**Michael MacNeill** - Okay, we might get started on this webinar to discuss the implementation of the new study design for 2023 to 2027, for the subject of VCE Mathematical Methods. My name is Michael MacNeill, I am the curriculum manager for F to 12, and mathematics here at the VCAA. My co-presenter tonight is Kevin McMenamin. And we'll start as is proper, with the acknowledgement of country. I would like to acknowledge the traditional custodians of the many lands across Victoria on which each of you are living, learning, and working from today. For myself, and those of us in the Melbourne metropolitan area, we acknowledge the traditional custodians of the Kulin nations. When acknowledging country, we recognise Aboriginal, and Torres Strait Islander people's spiritual, and cultural connection to country, and acknowledge their continued care of the lands and waterways over generations. While celebrating the continuation of a living culture that has a unique role in this region. I would like to pay my respects to elders past, present, and emerging for they hold the memories, traditions, culture, and hopes of all Aboriginal and Torres Strait Islander peoples across the nation and hope they will walk with us on our journey.

One of the formalities, if you wish to ask a question during the course of the presentation, you should see a Q and A function button located at the bottom of your screen. Please ensure that that when you ask you select all panellists from the menu, and that ensures that we'll be able to see any of your questions in the Q and A section. I'll endeavour to answer as many of your questions as possible during the course of the webinar, however, time constraints may mean that I won't be able to get to them today, and if I am not able to get to those questions today, then my details will be provided at the very end of the webinar. Our timeframe today is from four o'clock to 4:45. The general outline of any of these webinars is that I will speak to the new structure of VCE mathematics briefly, and then I will need to get into the changes, or the revisions, I should say for VCE Mathematical Methods units one to four. Kevin will then discuss the investigations, and the assessments for unit three and four. And then we'll talk a little bit about computational thinking and pseudocode, and then there will be time to address some of the frequently asked questions.

The study design for 2023 to 2027. Before implementation of the revisions, the study undergoes a thorough consultation and review process. All of VCE studies have been benchmarked against international standards, and consultation was wide across the government, Catholic, and independent sectors, as well as stakeholders from tertiary sector. The main high-level revisions to the study design overall were those found in Specialist Maths, which has had a significant restructuring, and in Foundation Maths where a brand-new study has been constructed at unit three and four. The role of the VCAA beyond the curriculum restructure, would be to provide support for schools in understanding their responsibilities around the revised study design requirements, and awareness of where their practice may need to evolve.

Part of the new study design, or the writing the new study design is that it refers to the notion of assumed knowledge, and in particular for Mathematical Methods, and for Specialist Maths. This provides students with a good indication of the skills and knowledge from the subject that will facilitate their learning across the sequences. To clarify the notion of prerequisite subjects, particularly for 2023 Mathematical Methods, unit three does not require units one and two. However, please apply a lens of common sense. Any student entering the units three and four of Mathematical Methods without foundational knowledge, and a facility with notions of functions, both polynomial and transcendental, and applicable domain restrictions, calculus and probability is not likely to meet with success. Confusion sometimes arises as well in the Mathematics studies around the distinction between what is considered examinable, and what is considered an essential conceptual basis for learning, and the development of key knowledge and key skills within the parameters defined through the areas of study within the subject.

Not all elements essential for learning in unit one and two, or three and four would necessarily appear on examination papers. Exams for unit three and four constructed around the key knowledge and key skills listed under units three and four for the particular study. And in Mathematics studies, the key knowledge, and key skills find contextualization through the lens of the areas of study. The Mathematical Methods units one and two. You can see on the screen there, the areas of study, and there are four of them there. And there's been a little bit of renaming. We've now got functions, relations and graphs, algebra, number and structure, calculus, and data analysis has been added to probability and statistics.

Mathematical Methods unit one and two, I might just flip back there, Kevin, to the previous one. Mathematical Methods units one and two do provide an introductory study at the simple elementary functions of a single real variable algebra, calculus, probability, and statistics and their applications in a variety of practical and theoretical contexts. Now, flip to the next slide, thank you. The revised areas of study, now as we're starting in unit one, across units, one, two, three, and four, there's been a, a lot of revision, probably more revision of the components of the areas of study, and the key knowledge and key skills than perhaps in say specialist maths, where there's been additions to the content, or to the areas of study, different areas of study, and it's possibly more obvious.

