

6th form Mathematics A level induction

Expectations

- Attending lessons
- Notes from lessons
- Exercises completed at home
- A file / folder to organise your work
- Independent exercises – every two weeks
- In class tests
- End of year 12 IPE (an AS style set of exam papers)
- Term 1 and Term 2 IPEs (partial A2 exam papers) in Y13

Entry requirements

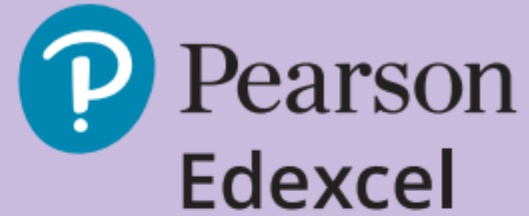
- Grade 7 (57%, 2022) at GCSE on Higher paper
- Dr Frost (Bridge the gap) summer work

This does not guarantee you a good grade at A level, your work and attitude during the first year are essential to making you ready for the second year of study.

- Grade 6 (43%, 2022) at GCSE on Higher paper and an entrance exam
- Dr Frost (Bridge the gap) summer work

The course may be very challenging as there is a large reliance on work learnt in the GCSE course.

The course specification



A Level Mathematics

Specification

Pearson Edexcel Level 3 Advanced GCE in Mathematics (9MA0)

First teaching from September 2017

First certification from 2018

Issue 4

Assessment: Summer 2025

- Pure paper 1 – duration 2 hours
- Pure paper 2 – duration 2 hours
- Statistics and Mechanics paper – duration 2 hours

- Equal weighting to each paper
- Some formulas and statistical tables are provided in the exam

Assessment: Content

Content overview

- Topic 1 – Proof
- Topic 2 – Algebra and functions
- Topic 3 – Coordinate geometry in the (x, y) plane
- Topic 4 – Sequences and series
- Topic 5 – Trigonometry
- Topic 6 – Exponentials and logarithms
- Topic 7 – Differentiation
- Topic 8 – Integration
- Topic 9 – Numerical methods
- Topic 10 – Vectors

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

9 hours in lessons, 9 hours out of lessons

Example two week cycle

- **Teacher A (3 hours)**
 - Finish Chapter 1 Algebraic expressions
 - Start Chapter 2 Quadratics (4 lessons)
- **Teacher B (6 hours)**
 - Finish Chapter 6 circles
 - Start Chapter 11 vectors (3 lessons, ...)
 - Assessment 1: Chapter 1 and Chapter 5 short test
- **Independent learning**
 - Independent Task 2: Straight line graphs worksheet, expected duration 60 minutes
 - Ch1 Mixed Exercise, 24 questions, Expected duration 90 minutes
 - Ch6 Mixed Exercise, 25 questions, Expected duration 150 minutes
 - Work on notes and questions from exercises, 3-4 hours

Your mathematics folder

- You must provide this along with file paper.
- This is an essential part of your learning.
- It needs to have an index.
- There should be sections for the chapters.
- The folder will be assessed during the year.
- Mixed exercises will be completed in a lined book, the first one is provided.



1 Algebraic Expressions

2 Quadratics

3 Equation + Inequalities

4 Graphs + Transformations

5 Straight Line Graphs

6 Circles

7 Algebraic methods

8 binomial expansion

9 Trigonometric ratios

10 Trigonometric identities & equations

11 Vectors

12 Differentiation

13 Integration

proof

Types: **contradiction** → matrices or nested equations
Exhaustion → simple proof
Induction → divisibility (ive integers only)
Geometric → graphical proof (not ideal)

ex **STATEMENT**: product of 2 odd numbers is odd.

DEMONSTRATION $5 \times 7 = 35$ ✓

PROOF: p and q are integers.

$(2p+1)(2q+1)$ will always be odd because $2 \times q$ is even
+1 is always odd.

$$(2p+1)(2q+1) = 4pq + 2p + 2q + 1$$

$[2 \times (\text{anything}) \text{ is always even}] + [1 \text{ means it becomes odd}]$

$$2(2pq + p + q) + 1$$

can be replaced with any letter bc
 p and q were arbitrary

$$2(N) + 1$$

STATEMENT OF PROOF: the product of 2 odd numbers is always odd.

