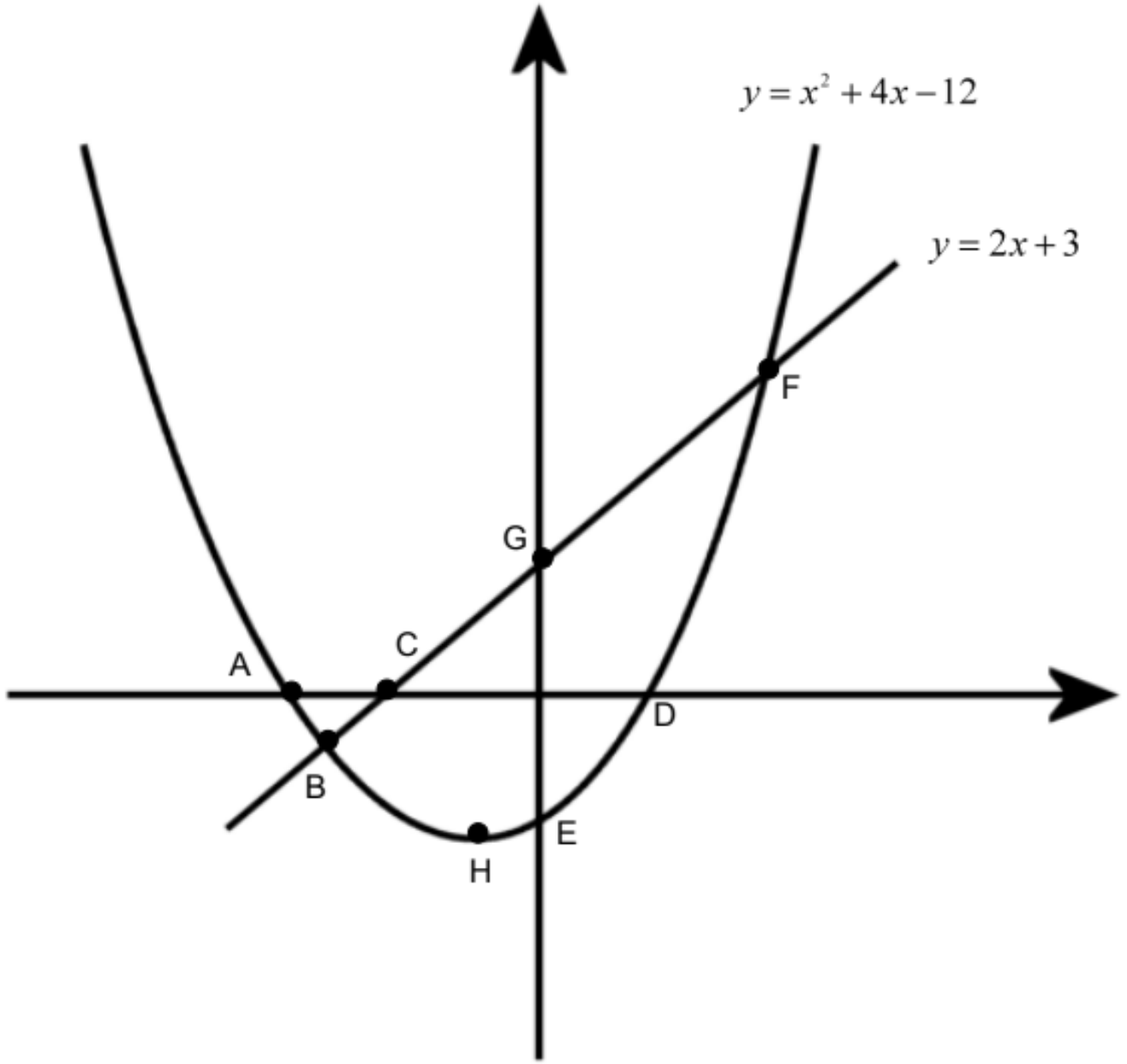


CASIO Classwiz fx-991EX

Approx £25

Starter

Find the co-ordinates of the points A, B, C, D, E, F, G and H



ANSWERS

Find the co-ordinates of the points A, B, C, D, E, F, G and H

A(-6,0)