So that's what I'm going to be speaking to a lot today. Hopefully explaining what's what's going to be appearing on the screen rather than just reading what's on the screen. So, in unit one area of study dot-point two, I'll be referring to specific places too, so that when you have your own copy of the study design, you'll be able to refer directly. Qualitative interpretation of features of graphs, of functions, including those of real data, not explicitly represented by rule, with approximate location of any intercept, stationary points, and points of inflection.

I want to speak to points of inflection in particular. The explicit mention of non-stationary points of inflection warrants an expansion. Students of Mathematical Methods should complete units three and four across the four units, with an appreciation of what a point of inflection looks like for both the non-stationary and the stationary case. Be able to informally articulate the behaviour of the tangent, gradient in either side of the point of inflection. There remains however, no explicit requirement that students need to employ the second derivative in categorising stationary points and locating a point of inflection. Students should continue to appropriately label relevant points, which are called key features in the study design on a graph as coordinate pairs, and these would include axial intercepts, critical points, stationary points, and end points. Where more than one curve line appears on one set of axes, students should be also seeking the location of intersections. Any asymptotes, whether vertical, horizontal, or oblique, although oblique doesn't apply in Mathematical Methods, should be labelled with their equation.

I'll also refer to unit one area study one dot-point five, which talks about matrix representation may be used, but is not required. Now the utilisation of matrices in Mathematical Methods has progressively diminished from the 2005 study designs. I'm going to wave around to try and get the lights back on, there we go. Where an assumed familiarity with matrix algebra, simultaneous equations, transformations, and Markov chains was present. This familiarity is no longer assumed or required, matrix algebra is not precluded, however. And teachers should also be aware that in the key skills for unit one, there remains the requirement for simultaneous equations up to four unknowns, and matrices with CAS would be a most sensible approach to the solution of this kind of system of equations.

Students should also be developing an awareness of the shapes that might be generated from a probability mass function without necessarily having a facility with the mechanics of how the shapes are generated. And this emerges from another one of the revisions, which is unit in unit one area study four dot-point one, which talks about random variables, and the distribution of results of experiments. Now, this is designed to cultivate and develop an awareness within students of what they might expect as the study of probability, and data representation evolves across the four units, rather than just across units three and four.

Okay, continuing with unit one. We've got unit one outcome one, key knowledge, which refers to the, or explicitly refers to the presence of vertical or horizontal asymptotes. And again, students should continue to appropriately label these with the equation, y = 3, or x = -2, or as an example, or something along those lines. Outcome one, sorry, unit one, outcome one, key knowledge dot-point 10 has the properties that probability for a given sample space and non-negative and the some of these probabilities is one. This is not a revision necessarily, it's more of a clarification, and so operationally in terms of teaching, there'd be no change to what you're doing in fact, you're probably already doing that anyway.

Unit one, outcome two, key knowledge, in the key knowledge and key skills, refers to a new element of the course in terms of pseudocode, and the key elements of algorithm design, referring specifically to sequencing, decision making, and repetition. Kevin will be talking about pseudocode a little later in this webinar. So, I won't expand upon that now, but I will alert you to the fact that it is in unit one, it's in unit two, and it's also in units three and four, and that's across Maths Methods, and Specialist Mathematics. There's a specific expansion on the role in outcome three of computational thinking, particularly abstraction, decomposition, pattern, identification, and algorithms, in problem solving, and their application to mathematical investigations. Kevin will also be presenting some information about the investigations, and the importance in unit one and two of the investigations, in cultivating in students, an awareness of what assessment might look like at the unit three and four level. Certainly, a lot of things in unit one.