GENERAL STEPS

- 1) state information and assumptions being used.
- 2) show every step of the proof
- 3) every step must follow logically from previous step.
- 4) make sure every possible case has been covered.
- 5) Always conclude with a statement of proof.

proving an identity

- * set up the identity and manipulate the expression with every step being shown until both sides are equal.
- * only work 1 side of the identity.

PROVE $A(1,1) + B(3,3) + C(4,2)$ are vertices of a right angle triangle

$$m_{AB} = \frac{(3-1)}{(3-1)} = 1$$
$$m_{BC} = \frac{(3-2)}{(4-3)} = -1$$
$$m_{CA} = \frac{(2-1)}{(4-1)} = \frac{1}{3}$$

all gradients are different
 $\therefore$ 3 points aren't collinear
 $\therefore$ ABC is a triangle, bc A cannot lie on BC.

m_{AB} and m_{BC} are negative reciprocals
therefore are perpendicular.
 $\therefore$ ABC is a rt triangle.

Calculators

- Casio fx-991EX
You must buy this essential tool, necessary for Statistics calculations. Approximate cost is around £30



- Casio fx-cg50
An optional graphical calculator. Approximate cost is around £120 but if purchased through school Casio discounts this to around £90.



The textbook is provided in e-book form

The first six chapters

1 Algebraic expressions

- 1.1 Index laws
- 1.2 Expanding brackets
- 1.3 Factorising
- 1.4 Negative and fractional indices
- 1.5 Surds
- 1.6 Rationalising denominators
- Mixed exercise 1

2 Quadratics

- 2.1 Solving quadratic equations
- 2.2 Completing the square
- 2.3 Functions
- 2.4 Quadratic graphs
- 2.5 The discriminant
- 2.6 Modelling with quadratics
- Mixed exercise 2

3 Equations and inequalities

- 3.1 Linear simultaneous equations
- 3.2 Quadratic simultaneous equations
- 3.3 Simultaneous equations on graphs
- 3.4 Linear inequalities
- 3.5 Quadratic inequalities
- 3.6 Inequalities on graphs
- 3.7 Regions
- Mixed exercise 3

4 Graphs and transformations

- 4.1 Cubic graphs
- 4.2 Quartic graphs
- 4.3 Reciprocal graphs
- 4.4 Points of intersection
- 4.5 Translating graphs
- 4.6 Stretching graphs
- 4.7 Transforming functions
- Mixed exercise 4

5 Straight line graphs

- 5.1 $y = mx + c$
- 5.2 Equations of straight lines
- 5.3 Parallel and perpendicular lines
- 5.4 Length and area
- 5.5 Modelling with straight lines
- Mixed exercise 5

6 Circles

- 6.1 Midpoints and perpendicular bisectors
- 6.2 Equation of a circle
- 6.3 Intersections of straight lines and circles
- 6.4 Use tangent and chord properties
- 6.5 Circles and triangles
- Mixed exercise 6

Purpose of induction activity

- A reminder that GCSE knowledge and skills will be assumed and necessary for the A level course.
- An introduction to the style and standard of the easiest questions.
- An introduction to how exam questions are assessed.
- The questions that follow whilst being AS questions are fully based on knowledge gained for the GCSE examination.

Practice questions: method is essential

The Edexcel Mathematics mark schemes use the following types of marks:

M marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.

A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.

B marks are unconditional accuracy marks (independent of M marks)

3.

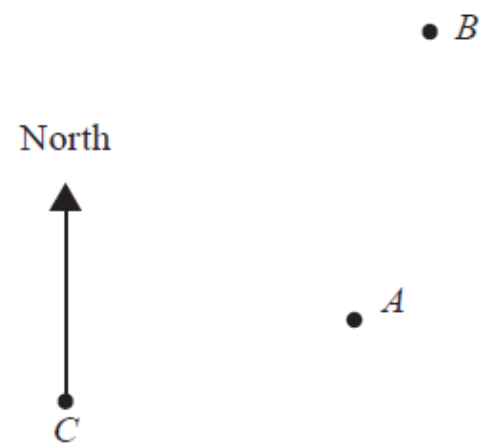


Figure 1

Figure 1 is a sketch showing the position of three phone masts, A , B and C .

The masts are identical and their bases are assumed to lie in the same horizontal plane.

