Year 13 Further Mathematics – Graphs and Networks

West Kirby Grammar School

Learning about this topic is important because:
Planar graphs help simplify complex systems, reduce visual clutter, and reveal structural properties that are hidden in more tangled representations. Understanding how the algorithm works strengthens your ability to analyse networks logically, spot underlying patterns, and decide when a problem can be simplified or when a more advanced method is needed.

This builds on: Graphs and Networks Y12FM

This leads to: Computer Science, Mathematics or Engineering in Further Education

We will learn:

- Use the planarity algorithm to determine whether or not a given graph is planar

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:
Planar graph, edge, vertex, Hamiltonian cycle, inside, outside, opposite label.

You could learn more about this topic by:
Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.

Year 13 Further Mathematics – Graphs and Networks

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.	

Year 13 Further Mathematics – Route Inspection

West Kirby Grammar School

Learning about this topic is important because:
Learning about route inspection problems with more than four odd nodes is important because it prepares you to handle realistic, complex networks where simple shortcuts no longer work. This mirrors real situations like planning delivery routes, maintenance schedules, or inspection circuits where networks are rarely neat or minimal.

This builds on: Route inspection Y12FM

This leads to: Logistics and network analysis in Further Education

We will learn:

- Use the route inspection algorithm in networks with more than four odd nodes

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:
Eulerian graphs, semi-Eulerian graphs, degree, vertex, even, odd, trail, connected graph, Chinese-postman, weight, shortest route, pairings, least sum, network, nodes.

You could learn more about this topic by:
Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.

Year 13 Further Mathematics – Route Inspection

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.	

Year 13 Further Mathematics – Travelling Salesman Problem

West Kirby Grammar School

Learning about this topic is important because:
Studying the travelling salesman problem is important because it introduces you to challenging optimisation problems in mathematics and computer science, showing how difficult it can be to find the most efficient solution when many possibilities exist.

This builds on: Algorithms Y12FM, Graphs and networks Y12FM, Algorithms on graphs Y12FM

This leads to: Computer Science, Mathematics or Engineering in Further Education

We will learn:

- Explain the differences between the classical and practical problems
- Use a minimum spanning tree method to find an upper bound
- Use a minimum spanning tree method to find a lower bound
- Use the nearest neighbour algorithm to find an upper bound

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:
Classical problem, practical problem, walk, finite, edge, vertex, tour, Hamiltonian cycle, upper bound, lower bound, optimal solution, network of least distances, triangle inequality, network, minimum spanning tree, Prim's algorithm, Kruskal's algorithm, shortcuts, residual minimum spanning tree, nearest neighbour algorithm.

You could learn more about this topic by:
Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.

Year 13 Further Mathematics – Travelling Salesman Problem

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.

Year 13 Further Mathematics – The Simplex Algorithm

West Kirby Grammar School

Learning about this topic is important because:
Studying the simplex algorithm is important because it gives you a powerful, systematic method for solving linear programming problems, which appear everywhere in real-world optimisation. The simplex method is one of the most widely used algorithms in applied mathematics and gives an insight into how large-scale decisions are made in business, engineering, logistics, economics, and data science.

This builds on: Linear Programming Y12FM

This leads to: Computer Science, Mathematics, Engineering, Economics or Business in Further Education

We will learn:

- Understand and use slack and surplus variables
- Solve maximising and minimising linear programming problems using simplex tableaux
- Use the simplex tableau method to solve linear programming problems requiring integer solutions
- Understand and use the two-stage simplex method for maximising and minimising problems which may include < and > constraints
- Understand and use the Big-M method for maximising and minimising problems which may include < and > constraints

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:
Linear programming, decision variables, objective function, constraints, inequalities, non-negativity constraints, equations, slack variables, vertex, feasible region, optimal, simplex tableau, basic feasible solution, pivot column, maximise, minimise, iteration, integer, surplus, artificial variable, Big-M method, arbitrarily large number.

You could learn more about this topic by:
Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.

Year 13 Further Mathematics – The Simplex Algorithm

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.	

Year 13 Further Mathematics – Critical Path Analysis

West Kirby Grammar School

Learning about this topic is important because:
Learning to construct resource histograms and scheduling diagrams is important because these tools help you visualise how time and resources are allocated across a project, making complex plans easier to understand and manage. Together, they strengthen your ability to plan realistically, avoid bottlenecks, and make informed decisions — skills that are essential in project management, engineering, construction, computing, and any field where coordinating tasks and resources matters.

This builds on: Algorithms Y12FM, Graphs and Networks Y12FM, Critical Path Analysis Y12FM

This leads to: Computer Science, Mathematics, Engineering, Economics or Business in Further Education

We will learn:

- Construct resource histograms
- Construct scheduling diagrams

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:
Modelling, project, completion, activities, dependencies, precedence table, activity network, arc, events, nodes, source node, sink node, dummy activity, early and late times, duration, preceding, forward pass, forward scan, backward pass, backward

You could learn more about this topic by:
Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding

Year 13 Further Mathematics – Critical Path Analysis

scan, critical activity, critical path, float, delay, Gantt chart, resource levelling, assign, dependency conditions, lower bound.	new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.
Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.	