1. [6 marks]

    Plot P $(2,\pi)$ and Q $(4, -\dfrac{\pi}{3})$ and hence, find the exact length of $\overline{PQ}$.
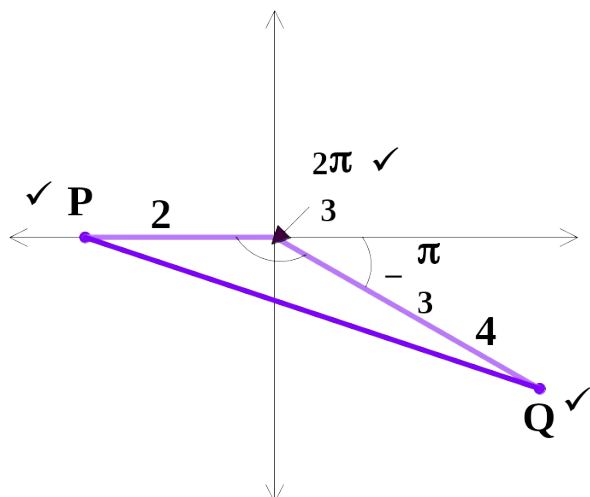
2. [5, 5 = 10 marks]

    a) Find the Cartesian co-ordinates of the point with polar co-ordinates $(2, \dfrac{\pi}{3})$.

    b) Transform the Cartesian co-ordinates (1,-1) into polar co-ordinates where $0 < \theta \leq 2\pi$.

1.

$$PQ = \sqrt{2^2 + 4^2 - 2(2)(4)\cos\left(\frac{2\pi}{3}\right)} \quad \checkmark\checkmark$$

$$= 2\sqrt{7} \quad \checkmark$$

2. a) For $\left(2, \dfrac{\pi}{3}\right)$,

$x = r\cos\theta = 2\cos\dfrac{\pi}{3} = 1$ ✓✓

$y = r\sin\theta = 2\sin\dfrac{\pi}{3} = \sqrt{3}$ ✓✓

∴ the Cartesian co-ordinates are $(1, \sqrt{3})$. ✓

b) For $(1,-1)$,

$r^2 = x^2 + y^2 = 2 \Rightarrow r = \sqrt{2}$ ✓✓

As $(1,-1)$ is in the 4th quadrant, θ must lie in the 4th quadrant. ✓

$\tan\theta = \dfrac{-1}{1} \Rightarrow \theta = \dfrac{7\pi}{4}$ ✓

∴ the polar co-ordinates are $\left(\sqrt{2}, \dfrac{7\pi}{4}\right)$. ✓