Next slide please Kevin. Talking now about the reviews, and we're going to find as this webinar progresses that the dot-points which no longer explicitly appear in the study design, a lot of them refer to a review of a particular component. In unit one, it's the review of coordinate geometry. The notion of assumed knowledge was introduced in the preamble on page nine of the study design. And again, while there are no formal prerequisites for entry into unit one, two, and three, please apply a lens of common sense for students who wish to meet with success in the subject. The relevance in this instance for unit one of straight-line graphs, particularly in differential calculus makes student proficiency with this topic essential, and while not explicitly written into the study design, student facility with straight line geometry does remain essential.

Teachers must also be mindful at this stage of the impact that COVID might have had, and particularly the lockdowns for the cohort of 2023, that will have impacted on their year eight and year nine mathematics. And that may inform how you might want to in the context of your school, may want to facilitate some kind of revisiting of the relevant topics, and the manner in which that that might occur, whether it's through explicit teaching, or more of a flipped classroom experience for the students. Unit one, outcome one, key skills dot-point one and 12, refers to the notion of relations, or functions, or functions being a subset of relations. Now, the vertical line test has been removed from the areas of study descriptors, however, it is necessarily still part of the course, it doesn't have to be a big part of the course of course, but students do need to be able to identify a function, categorise a function as a subset of relations, and how that might then manifest as a one-to-one function for the purpose of developing an inverse function.

Again, which is going to be held within the key skills. And the specific is, sketch the graph of an inverse function, sorry, sketch the graph of the inverse function of a one-to-one function, given its graph. Here, we want to see the development of these notions over four units, not just immediately in unit one necessarily, developing the graph of an inverse function from a graph of an original function is a good start. Implicitly held here though is also the notion of a reflection in the line y = x, and intersections on this line between f, and the inverse of f.

And please take care with nomenclature for functions as well. Some of the material that is not going to, or that you're not going to find if you look directly at the study design, graphs of polynomial functions of low degree and interpretation of key features of these graphs is still present, not necessarily in the writing, which appears on the screen at the moment. The intention of that particular dot-point was to facilitate the exploration of polynomials, and in particular, the different features that are present near the x-axis, that are dependent upon the power of the linear factor, that might be a linear axial cut, or the function behaves in a quadratic, or a cubic fashion manifesting as a stationary point of inflection at that particular x-value.

The concern was that by listing four as the highest numeric power, even though the scope may have been present for further exploration with higher powers, that this further exploration and consequent link to graphical features might not be being made. And it should be done. Similarly, with the expansion of to the power n, might not be explicitly written there, although it should still be explored, and student proficiency with the skills to perhaps do difference of binomial expansion of squares and cubes, perfect squares, difference of perfect cubes, et cetera, is going to be a skill that students will find beneficial. Another one which has been removed has been the Cartesian form, algebraic or graphing, of circles.

This is aside from the unit circle in unit two, I'll talk about unit two when we get there, but Cartesian forms are not a part of the course for Maths Methods anymore. Revised areas for unit two. And I'll talk directly to these revisions. Numerical approximation of roots of cubic polynomials and functions using Newton's method algorithm, and we're specifying the algorithm as part of the areas of study dot-point. The intention was to introduce students to a numerical recipe in order to facilitate learning through our algorithmic thinking, and now computational thinking.

And for the revised study design for 2023 to 2027, both bisection and Newton's method may be examined through the introduction of pseudocode, more on that in units three and four, but it may not be limited to bisection and Newton's method. Again, more of that when we get to the pseudocode component. Informal treatment of the gradient of the tangent of the curve as a limit with limit definition, derivative of a function. First principle's differentiation has been removed as a formally written or explicitly written dot-point. However, it clearly is still a part of the course.

It's not a part of the course, however, that really needs to have too much time spent on it as its own little section, we wouldn't spend weeks and weeks on first principles differentiation. What we want students to do is to get the notion that there is a calculus link between the rule for the function, particularly polynomial functions in Maths Methods units one and two, and the gradient of the tangent line to that polynomial function. The central difference approximation is the big introduction to unit two, and its graphical interpretation.

