

Year 12 Further Maths Summer Work

Instructions

- On the reverse side of this sheet are 9 exam-style questions based on Higher GCSE maths content. You should feel confident with these questions before enrolling in Further Maths.
- If you are not yet confident, but still keen to take the course, use the topic list below to help guide your revision and preparation.
- Present your work in a clear, logical order, with all questions labelled.
- You may submit your work as:
 - A scanned PDF or photos (mobile phones often have a “scan to PDF” option)
 - A physical paper copy to be handed in during the first week of the term.

About the course

Exam Board: Pearson Edexcel

Qualification: Level 3 Advanced Subsidiary GCE in Further Mathematics (AS Level)

Assessment: Two written exams taken at the end of Year 12 in May/June

- Paper 1: Core Pure Mathematics (50%)
 - Content overview: Proof, complex numbers, Matrices, Further algebra and functions, Further calculus, Further vectors
- Paper 2: Decision Mathematics 1 and 2 (50%)
 - Content overview D1: Algorithm and graph theory, Algorithms on graphs, Critical path analysis, Linear programming
 - Content overview D2: Allocation (assignment) problems, Flows in networks, Game theory, Recurrence relations
- Further Maths is a full A Level (with the option to continue into Year 13). Unlike most A Levels, which receive 9 hours of teaching time per fortnight, this course is allocated only 6 hours. As a result, a strong commitment to independent study is essential. You must be prepared to complete work outside of lessons regularly, and you should expect to spend around **1.5 hours of independent study per lesson hour** — approximately **4.5 hours per week**.
 - **Please note:** In recent years, students who achieved a **Grade 8 or higher** in GCSE Mathematics have generally found the demands of Further Maths manageable. Those with a **Grade 7 or below** have often found the course more challenging and may need to invest **more than 4.5 hours per week** to succeed. However, with dedication and consistent effort, it is still possible to do well.
- Further Maths lessons will begin the second week of term. Lessons will likely take place during **twilight sessions** (after school). Depending on the timetables of those who enrol in the course, it may be possible to move some lessons to within the school day. Final arrangements will be confirmed via e-mail to those who submit their summer work on time.

Topic Guide for Summer Work Questions

If you're unsure about any question, use this list to help identify the relevant topic and revise it. A quick online search (e.g., YouTube) will provide helpful tutorials and worked examples.

- Q1: Factorising Quadratics, Algebraic Fractions, Algebraic Division
- Q2: Equations of Circles, Equations of Tangents, Area of Triangles
- Q3: Expanding double brackets (binomial expansion), Multiplying and Adding Surds
- Q4: Completing the Square, Turning points from equations
- Q5: Algebraic Proof
- Q6: Function notation, Solving equations, Factorising
- Q7: x- and y- intercepts, Distance of a Line (Pythagoras), Equations of Perpendicular Lines
- Q8: Cosine rule, Sine rule for area
- Q9: Trigonometric graphs, Solving basic trigonometric equations

- 1 Simplify these expressions as far as possible.
- a $\frac{x^2 - 3x - 10}{x^2 + 4x + 4}$ (3 marks)
- b $\frac{x^2 - 36}{x^2 + x - 12} \div \frac{x^2 - 4x - 12}{x^2 - 9}$ (4 marks)
- 2 The line l is a tangent to the circle $x^2 + y^2 = 13$ at the point $P(3, 2)$.
The tangent intersects the y -axis at point A . Find the area of the triangle OPA . (5 marks)
- 3 Expand and simplify $(2\sqrt{p} - 3\sqrt{q})(2\sqrt{p} + \sqrt{q})$ (3 marks)
- 4 a Write $3x^2 - 9x + 5$ in the form $a(x + b)^2 + c$ (3 marks)
- b Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 9x + 5$. (1 mark)
- 5 Prove algebraically that the sum of the squares of two consecutive **odd** integers is always an even number. (4 marks)
- 6 The functions g and f are defined as $g(x) = \frac{3x}{3+x}$ and $f(x) = 2x - 5$
Given that $x \neq -3$, find the value(s) of x such that $g(x) = f(x)$, giving your answer(s) to 2 decimal places. (6 marks)
- 7 The line l_1 has equation $y = -\frac{1}{4}x + 5$ and intersects the x - and y -axes at points A and B respectively.
- a Find the exact length of the line segment AB . (3 marks)
- b Find the equation of the line l_2 perpendicular to l_1 which passes through the point $P(1, -3)$. (2 marks)
- The line l_2 intersects l_1 at the point C .
- c Find the midpoint of the line segment AC . (4 marks)
- 8 A triangle ABC has side lengths $AB = 12$ cm, $BC = 7$ cm and $AC = 9$ cm.
- a Find the size of the largest angle, giving your answer to 2 decimal places. (3 marks)
- b Find the area of the triangle, giving your answer to 2 decimal places. (2 marks)
- 9 a Sketch the graph of $y = \sin x$ for $0 \leq x \leq 540^\circ$, showing the points where the graph cuts the axes. (2 marks)
- b Hence find the exact values of x in the interval $0 \leq x \leq 540^\circ$ for which $\sin x = \frac{1}{\sqrt{2}}$ (3 marks)