Welcome to this set of PowerPoints that will go through a problem-solving and modelling task for Further Mathematics, particularly the networks and decision mathematics module. Through these videos we will introduce the problem and talk through what it might look like if you were to set it up in your particular school community. As part of this presentation, any of the work that is undertaken from this point, there is a copyright on all of the material that's being developed.

And in terms of the tasks themselves, the information will present the problem, it'll go through and discuss how it was instigated in the first instance, how the questions were then formed based on that initial thought, and then through the assessment procedures and how you might actually mark it at the same time.

The purpose of the modelling or problem-solving task for this particular module, networks and decision mathematics, is really to involve an element of content of the module itself in a context that students can visually see or understand, particularly where the mathematics might actually be developed and then applied to the question itself. A few examples of where information might come from, it could be through the graphs and networks idea, it could be through flow problems, shortest path, algorithms, et cetera.

And in terms of applying the information, travel could be involved, it could be a pathway that's being constructed, it could be the flow of communication or fluids through a network system, could be about travel within an inner-city urban area, and what that might actually look like. So there's a diverse range of areas where this topic and problem could certainly be developed and modelled. In terms of the whole process of modelling and problem-solving, the idea is to really construct a problem and through that problem bring in the mathematics that's actually required.

And then through some applications, through some hypothesising, and then the idea of getting students to make conjectures, hypotheses, play with the mathematics that's actually there to see how it all fits in, and then to try and form some sort of a solution or a generalisation, or some other element to the problem itself. So many of these problems that are set up may not involve a large amount of mathematical content, but involve a lot of the analysis and hypothesising that actually goes with it.

There is always a good source of information regarding the modelling and problem-solving framework. Certainly through the International Mathematical Modelling Challenge, there was a lot of information that came about of what problems should look like, how they should be constructed, and the website that's on your screen is a great source of that information, so I do encourage you to go through and have a look at that particular information and see how it might fit into one of the problems that you are trying to get up.

The problem solving itself, we try and come up with a context or a real-world application. Through that you can then try and develop some mathematics. And generally if the problem is well constructed the mathematics will actually flow quite freely. In terms of the formulation you might then decide how that can occur, how you might apply it, what you are in fact trying to model in the problem-solving or modelling task itself, what techniques might actually come up as useful ways of implementing that mathematics. Trying to form some results, or some conjectures, or some solutions, but then to refine what's actually been proposed for your theoretical real-world context and then redevelop. So a circular motion would occur through these four aspects of your modelling and problem-solving and eventually it would be in a format that would certainly answer the initial question you had.

In terms of the structures, the introduction forming the scenario, how it came about, what questions we might formulate, examples we might throw in. That would be a fairly directed approach in the initial stages. That would then be developed a little bit further, maybe opening it up somewhat, trying to give a little bit of variation or choice or openness in the model as it's constructed a little bit further. Trying to find some general solutions or some pathways that might lead to a solution. And then trying to, again, evaluate the model or possibly further extend it in a pathway that may have become apparent through the second phase. Redeveloping the problem, revisiting questions that were posed, and then how you might actually try and go and get some solutions. So generally problems would follow this scenario regardless, which is then very much linked to that circular reference that we were just talking about before.

In terms of the task itself, four elements that are involved, we're going to look at choosing the question or the context, getting some questions that might be developed or investigated as part of that context, getting the questions to relate to mathematical concepts, skills, processes, et cetera. Then coming up with an assessment scheme that could be used to assess students’ responses as they go through and to give some sort of a ranking process in that. This is a two-part sample that we're actually going to be looking at which is more than enough material to get the problem developed and then solutions formed well within the timeframe that's actually posed for these particular problem solving tasks.

So looking at the context that we're going to be developing for this particular problem-solving or modelling task, explaining how the context was chosen, where the questions came from and I'll be talking through essentially how it came to my mind. This would be a good problem to actually get up as a school orientated task, what the questions might look like, and then how it's developed as we go along.

So in terms of the task itself there was, a few months ago where I happened to be travelling in and around Melbourne, particularly the central business district and there were a set of one-way streets in this particular vicinity of where I was wanting to travel. And I couldn't actually make my way directly to the destination from the starting point of where I was in this particular area of Melbourne. And it led me to think about the impact of one-way travel in a network of streets and that was where the problem was developed.

In terms of the venue itself, trying to get to the particular destination and the one-way elements, unless I thought about the pathway initially, I wasn't actually going to go and make my destination along the series of one-way streets. And even for parking purposes, trying to get somewhere close to the venue to then enable me to either walk a short distance without too much trouble, again required a fair amount of detailed planning to actually get there.

In terms of this particular instance it was a trial-and-error approach to work out where the one-way streets ran, where they ended up, how I could then navigate my way through to the venue itself. And it was quite an interesting exercise from the car that I was travelling, but then to try and put it into some context for a problem that we can then actually go and look at.

So in terms of the question itself, trying to work out where the venue is that's actually going to be the one that you are travelling to, whether you started at a specific starting point in the network itself, where the one-way travel was going to occur, how big the network was going to be, the network system itself. I could develop it further to then take in time, so not just the travel along the network itself, but determining whether the time involved was efficient or inefficient, whether the impact of calming devices for traffic impacted on that travel and I thought these were really good questions to go and explore, from a real context of inner city streets and how you can get to destinations particularly where one is involved in such a network.

So they were the questions I had identified that may in fact be then quite useful to go and explore under this particular scenario. Where we then went to in terms of the problem itself, I felt a good title was possibly 'one-way travel through streets'. Of course you can modify that as you like going along, but it certainly became quite obvious to me that it was all about one-way travel through streets. You might indicate through a central business district, through a set of network streets, whatever, just to make that a title that you can then go and work with.

In terms of the background which we've already discussed in a fair amount of detail, the whole idea of getting to this particular venue is the goal of this task, but more exploring pathways that might actually be used until you in fact get there. So once I know what the network looks like and try to develop possible networks that may allow this travel to either be undertaken quickly or slowly, I think is an element that needs to be brought into it as well.

So through the next few videos we will explore each of these ideas as we move forward. And I will see you back shortly with the video that constructs the first part of the task and then some initial questions. Thank you.

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