It's important for teachers to note that, or teachers only, that students don't need to develop these ideas, they need to be able to interact with this topic, or this idea in an operational sense, and have some notion about how it might graphically evolve. For teachers however, it's important to note that this can be developed, or the central difference approximation may be developed through a Taylor series expansion where the first order error terms cancel, and so for small values of h, then we're going to see a close approximation between the central difference approximation, and the actual value of the tangent to the curve, due to the error being proportional to h squared. It's a two-point derivative of approximation, and it lends itself to numerical recipes, which again can be explored through pseudocode, but also graph and table comparisons can be useful for the development of the idea. Simulation to estimate probabilities involving selection with and without replacement is again, something which it's a simulation, so it's not something that we expect students to sit down, and in a by-hand fashion produce an iteration, or describe the iteration, it's to promote the development of the ideas, promote the development of learning.

Moving on to the revised key knowledge and key skills, the newer content for unit two, the unit circle very specifically the unit circle, and exact values for sin, cosine, and tangent. The unit circle is not explicitly listed in the previous, or the current iteration of the study design. It is however essential for students to be able to engage with that and can be used as a good base for highlighting the emergence of signage of the ratios, of the exact value ratios in the evaluation of sin, cosine, and tangent of an angle, for those specific angles that are listed in the study design. The limit definition of the derivative of a function, central difference approximation, and the derivative, we've already spoken about that.

And we might move on to, and I think we've lined up now with where I'm at. Review of basic trigonometry ratios, yes. So realistically there will be a context dependent need that will vary between schools, and sometimes between classes within any one school to revisit the ideas of trigonometry, the extent to which you choose to revisit it would be informed by the needs of your particular group, your particular cohort. Conversion between degrees and radians is still required. It's only in the writing, or in the study design, it's only implied that it would be required, but without that, it would be impossible to evaluate sin, cos, and tan for both degree, and radiant equivalent angles. Obvious alterations for here would be the explicit direction to approximating the gradient function has been removed along with specific notations for the derivative.

I wanted to speak to that one just a little bit. Dot-point three highlights the recognition of the derivative as a rate of change, a sensible exploration could still include these aspects in terms of nomenclature, any of the Leibniz, Lagrange, Euler or Newtonian nomenclature, which has previously been present would be acceptable. Students, particularly those in units three and four, however, would do well to remember that as a good rule of thumb, the solutions that they generate should retain some fidelity to the notation used in the question presented on the exam. Previously straight line 1-D motion was listed explicitly for Maths Methods and is now implicitly under the umbrella of motion graphs, displacement-time, velocity-time, and acceleration-time.

Providing some contextualization such as the speed formula remains sensible however, the focus is really about linking graphical features revealed through the use of calculus to the physical interpretation. Example of that might be that a velocity-time graph has instantaneous velocity revealed by the line itself. The gradient will provide the acceleration, and the area contained between the curve and t-axis will give the change in displacement, or the distance. I also wanted to mention Karnaugh maps, which appear to have been explicitly removed, or written out of the study design, they are remaining under tables in area of study four, they're very useful tool, and they would remain an expectation as one of the counting techniques, or a means of keeping track of intersections. All the complimentary probabilities and total probability formulas are remaining explicitly written into the unit two of the study design, and the Karnaugh map is a great way of keeping track of those.

Moving on now, units three and four. There's certainly a lot in this, and hopefully, we'll get through it a little quicker, we do need to move on to the assessment section too. So, in units three and four, we're extending the introductory study of simple elementary functions, of a single real variable to include combinations of these functions, algebra, calculus, probability, and statistics, and their applications in a variety of practical and theoretical contexts. I'm reading that one directly from the study design. And I would urge you at your convenience to download the copy of the study design and, to read it carefully, and you'll see there's a lot of familiar things, and implementing the changes that are being highlighted today will certainly assist you in making those changes visible, and real for your students. I don't think there's anything here.

Moving on to the next slide, thank you, Kevin. Yep, that's the slide there, thank you. And again, there's highlighting of key features for the prescribed functions. And just as a reminder, again, these include axial intercepts, critical points, stationary points, and endpoints. And the continued expectation is that they are listed as co-ordinate pairs. Where more than one curve line appears on one set of an axis, students should be seeking the location of line intersections, and any asymptotes whether vertical, or horizontal should be labelled with their equation. The dot-point one of area of study two now includes using numerical solutions. And this is to facilitate the utilisation of Newton's method as an algorithm, which lends itself to algorithmic thinking, computational thinking, and pseudocode.