From mast C

- mast A is 8.2 km away on a bearing of 072°
- mast B is 15.6 km away on a bearing of 039°

- (a) Find the distance between masts A and B , giving your answer in km to one decimal place.

(3)

An engineer needs to travel from mast A to mast B .

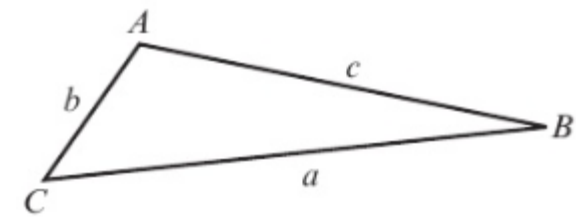
- (b) Give a reason why the answer to part (a) is unlikely to be an accurate value for the distance the engineer travels.

(1)

Bearings

Non-right angled triangles

$$a^2 = b^2 + c^2 - 2bc \cos A$$



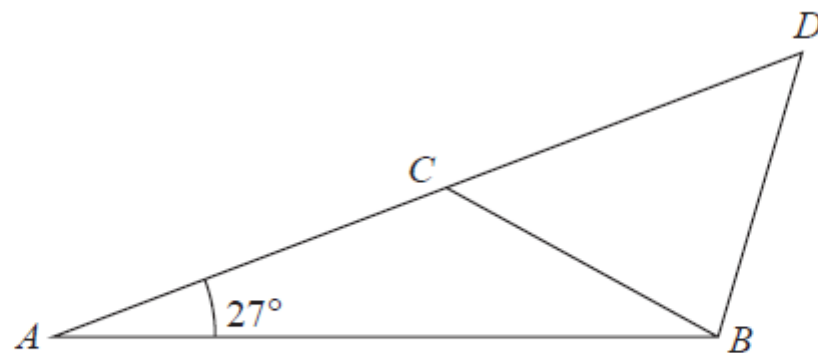
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Question 3 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
3(a)	Angle $ACB (= 72^\circ - 39^\circ) = 33^\circ$	B1	This mark is given for subtracting the bearings to find angle ACB .
	$AB^2 = 8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos 33^\circ$ $AB = \sqrt{8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos 33^\circ}$	M1	This mark is given for using the cosine rule to find AB .
	9.8 (km)	A1	This mark is given for the correct answer.
		(3)	
3(b)	- Road unlikely to be straight - There may be objects in the way - Bases of masts unlikely to be in the same (horizontal) plane	B1	This mark is given for explaining that the actual route is likely to be longer, because it is unlikely to be a straight line.
		(1)	
(4 marks)			

5.



Not to scale

Figure 1

Figure 1 shows the design for a structure used to support a roof.

The structure consists of four steel beams, AB , BD , BC and AD .

Given $AB = 12\text{ m}$, $BC = BD = 7\text{ m}$ and angle $BAC = 27^\circ$

(a) find, to one decimal place, the size of angle ACB .

(3)

The steel beams can only be bought in whole metre lengths.

(b) Find the minimum length of steel that needs to be bought to make the complete structure.

(3)

Question 5 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{\sin \theta}{12} = \frac{\sin 27}{7}$	M1 1.1b	This mark is given for a method to find θ using the sine rule
	$\theta = 51.1^\circ$ or 128.9°	A1 1.1b	This mark is given for a method to find $\angle ACB$
	$\theta = 128.9^\circ$	A1 1.1b	This mark is given for a correct answer only (i.e. rejects 51.1°)
(b)	$AD^2 = 7^2 + 12^2 - 2 \times 12 \times 7 \cos 101.9$ $AD = 15.09$	M1 1.1b	This mark is given for a method to use the cosine rule to find the length AD
	$12 + 7 + 7 + 15.09 = 41.09$	M1 3.1a	This mark is given for a method to find the total length of the structure
	42 m	A1 3.2a	This mark is given for rounding up the answer to find the total length of the steel beams bought

10.

