# 0.1P

### 1. Select and describe a workshop that you best represented the band

The workshop where I contributed most was the 'Trigonometric functions' workshop in week 6. The week was all about trigonometry and linking new knowledge to any prior knowledge from secondary school. We learnt all common trigonometric ratios with SOH CAH TOA, the special triangles, how to use the unit circle for many purposes, and lots more in-between. We learnt how to utilise these tools to solve simple problems like finding angles in right-angle triangles to more complex problems like sketching graphs using the unit circle as a guide.

As I only had basic remembrance from high school, my team members assisted me greatly and in return I assisted them when they struggled. I have been the de facto spokesperson for our team so I represented them to the other teams and the teacher verbally.

### 2. Discuss an activity in this workshop that enabled significant learning opportunities. Include collaboration.

The unit circle was introduced roughly halfway through the workshop. It soon presented itself as an invaluable tool that could have many lessons derived from it. We first encountered the unit circle after learning about the Pythagorean cult and about the equation $x^2 + y^2 = 1$ which forms said unit circle.

The first fact we learnt was that a unit circle is a tool for determining values of $\sin$ and $\cos$ quickly. They are inextricably linked to each other through the trigonometric ratios. My team member and I watched as the $\sin$ value increased and reached the $\frac{\pi}{4}$ ($\frac{\sqrt{2}}{2}$) on the unit circle. The same was then done for the $\cos$ function. Combined, these formed the coordinates ($\frac{\sqrt{2}}{2}$, $\frac{\sqrt{2}}{2}$). This moment linked the Pythagorean theorem with trigonometry, showing that triangles and circles are strongly linked, even though they seem they should be completely different. On reflection, it also connected $\frac{1}{2} \times \frac{1}{2}$ squares and how their diagonal is also $\frac{\sqrt{2}}{2}$.

Connected again to the coordinates of ($\frac{\sqrt{2}}{2}$, $\frac{\sqrt{2}}{2}$), when the $x$ and $y$ were extended from the unit circle creating the ratio for $\tan$ and created a bigger triangle felt mindblowing. I had seen the unit circle before but having it explained in clear terms was gratifying. Specifically, the knowledge we learnt about similar triangles mere minutes before connected beautifully to the $\sin$-$\cos$ triangle being a smaller similar triangle to the $\tan$ triangle.

The idea of radians always eluded me and, from my (former) outsider's perspective, it seemed archaic and seemingly only for math purists who demanded rigour. Furthermore, $\pi$ felt like a magic number that seemed to come from nowhere. I asked myself 'Why bother learning these?'. Later, seeing the value of $\pi$, $\frac{\pi}{4}$, $\frac{\pi}{2}$ etc. as the angles in the unit circle helped the idea of radians and $\pi$ click in my head. Furthermore, playing around with the radian-to-degree and degree-to-radian formulas also helped with coming to terms with having a 'magic number' and fractions of it instead of degrees make sense. I can now appreciate the simplicity of radians being used instead of degrees.

With my new understanding of the unit circle, I could mentally approximate values of $\sin$ and $\cos$ like $\cos\left(\frac{\pi}{5}\right) \approx \cos(\frac{\pi}{4})$ and $\cos\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$. While not a commonly applicable skill, the idea of being able to do it was enough motivation to learn more. A more applicable skill was learning the radians and their degree counterparts. One of my team members did seem enthused about learning the radian-degree conversions as discussed later.

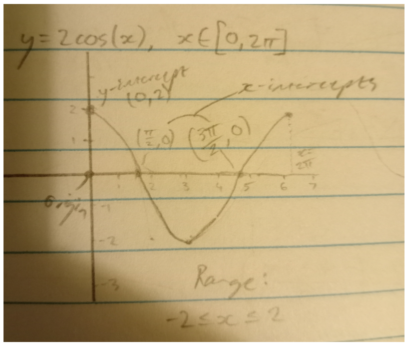
## 3. Evidence of contributions and 4. What I learned from each

| $\theta$ (rads) | $0$ | $\frac{\pi}{6}$ | $\frac{\pi}{4}$ | $\frac{\pi}{3}$ | $\frac{\pi}{2}$ | $\pi$ | $\frac{3\pi}{2}$ | $2\pi$ |
|---|---|---|---|---|---|---|---|---|
| $\theta$ (deg) | $0^\circ$ | $30^\circ$ | $45^\circ$ | $60^\circ$ | $90^\circ$ | $180^\circ$ | $270^\circ$ | $360^\circ$ |
| $x = \cos(\theta)$ | $1$ | $0.866$ | $0.707$ | $0.5$ | $0$ | $1$ | $0$ | $1$ |
| $y = \sin(\theta)$ | $0$ | $0.5$ | $0.707$ | $0.866$ | $1$ | $0$ | $-1$ | $0$ |
| Unit circle coordinates | $(1, 0)$ | $(0.866, 0.5)$ | $(0.707, 0.707)$ | $(0.5, 0.866)$ | $(0, 1)$ | $(-1, 0)$ | $(0, -1)$ | $(1, 0)$ |
| $\tan(\theta)$ | | | | | $\text{undef.}$ | | $\text{undef.}$ | |