We'll also highlight that composition function, that composite functions have got a formalised f, and f-of-g notation, which is going to be acceptable for the duration of the study design. It's really recognising conventional representations, operationally, there's probably not much that will change in how this is going to be taught. We revisit at this stage the notion of points of inflection, and what that may look like, and what the expectation may look like for students. Emerging the studies in unit one where students would be able to identify on a presented graph, what a point of inflection would look like. They would transition that across to unit three, implementing CAS as a means of students locating a point of inflection, or alternatively they could be making good use of linked graphs between a function, and it's corresponding gradient function using the graphical properties of the derivative function graph, to identify those relevant features in particular, the location of a point of inflection, or a stationary point of inflection.

And I'll reiterate again at this stage that there is no explicit requirement that students need to employ a second derivative, to locate a point of inflection, or to categorise a stationary point. Having said that then students who do utilise that particular technique, it's not strictly prohibited from the utilisation. The identification of local maximum and minimum is a dot-point which has seen some clarification. Now, a big introduction, or a big change from what has previously been there is the area approximations using the trapezium rule. The trapezium rule particularly again, lends itself well to pseudocode, and pseudocode familiarity. Rectangle rules are no longer written into the study design. However, a sensible learning activity would be an exploration of multiple forms of area approximation. And that would be at the discretion of the school, of course, and techniques might include left and right rectangle rule, midpoint rule, and then the trapezium rule as an evolution of that.

Students in the fourth area of study. Simulation of random sampling for a variety of values of p, and a range of sample sizes to illustrate the distribution of p-hat, and variations in confidence intervals between samples Again, assumed knowledge and skills. The review has been removed as a particular dot-point. However, the value of a review has not been diminished. And again, I want to reiterate that it will be context specific. Lights have gone off on me again. There we go.

Next slide, please Kevin. I might just take a moment, I think I've spoken to all of those particular points at some point, I want to reiterate, there are no oblique asymptotes in Mathematical Methods, oblique asymptotes may manifest in Specialist Mathematics. Some of the notions which are no longer present, and they require no real, I don't need to read through them too much, you can read those on the screen there. Functional relations have been removed. Matrices for transformations of functions have been removed, although students may wish to use matrices, although that they're certainly not going to be examined on that.

Take the next slide, please Kevin. I'll speak now to the structural, or the restructure of the assessment within Mathematical Methods. One of the questions which has been asked previously, perhaps not today, but it has been previously asked is, is there a change in the structure to the School Assessed Coursework for Mathematical Methods? And although the weightings have changed a little bit, and you can see those weightings on the screen there, the actual SAC work construction, in fact, all of the assessment for Mathematical Methods units three and four has not changed. We still have one Application task in unit three, which should go for four to six hours across one to two weeks.

And then in unit four, we a have two modelling, or problem-solving tasks, or a combination of the two. And they should go for two to three hours duration across one week. We have exam one, being a technology free paper, and we have exam two, being a technology active paper. The technology free exam will continue to go for one hour with 15 minutes’ worth of writing time, and exam two will go for two hours writing time, and 15 minutes of reading time. And this might be where I hand over to Kevin to talk about some of the particulars for assessment within Mathematical Methods, thank you, Kevin.

**Kevin McMenamin** - Thanks, Michael, and good evening to each of those of you who are attending. The part of the presentation here is to talk about investigations, which are being introduced into unit one and two specifically, they are a precursor or a lead into the SAC material that will be undertaken in the three and four level. The whole notion behind these is to give the students a bit more of an awareness of what a SAC does look like in that open-ended nature, and possibly to develop their investigative skills, or application skills, problem solving, or modelling skills through the unit one and two, where it could be linked more directly to some material that you're going to introduce.

