Sounds harmonious

Sine curves

JANICE
Well you've shown me how to produce a sine curve through a musical note, but what does it mean mathematically?

ALAN
We tend to think of the sine curve as coming from a circle mathematically. Erm it's…if I can just show you using the bodhran here. The bodhran is of course a circle, and if you imagine a diameter running across here, and then imagine a point that travels round the circumference of the bodhran, round and round, and we take measurements of its height at each point. So for instance the height is zero there, it's on the diameter. Here, that's the measurement of height. Here, that's the measurement of height, and so on. So it reaches a maximum here, then it comes back to zero. Then a minimum here, and then back to zero. And if you were to plot those heights against the angle that it makes at each stage, the graph that you would get would start at zero, then reach a maximum, go through zero, reach a minimum, go through, and so on.

JANICE
And that gives you your sine curve, yeah.

ALAN
And that's a sine curve, that's where the sine curve comes from yes.

The mathematical origins of a sine curve may become clearer if shown graphically. A circle with a diameter, moveable point P. As point P moves anti-clockwise around the circumference of the circle, it moves further from the diameter line until it reaches a maximum at the top of the circle. It then returns to the diameter line, and reaches a minimum at the bottom of the circle, before returning to the line once again. Here are two measures that can be taken as P moves around the circle. The distance from to the diameter line, and the angle that P makes at the centre of the circle, in degrees. Plotting one against the other at each stage produces the sine curve.

JANICE
Now you're talking there about angles. Presumably you're measuring them in degrees are you?

ALAN
You can do, yes. Er the angle here is zero. If you…if you come up to the top of the clock, that's a right angle so the angle is 90%. So it goes zero, 90, 180, 270, 360. But you don't have to measure them in degrees and in fact mathematicians prefer to use a different measurement called radiant's. Purple circle A/B with white radius line radius line moves to circumference to form arc s/i angle from arc to centre circle circle divides into segments diagram A/B with horizontal axis showing rotations in degrees
replace degrees with radiant scale

JANICE
Does that come from radius?

ALAN
It does, yes. Let's…I've got a little bit of ribbon here. If I mark off the length of the radius there, and then if I were to put that on the circumference like that, it makes an arc. And the

length of that arc marked off to the centre gives you an angle - that angle. That angle is one radiant. It's about 57 degrees something like that. You can think of it as little chunks of Dairylea cheese - there are roughly six of them.

ALAN
The radiant is derived from the radius. The length of the radius when placed on the circumference of the circle forms an arc. The angle that this arc makes with the centre of the circle is called one radiant, which is approximately 57 degrees. Use this arc length to step around the circumference, and it will go six times with a little bit left over. More exactly, the arc will go around the circle 2 Pi times, which is about 6.28 times. When explaining the origins of the sine curve mathematically, we plotted the movements of point P against the angle measured in degrees. If the angle is measured in radians it looks like this, exactly the same curve, but with a different scale on the horizontal axis.
[SCALE PLAYED ON KEYBOARD]