B(-5,-7)

C($-\frac{3}{2}$,0)

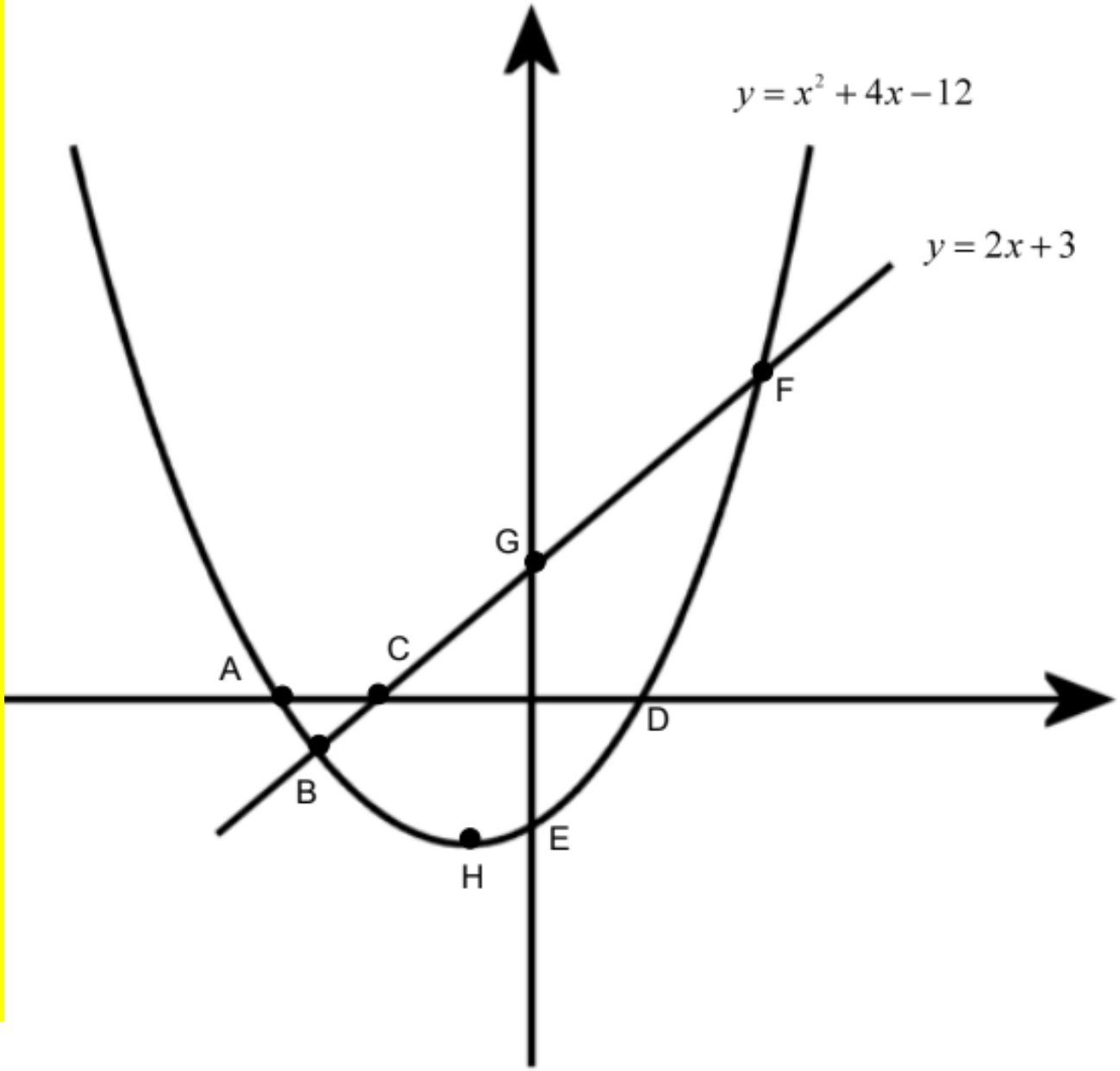
D(2,0)