Generally, these would be given across one to two weeks, but the two weeks really might be across a weekend. You've started it at the end of one week, and it flows into the new week. We're not, or it's not referring to specifically, you would spend two weeks of classes on these. If you are going to develop them as part of your teaching and learning sequence, they should be integrated into the normal classroom routines that you would be setting up. There are some good topics in a lot of the studies, including methods where it can become an investigative task based on some content that you want to introduce throughout these particular scenarios that you might look at.

The development of the skills throughout certainly would be assessable, could be assessable, and that would be a decision that your school would make as you integrate these into your teaching and learning. There are going to be three components to these, and this is generic across all of the Mathematical studies. They do follow a little bit the SAC structural guidelines that you'd be meeting in unit three and four.

The formulation part is really trying to set up the question itself, it could require some research, it could require some group work tasks to get students aware of what it is they're supposed to be investigating. It could be to give students an opportunity to explore, or ask questions, to develop an introductory phase to the scenario they're going to undertake. The major component, of course, would be the exploration. What are they going to look at? How's that going to be investigated? Is it going to be developed through mathematics within the classroom, by hand, by technology, could there be some development via technology and pseudocode?

The task of the exploration really is the nuts and bolts of the exploration that's being undertaken, what content is involved, what does it look like as that's unfolding as the task is being investigated, and then the communication part as well. How are you going to present it? And there are a variety of presentation options that you can go to, it doesn't have to be written in a booklet, it might be a poster that you want them to present, it could be through a presentation, either via PowerPoint, audio, video, could be in person, in terms of these findings. And that can be quite open in terms of what that communication would in fact look like. The integration of the tasks themselves. It could be a learning activity that you want to develop specifically within a topic area. It could be an assessment task that's a combination of a little bit of content within the class, and an explorative or investigative task that you're undertaking.

How you structure these is really up to you, and how it fits in with the running of your unit one and unit two courses. Some might decide at the end of a couple of the areas of study work that they'll investigate some topic that integrates both of those areas together, and therefore becomes quite a good investigative assessment task. The idea of the learning activities would just purely be at the start end of a topic, and the development of key ideas and skills through that particular investigation. The length of them, we've already talked about, how you set that up in terms of the task itself is really up to you and your school. It is meant to be integrated in, the role as we had already mentioned previously, the computational thinking component really does come into how you would structure and set up your investigation.

Particularly if it's quite open, mind you, the idea of trying to scaffold some learning through the unit one and two area would be certainly encouraged to give the students some idea of what it is they need to undertake as an exploration, or a research, or an application of a particular piece of mathematics. The computational thinking itself could be an inherent application of computational thinking. You may not see it specifically written down, but due to the nature of the task that's being undertaken, how they process their way through it, can certainly then be categorised under the banner of computational thinking. You might be assessing this by observation.

There could be other ways that you're actually assessing that component particularly when it comes into the outcome two and three of the assessment that we are looking at. The idea of the preparation themselves, as we've already talked about, looks at setting them up for the unit three and four SAC tasks. This might be some sort of an example that you might look at and referring to this particular example that's on the screen at the moment, the support material that will be developed and sent out at some stage on the website, will include examples like this one, this one refers to tidal patterns. In terms of the formulation element, it could be researching what it is you want to go and look at. What's the focus of the particular tidal area that you are wanting to concentrate on?

And that may change from student to student, but then the exploration part would start to develop the areas that you have decided to explore. You may want to introduce some of the areas to direct them a little bit more closely, which again, from a unit one and two level, certainly would be encouraged as they go through. The development from here is very open whether you take that on to develop yourself, whether you use the support material as a guide, but essentially that would be how an investigation might look in that one and two level. Just highlighting the three and four SAC outcomes and description, it's particularly the description. I think we would like to take a look at this is no different than has previously been documented in study designs.

It looks at the calculus-based task, and then under three components, the introduction, the general features, and then a variation of, now that variation could extend what was currently being looked at in the second part, or it might digress onto a completely different pathway, but the notion of the tasks themselves is really to create something that's broader, and studied in more depth than anything that would be given on an examination, thus, allowing the students to actually apply the skills that they've learned throughout.