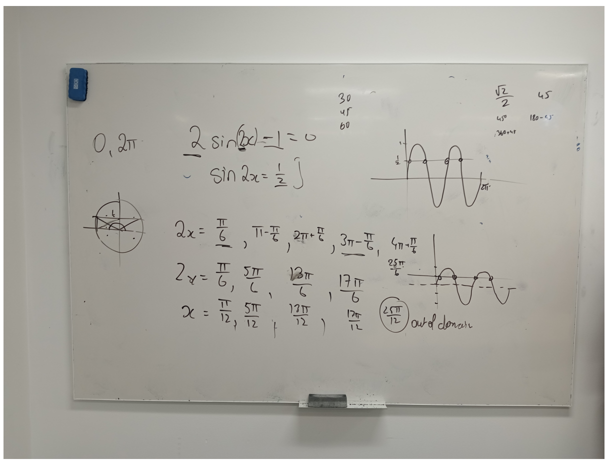
I made this table alongside the class to show how $\cos$ and $\sin$ apply to the unit circle and to help understand how to utilise the CAST system for determining classification of points in unit circle quadrants. It served as an excellent reference guide for certain problems and for understanding the unit circle at a more cellular level.

| Degrees | Radians | | Degrees | Radians |
|---|---|---|---|---|
| $0^\circ/360^\circ$ | 0 or $\frac{12\pi}{6}$ rad | | $144^\circ$ | $\frac{4\pi}{5}$ rad |
| $30^\circ$ | $\frac{\pi}{6}$ rad | | $150^\circ$ | $\frac{5\pi}{6}$ rad |
| $36^\circ$ | $\frac{\pi}{5}$ rad | | $180^\circ$ | $\pi / \frac{6\pi}{6}$ rad |
| $45^\circ$ | $\frac{\pi}{4}$ rad | | $210^\circ$ | $\frac{7\pi}{6}$ rad |
| $60^\circ$ | $\frac{\pi}{3} / \frac{2\pi}{6}$ rad | | $225^\circ$ | $\frac{5\pi}{4}$ rad |
| $72^\circ$ | $\frac{2\pi}{5}$ rad | | $240^\circ$ | $\frac{4\pi}{3} / \frac{8\pi}{6}$ rad |
| $90^\circ$ | $\frac{\pi}{2} / \frac{2\pi}{4} / \frac{3\pi}{6}$ rad | | $270^\circ$ | $\frac{3\pi}{2} / \frac{9\pi}{6}$ rad |
| $108^\circ$ | $\frac{3\pi}{5}$ rad | | $300^\circ$ | $\frac{5\pi}{3} / \frac{10\pi}{6}$ rad |
| $120^\circ$ | $\frac{2\pi}{3} / \frac{4\pi}{6}$ rad | | $315^\circ$ | $\frac{7\pi}{4}$ rad |
| $135^\circ$ | $\frac{3\pi}{4}$ rad | | $330^\circ$ | $\frac{11\pi}{6}$ rad |

For practice in developing my understanding of radians and the unit circle, I calculated a reference table of degrees in radians by hand.
Unfortunately, most of contributions to my team members were verbal or in their notebooks and trying to remember the details of most of them would be dishonest. One situation I do remember is I tried explaining radians to my team member to see if I understood the topic well enough. I showed my above reference table of degrees in radians and compared that with the unit circle to give her a visual aid and it helped both of us in that moment. Calculating the non-simplified values (like leaving $\frac{2\pi}{4}$ alongside $\frac{\pi}{2}$ for $90^\circ$) was a dramatic turning point in both our understanding. In return, she pointed out details I missed in my table (formatting errors, incorrect values) and helped me rectify them.




Here my team member helped me draw a $2\cos(x)$ graph. He and Jonathan linked the unit circle to how the values of $\cos$ progress as $x$ changes by tracing around the unit circle as the line was drawn to show the value changing. From their help, I could try experimenting in drawing bigger values than $-1..0..1$ while using a modified unit circle of $x^2 + y^2 = 4$.




During the second class of the workshop, I struggled immensely with understanding how to find the 'next' part of a periodic function. I could find the initial component correctly but I was stuck on how to calculate the next. He showed me the geometric way to find the next value using the unit circle on the centre-left.
$\arcsin\left(\frac{1}{2}\right) = \frac{\pi}{6}$. Meaning at $180^\circ$ over, or $\pi$ over at $\pi - \frac{\pi}{6} = \frac{5\pi}{6}$, there is another interval. At a full $360^\circ$ at $2\pi + \frac{\pi}{6} = \frac{13\pi}{6}$ is another interval and so forth.
I asked Jonathan for help and if he could draw some diagrams to help me understand better. I only asked the questions so I can not take any credit for the actual help provided to me and seemingly to most of the rest of the class by Jonathan's explanation. I now completely understand the concept at least at a basic level thanks to his help. I can give myself credit for participating in the workshop by seeing an important yet underdiscussed topic and bringing it to the attention of Jonathan.