E(0,-12)

F(3,9)

G(0,3)

H(-2,-16)



Complex Numbers

The determinant

There are three possibilities when solving the quadratic equation:

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

Either,

$b^2 - 4ac > 0$ Two real solutions

$b^2 - 4ac = 0$ Two identical real solutions

$b^2 - 4ac < 0$ No real solutions

To solve the final case, we introduce a new type of number called the imaginary number.

$$i = \sqrt{-1}$$

Note: in engineering, the imaginary number is sometimes written as j

The sum of a real number and an imaginary number is called a complex number and is written in the form:

$$a + bi$$

$$z = a + bi$$

Some important things to note:

$z \in \mathbb{C}$ z is in the set of complex numbers

but $a, b \in \mathbb{R}$ a and b are real numbers

Note the language of complex numbers:
a is called the real part

b is called the imaginary part

Complex numbers can be added, subtracted, multiplied and divided

Simplify $\sqrt{-36}$ in terms of i

Solve the equation: $x^2 + 28 = 0$

Solve $x^2 + 6x + 25 = 0$

Simplify $\sqrt{-64}$ in terms of i

Solve the equation $x^2 + 12 = 0$

Solve the equation $x^2 + 4x + 10 = 0$

When adding complex numbers, the real parts are added together, and the imaginary parts are added together.

$$a + bi \;+\; c + di = (a + c) + (b + d)i$$

Multiplying complex numbers

$$(a + bi)(c + di) = ac + adi + bci + bdi^2$$

but $i^2 = -1$

so $$(a + bi)(c + di) = (ac - bd) + (ad + bc)i$$

Multiply out: $(2 + 3i)(4 + 5i)$

a) $-3(4 + 7i) + 2i(3 - 7i)$

b) $(-2 - 9i)(4 + 6i)$

c) $2(6 + 5i) - (-3 - 2i)(2 + 4i)$

Simplifying Complex Fractions

This, as in surds, is all about rationalising (or rather "realising") the denominator. Multiply top and bottom by the complex conjugate.

$$(10 + 5i) \div (1 + 2i)$$

Simplify the following:

1) $(4 + 6i) \div (2 - 5i)$

2) $(2 - 9i) \div (-4 + 3i)$

3) $(-3 - 4i) \div (5i - 2)$

The complex conjugate

Given the complex number, $z = (a + bi)$, the complex conjugate is given by, $z^* = (a - bi)$

$$zz^* = (a + bi)(a - bi)$$

$$zz^* = a^2 - (bi)^2$$

$$zz^* = a^2 - b^2 i^2$$

$$zz^* = a^2 + b^2$$

Roots of quadratic equations

If the roots of a quadratic equation are complex, then the two complex numbers will be a **complex conjugate pair.**

Example

$$x^2 + x + 1 = 0$$

$(3+5i)$ and $(3-5i)$ are roots of a quadratic equation. Find the equation

$(7 + 2i)$ and $(7 - 2i)$ are roots of a quadratic equation. Find the equation

$(1 + 2i)$ and $(1 - 2i)$ are roots of a quadratic equation. Find the equation

A-Level Mathematics Summer Task

- All maths and further maths students are expected to complete the task.
- Work to be completed in the booklet, showing written calculations.
- You may wish to attempt all questions independently first, then use your notes or other resources to help with more difficult questions.
- 2-5 hours to complete
- You may use a calculator for all questions unless otherwise indicated.
- This will be checked by your teacher in September
- Due: First lesson back in September