You'll also notice on the left-hand side, under outcome three, where it's specifically mentions the computational thinking, which as I said, does come into this whole idea of these tasks, both at the one, two, and then the three, four level. That in itself really does give you some broad awareness of how these are to be set up, and all of the current documentation on the VCAA website regarding SAC writing SAC samples will still be there to be used as guides when you look to construct these sorts of tasks next year, as well.

And here's the start of what a unit three and four SAC might look like. You'll notice it talks about a general case will begin to be explored in component two, but just at the moment, it's trying to identify key features of a combination of functions, getting students to explore what this might look like given specific values of parameters. How does it develop? What happens to the graph as those parameters begin to change? And then in terms of the context, we're talking about the absorption of a drug into a bloodstream, and how realistic that might in fact be for students as they go through.

Those who have been in the Methods circle for a little while, certainly would recognise this as coming from previous examples of a SAC task, and just structured a little bit differently to flow in with the SAC construction that's currently being undertaken in the new study design. Michael had mentioned the idea of pseudocode earlier, just to give you a broad thinking of what a pseudocode is ging to look like. Essentially, you're going to represent an algorithm pretty much through an English knowledge background, you're going to write some of it, it's certainly going to have some code in there. It's not meant to be a coded program that would go directly into a piece of technology, but it certainly should flow and develop in terms of what you are trying to show through this pseudocode that's being set up.

Most of the pseudocode that would be introduced would only be reasonably short, we're not talking about pages of pseudocode that are going to be developed in the unit one to four of both Methods and Specialist, but certainly students should be able to understand what the algorithm is saying, how they might work their way through it, and to even write some lines themselves. Understandably, if they were going to structure a particular pseudocode, Michael had mentioned the idea of Newton's algorithm earlier, anything where an iterative process is going to be developed, they might actually then go and put it into a calculator under a program. The TI currently has the Python software available. The Casio certainly has the programming available on it as well.

So, through the pseudocode development, there will be specific areas and again, the support material will help to identify some of these areas a little bit more closely, as to where pseudocode may in fact be useful beyond other topics that are actually involved. It is certainly an area that is explicitly mentioned in the study designs, therefore should be taken as being a component to certainly bring in at the one, two level, and then develop a little bit more at the three, four level. And with that, I'll go back to Michael.

**Michael MacNeill** - Thank you, Kevin. I might actually ask you to flip back a slide just to talk to the pseudocode, just adding on to what Kevin was saying. Students would need to be familiar with some of the reserve words for pseudocode. We can see some of them there they're printed in bold, and the particular conventions for representing pseudocode in at least an interpretive sense. Things like the indent, you can see on the screen there that "print a" and "print b" have been indented, and that's one of the conventions for pseudocode.

But I'd also like to reassure everyone as well, that although this is new and probably represents a section of the course that may require a development of teacher capacity, there's still plenty in the course. It's not like we're going to go to exam one and have 30 out of 40 marks allocated to pseudocode, or similar proportions on exam two. It forms a part of the course, but it's certainly nowhere near the whole course. It's something which has come into the course.

And as Kevin had said, there is a very particular part of the support material, which is specifically addressing pseudocode that will go a long way towards assisting teachers in developing their own capacity, and their ability to teach. I'm very conscious of time, this has been a very packed agenda that we've had today. Computational thinking and algorithmic thinking. I'll talk briefly, only very briefly about this. This PowerPoint should be available on the website once quality assurance has gone through the presentation that we're developing tonight during the recorded session.

And as part of the notes, there are many hyperlinks to components on the VCAA website. Algorithmic thinking has been in the F to 12 curriculum, sorry, F to 10 curriculum for a long time. And it really refers to a procedural set of steps. And when you think carefully about how you would teach almost any problem solving in mathematics, it really is a set of procedural steps. The more complicated application, or perhaps interpreting a story question, or something like that, that you might see on exam two, then involves computational thinking, decomposition, spotting patterns, and abstraction, and then employing the particular algorithm in order to develop a solution to a particular problem. It's a means of addressing a complicated scenario, but it's not something which is completely unfamiliar. It's probably more of a re-badging of how teachers are already doing things.