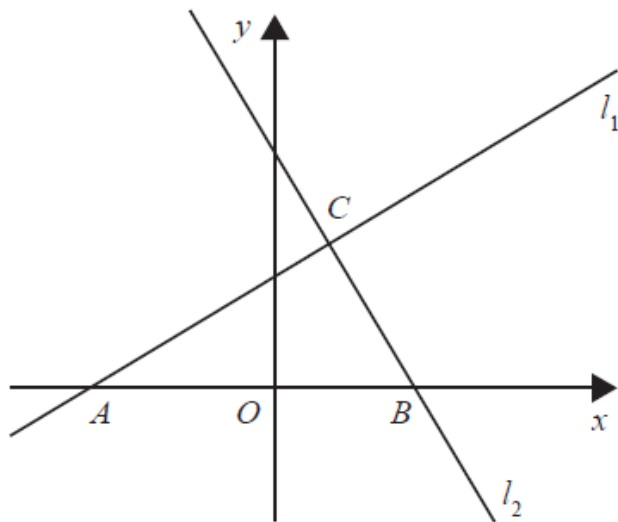


Figure 4

The line l_1 has equation $y = \frac{3}{5}x + 6$

The line l_2 is perpendicular to l_1 and passes through the point $B(8,0)$, as shown in the sketch in Figure 4.

(a) Show that an equation for line l_2 is

$$5x + 3y = 40$$

(3)

Given that

- lines l_1 and l_2 intersect at the point C
- line l_1 crosses the x -axis at the point A

(b) find the exact area of triangle ABC , giving your answer as a fully simplified

fraction in the form $\frac{p}{q}$

(5)

Straight lines

$$y = mx + c$$

$$ax + by + c = 0$$

$$y - y_1 = m(x - x_1)$$

Perpendicular Gradient to m

$$\frac{-1}{m}$$

Ex5B, 5C, 5D, 5E, 5F textbook

Part	Working or answer an examiner might expect to see	Mark	Notes		
10(a)	Gradient of l_2 is $\frac{-1}{\left(\frac{3}{5}\right)} = -\frac{5}{3}$	B1	This mark is given finding the gradient of l_2 which is perpendicular to l_1		
	$y - y_0 = m(x - x_0)$ where (x_0, y_0) is $(8, 0)$ $y - 0 = -\frac{5}{3}(x - 8)$	10(b)	Deduces that A is at $(-10, 0)$ by solving the equation $0 = \frac{3}{5}x + 6$	B1	This mark is given for finding the coordinates of A .
	$3y = -5(x - 8) \Rightarrow 3y = -5x + 40$ $5x + 3y = 40 \mid^*$		$y = \frac{3}{5}x + 6$ $5x + 3y = 40$	M1	This mark is given for attempting to solve the pair of simultaneous equations to find the y coordinate of C (there is no need to find the x coordinate).
			$\frac{135}{17}$	A1	This mark is given for stating the y coordinate of C .
			$\text{Area} = \frac{1}{2} \times (8 - (-10)) \times \frac{135}{17}$	dM1	This mark is given for a complete method to find the area of triangle ABC .
			$\frac{1215}{17}$	A1	This mark is given for the correct area of triangle ABC .
				(5)	
			(8 marks)		

3.

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(i) Solve the equation

$$x\sqrt{2} - \sqrt{18} = x$$

writing the answer as a surd in simplest form.

(3)

(ii) Solve the equation

$$4^{3x-2} = \frac{1}{2\sqrt{2}}$$

(3)

Rules for indices

$$a^{\frac{1}{m}} = \sqrt[m]{a}$$

$$a^{\frac{n}{m}} = \sqrt[m]{a^n}$$

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

$$a^0 = 1$$

Rules for surds

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

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

Part	Working or answer an examiner might expect to see	Mark	Notes
(i)	$x\sqrt{2} - \sqrt{18}$ $x(\sqrt{2} - 1) = \sqrt{18}$ $x = \frac{\sqrt{18}}{\sqrt{2}-1}$	M1 1.1b	This mark is given for a method to find an expression for x in surd form
	$x = \frac{\sqrt{18}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$ $x = \sqrt{18}(\sqrt{2} + 1)$	M1 3.1a	This mark is given for a method to simplify an expression for x by multiplying both numerator and denominator by an appropriate term
	$x = 6 + 3\sqrt{2}$	A1 1.1b	This mark is given for a correct answer only
(ii)	$2^{6x-4} = 2^{-\frac{3}{2}}$	M1 2.5	This mark is given for a method to set both sides of the equation as powers of 2
	$6x - 4 = -\frac{3}{2}$	M1 1.1b	This mark is given for complete method to find x
	$x = \frac{5}{12}$	A1 1.1b	This mark is given for the correct answer only

Questions?