Adjacency matrices

Year 12
Further Mathematics

"This is fantastic! Especially in these current circumstances. You just saved me from making this exact video for my students."
Youtube comment
(from a current Teacher)

"Your british accent is so intriguing"
Youtube comment (Other YouTuber)

"Very helpful. I'm having trouble with mathematics during quarantine, I've found this channel off a tiktok one of your students has made and it's much easier now!"
Youtube comment
(from current Year 12 student)

"Mate. You're bloody awesome. To be a maths teacher and to make this stuff. You know... brilliant."
Youtube comment
(from current Year 12 student)

"Thank you so much for your videos! Especially now that we have had to move to remote learning they have been a life saver!!"
Youtube comment
(from current Year 12 student)

Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Unit 3 and 4 Specialist Mathematics course.

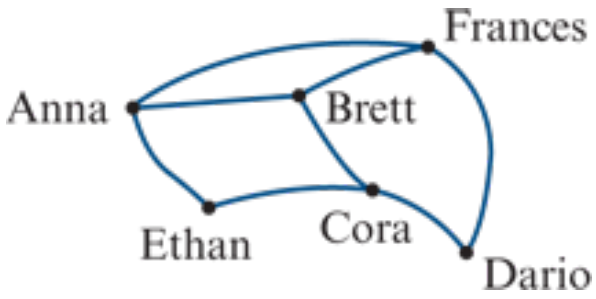
- Understand how to summarise the connections in a graph using a matrix

Recap of past learning

In a previous section of the course, we learned about graphs and all the very exciting language which comes with it. Graphs are used to pictorially demonstrate connections between things. It might be people, towns, computers on a network etc.

It's important to make sure we use the correct language when describing graphs (or networks).

This lesson is now going to look at something called an **adjacency matrix.**



What is a matrix?

If you've done the matrices section of the Further Maths course, or you have been taught it in previous years, then you will be familiar with the following:

A matrix is a mathematical tool used to represent information., It's really good for describing the connections between vertices.

The example below might describe the connections between 5 people; Amber, Barry, Celeste, David and Emma.

A zero would stand for **no connections**, a 1 for **one connection**, a 2 for **two connections** and so on.

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 2 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

Examples have been extracted, with permission, from the Cambridge Further Mathematics Units 3 and 4 Textbook

Turning a matrix into a graph

We can use the adjacency matrix to help us draw a graph.

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 2 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

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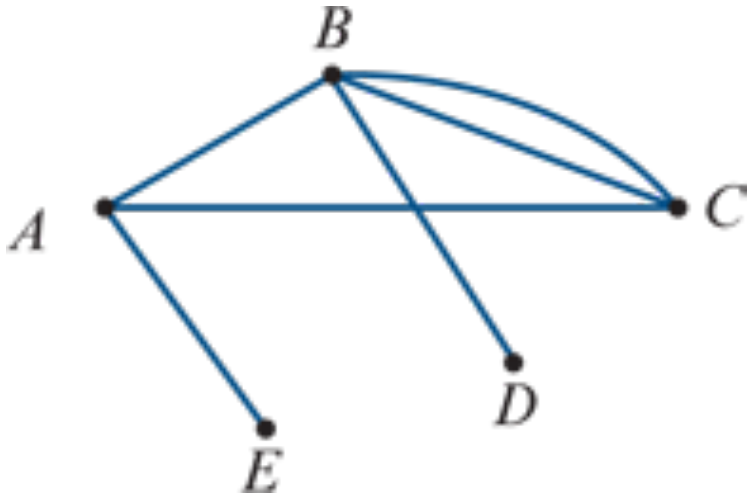
Turning a matrix into a graph

We can use the adjacency matrix to help us draw a graph.

	A	B	C	D	E
A	0	1	1	0	1
B	1	0	2	1	0
C	1	2	0	0	0
D	0	1	0	0	0
E	1	0	0	0	0



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Example

Draw the graph that has adjacency matrix

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 0 & 2 & 0 & 1 \\ 0 & 0 & 2 & 1 & 0 \\ 2 & 2 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

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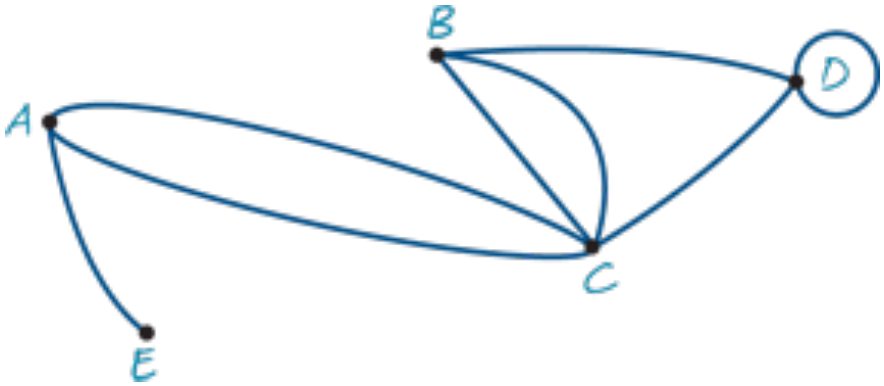
Example

Draw the graph that has adjacency matrix

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 0 & 2 & 0 & 1 \\ 0 & 0 & 2 & 1 & 0 \\ 2 & 2 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$



Note: At this time, there is no direction shown in a graph. With roads we might have one way streets, water pipes might only allow water to flow in one direction.

Note: We need to ensure that we take note of loops.

Note: Loops are counted as one edge

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Equations with brackets and pronumerals on both sides

Chapters

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Equations With Brackets And Pronumerals On Both Sides

Linear and simultaneous equations

Year 9

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Equations with brackets and pronumerals on both sides

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