And I think as time progresses, teachers will certainly be surprised at how much computational thinking they're actually already doing. It's really a means of naming the components of the problem solving that that is already happening at a certain level. I might ask you to flip over to the next slide, we're already one minute over time. Now, I have noticed there are some questions in the Q & A, if I can get to some of those, then I will, and if I can't, then my contact details will be on the final slide, or alternatively, you can find my contact details on the study design pages of the study for Mathematics, any of the Mathematics studies has my contact details down the bottom of it.

So, addressing these, support materials are yes, they will be available, they have been developed, we have learning activities, and sample investigations, and creative scenarios for Application tasks and Modelling tasks. And they all form part of the support material. They are being released across the course of the second half of the year. They were always going to be. There are also going to be sample questions, sample examination questions, which are representative of the newer components, or the revised components of the course. Will sample SACs be directly published by the VCAA? No, they won't be, were we to do that, then authentication would become a problem.

However, the difficult part of the SAC writing, the creative component, that's the component that has been addressed and goes, and will be published as part of the support material. Pseudocode, is it going to be examinable? From next year, yes, it will be, it does form a part of the course, and it is part of the study design. However, as I've alluded to, it is not the entirety of the study design, and a teacher should be mindful of the proportion of the key knowledge and key skills within which pseudocode sits. That's not to diminish the importance of it, and it should form part of the teaching and learning for 2023, and the sample questions will provide a good indication of the expectations for students in the examinations at the back end of 2023.

Has the SAC structure effectively changed? The answer is no, we've already looked at that. It is identical to the previous iteration; the weighting is what has changed slightly for the 2023 to 2027 study design. Algorithmic thinking, I've already described this a little bit, would be a procedural mindset, or an approach to problem solving. And the role of computational thinking is really to understand a problem-solving approach, and to provide names to have students be able to articulate how they approach problem solving. And that's where computational thinking really comes into its strengths.

Now, addressing some these questions from the Q & A, could matrices show up on the exam, or can we remove the topic entirely? Matrices will not show up on the exam. They do not form part of the key knowledge and key skills for units three and four. And that is what the exams are written from. You could, here we go again, there we go, get those lights again. Sorry about that folks. Students could however, if they wish to use a matrix approach, they could use a matrix approach for questions, but it's certainly not going to be a question that's framed, I'm thinking particularly of transformation questions of say a function, or an integral or something like that, that's appeared on the exams in the past few years.

Changes to the formula sheet, or to the exams are made by a panel after consideration. That consideration process is currently undergoing, and we'll take the course of the second half of the year. It is the kind of thing that we want to get right first time, we don't want to release a formula sheet, or sample questions, or any other material for that matter, and then have to either retract, or redact, or adapt them further, we want to make sure it's right first time.

Will the VCAA provide examples and resources that schools can use in the development of SACS, and the assessing of SACS at three and four, and one and two? Yes, absolutely. Kinematics, kinematics in Maths Methods is now really under aspects of motion graphs. And the notion is to apply both differential, and integral calculus notions to probably straight-line graphs. We could apply the notions that may have appeared in Specialist Maths, but there's a steering away from that. We're not looking to enforce kinematics as a required, or an implied context for units one to four, however, teachers should be aware that contextualization remains a component of Mathematical Methods, and so applications of calculus, both integral and differential should continue to be a part of the teaching and learning process.

Very mindful of the time, we've gone one minute over our reserve time here. So, folks, this is where we're going to have to wind up the webinar, I would like to thank you as teachers for your ongoing fulfillment of care for the students, and for the continued work that you are doing in that particular space. I've come out of the classroom after close to 20 years, and teaching over the last two years has been difficult, it continues to be difficult. I thank you for your ongoing efforts in this regard.

My contact details should be on screen at the moment. And as I alluded to it, you can find them as hyperlinks on the study design pages, particularly for Maths Methods, also for Specialist, Foundation, and General Mathematics. Any of those are going to going to get you through to be able to contact me. I'm happy to engage in conversation over the phone, or to answer emails, and I do try to do address those as promptly as possible. I thank you again for your time tonight and wish you all the best in your ongoing efforts.

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