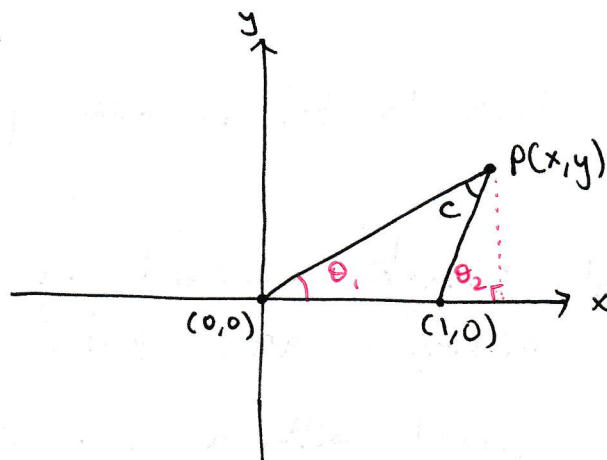Q1) • Sketch $y = \ln x$, on a set of axes.

• Now sketch $y = \log_{10} x$ and $\log_2 x$, on the same set of axes.

• Why do they look the way they do?

• Now sketch $y = \log_x e$ on a new set of axes, reason what you do.

• Using what you did at some point in sketching that graph, compute $\lim_{n \to \infty} (1 + \frac{1}{n})^n$.

Q2) • Consider

• Find the locus of all points P, such that P is as in the diagram with c an arbitrary fixed angle.

    Hint: Construct θ_1 and θ_2 as shown in the diagram.

• Are $(0,0)$ and $(1,0)$ on the locus?

• What would happen if $\theta = \frac{\pi}{2}$?

Q3) • Prove that $n^3 - n$ is divisible by 3, $n \in \mathbb{Z}^+$.

• Prove that $n^5 - n$ is divisible by 5, $n \in \mathbb{Z}^+$.

• For what values of p does p divide $n^p - n$? ($n \in \mathbb{Z}^+$)

    Hint: Try induction.

• Do you know what this result is called?