So this is video two in the discussion of writing an application task for Maths Methods.

And this is component one that I described before as - component one is where you introduce the context. You decide as a teacher what assumptions to make, you decide on the variables, the functions you're going to use, the parameters, the constraints and conditions. You state the questions of interest and the related analysis, you identify the relevant content.

One of the things that teachers try to do is to put too much content in. So just be a little bit careful for Maths Methods that you don't try to cover every dot point you've ever thought of. So you identify the relevant content, you state the analysis required for this component. And then I'm going to show you what my component one is for this task that I've decided for drug concentrations.

So the first section, component one, identifying the context. I've decided to use a context such as the following can be used to investigate drug absorption using a product function model involving circular functions and exponential functions. So I've played around with this for a bit, just to get a feel for the domain, feel for what the graph looked like.

And I started off by introducing it in terms of x. Very soon I'll move it to in terms of t because I want to make it in terms of time. But in the beginning, remember it's skills. So the students can just consider what the function f of x is e to the negative x sine x looks like. But that's the first, that's the start of what the drug concentration can look like. And one thing to do is to get your students to graph that and see if they can see it on their screen and alter, put some different numbers in and see how it alters your graph.

So the question of interest here is we want to look at behaviour and variety of shapes. We want to look at the domain and the corresponding range, what's relevant. We want to look at the key features as the x intercepts stationary points, points of inflection. If there's any symmetry in the graph, if there's any asymptotes and we know that there's going to be an asymptotic nature because of the exponential part. The shape of the graph, we know it's going to be cyclic because of trig, over its natural domain. And natural domain is interesting because this graph actually goes below the x-axis or below the t-axis. So you need to restrict the domain so that the concentration doesn't become negative. And we use the derivative function for analysis as applicable.

Now, the relevant content on the analysis. So the task will begin with an investigation of a graph that might model a concentration of a certain drug in a patient system over time. The use of parameters in the family of the function gives the students the opportunity to explore the effect, the size of parameters, have on the graph. But the previous one, I didn't have any parameters. I just had e to the negative x sine x. So I'm going to add some parameters, hence on the magnitude of the drug in the patient's system over time, students can then explore a similar function.

So I began with, as I said, consider the function with the rule f of x equals e to the negative x sine x. And I would start off by asking the students to graph the function, identifying its key features and explain how the shape of the graph can be deduced from its current functions. So in fact, it rises up and then falls off again. So that's the first stage, but you're looking at what happens. It reaches a peak and then it goes off in an asymptotic nature.

Then I moved into this story. So I've changed it to time. So I have labelled it a function d for drugs, the graph of d to t is Ae to the minus kt sine kt. So I'm introducing parameters, where A and k are positive real constants. And I think this graph can be used to describe drug absorption in a patient's bloodstream. And I've got units here of milligrammes per litre for units of time in minutes. So we start off with that first, we've got A and we've got k and you could, in fact, have discussions about, you could go off and have discussions about what does the A do to the graph. And it's going to be a dilation from the x-axis and you could discuss what that little k does. And that's going to be discussing the dilation from the y-axis. So in fact, you could have a discussion about what those parameters do. But what component one asks us to do is to put in particular values.

So I've suggested the students start with a special case where A is one and k is one and discuss this with respect to a dose of drug taken at t is zero. And then the students might say, well, that's far too long for the height of the drug or the maximum in the system or it's far too short, or the graph is too spread out. So then part C after they've thought about this, I've suggested they select several pairs of values of A and k. Now, you could make this completely open, but on purpose I've restricted it a bit so they're not just making them up out of the blue.

So I've suggested k could be chosen between 0.1 and one and A can be chosen between one and 10. The students can select several pairs of values of A and k and preferably not the same as the person sitting next to them. And they might choose let's say, k is 0.5. And they might think, well the graph doesn't look like what I want it to look. So let's look at 0.8. Let's look at 0.1, see what happens and explore and interpret the features of the graph. We're still in component one.

We can then discuss the role of the sine function. What's happening with the sine function up and down. What's the role of the exponential function and the constants A and k. So what happens if I make k bigger or smaller? And what happens if I make A bigger or smaller?

Now students may not know about dexamethasone but they could know about Panadol. So you could have a discussion of if I take a dose of Panadol, how long do you think it takes for it to work in my system? So some students might say it takes 10 minutes to really get the benefit of the Panadol. So you could have a discussion of moving your A and k depending on what the drug is. Do you want an instant effect or do you want effect that takes a little while to do.

Now, to finish this component one, we can look as indicative content here which is from the study design. So, the topic I'm covering is actually graphs of product functions, which is in the study design. So these are skills in the study design. We can talk about sketch graphs. We look at their behaviour with the assistance of technology knowing that these application tasks are technology active. But students want to clearly identify their key features, so by now, even after the end of component one, they should have an idea of maximum and minimum points. They should look at whether they think there's a point of inflection there. They should look at a natural domain.

It says here the concept of combined functions and the connection between domain and range. So do you stop the domain before it goes under the axis? So you have a positive, the concentration of drug in your system. And then a good discussion there would be, will you ever have a zero concentration of drug? You won't, according to this model, within a limited domain, which is an interesting thought about whether the drug stays in your system forever.

 The other topic that we cover is calculus. So students need to know techniques of finding derivatives. They're going to be using derivatives on their calculator. And we need to know the graph of a function and the graph of its derivative, and I would introduce the graph of its derivative into this component one and try to get the students to see the combination between the two.

So that's the end of component one.

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