So this is Video 2 in Mathematical Methods Unit 4, probability and statistics modelling or problem-solving task. In this task we will look at, we'll identify the information and the sources. We will state questions of interest and analysis. We'll identify the relevant content that we want the students to look at. And I will show you the written version of Part 1, remembering that I said that this task has three parts.

So these links are useful to look at for information and sources that you would like your students perhaps to explore before the task is introduced. And the last one I actually used to develop my own histogram, which is in Part 2 of the task.

So, the questions of interest, how has human height changed over time? How does human height vary between males and females? How has human height changed over time in secondary school students? I'm trying to make it relevant to the students at the time. The relevant content is in terms of probability, normal distribution of heights of males and females, mean and standard deviation of the normal distribution, graphing the probability density function for males and females, areas under the normal curve. And then, this first part looks at one, two and three standard deviations either side of the mean, and quantiles in the probability density function. And in this case, I've looked at 50% centred around the mean, or in different places.

So, this is where I started the height distributions, the name of my task. And this is the table I showed you before. This task assumes a normally distributed population for both males, which I've called M, and females, which I've called F, in centimetres with the following parameters at a given period of time, where the mean is 176 of males, standard deviation is 7.5. And the mean is 162 for females and the standard deviation is 7.

I've put up again in this second video, the formula that I had before, I think it's absolutely worth students starting with these graphs and trying to graph them themselves on their calculator, noting that they are exponential functions with an asymptotic nature. So, the first one is the standard normal distribution, and I find that students find it hard to get it onto their calculator.

So, it's very good practice for them to test their view window on their calculator so that they can get a good, nice looking bell curve. And then the normal distribution has parameters of the standard deviation and the mean. And what's really nice is we can start there by varying those parameters. So, as I said, the students can find a graph themselves, and I find that they say, 'there I've got it'. And when they look at their friends and see if they've managed to get a nice-looking bell curve.

Part 1 of the task I started with graph g and f for several different sets of values of the parameters for f in each case. So, g was the standard normal, which I just had in the previous slide. And f is the equation for the parameters using standard deviation and mean. So, I would start by getting your students to do various values of the mean and a standard deviation and see what the graph looks like, and then discuss it in terms of transformations. Have we dilated the original graph or have we translated the original graph? So that gives them an understanding of the relationship with that formula Z equals X minus mean on standard deviation. It actually gives them a feeling of what happens, particularly with the translation of the normal distribution. So, that's the start.

And then I would consider the actual distributions of M and F where I've given you the mean and standard deviation. And I would get students to graph them on the same set of axes. Now, again, that's quite difficult to actually graph. And if we look at them, I had to spread my x-axis quite wide to get some bell curves there. So, there's my male and female. And students ought to be able to see that one of them is wider than the other, therefore referring to the standard deviation. And one of them is to the right of the other, referring to the mean being moved. So, that's good practice for students to graph those and have a go at graphing them together.

Then part C, for each of those graphs of M and F that they've drawn ask the students to identify symmetrical intervals that are one, two and three standard deviations on either side of the mean, and rather than using norm CDF on your calculator, actually asking the students to use integration, to calculate the corresponding areas. And from there, they will find these 68, 95 and 99.7% confidence intervals. But I think it's a good idea to start from the area under the curves.

And then part D for this first part is for each of the males and females, find the interval corresponding to the middle 50% of the population heights. And this can be done in several ways. It can be done using your norm CDF on your calculator, or it can be done looking at areas and finding the middle 50% of the population, just to get a feel of what happens to the population around the centre or around the mean of the distribution.

And then I would suggest that you ask students to find several other non-symmetrical intervals. In other words, intervals that are not centred around the mean, but that also contain 50% of the respective population heights. And so this is a very good student choice question where students sitting next to each other, won't get the same answer. There'll be exploring 50% might be down the left-hand end of the bell curve or the right-hand end.

So, finishing this first part, the topic was in this first part of the task was continuous variables. They're actually drawing a probability density function, and they're looking at areas under the PDF, and they're looking at the normal distribution and key features of the normal curve. In other words, the mean, and the standard deviation and the fact that it looks like the bell curve. Transformations of a normal curve from the standard curve and one, two and three standard deviations, either side of the mean and then asking the students to look at symmetrical and non-symmetrical intervals under the curve. So, that's the end of part one of the task.

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