# 0.2 Complex Numbers on the Number Plane Problem Set

Summary of lesson: We can represent a complex number $a+ib$ as $r(cos(\theta)+isin(\theta)) = re^{i\theta}$ where $r$ is the distance from the origin of the complex number and $\theta$ is the angle it makes with the positive x-axis.

1. Plot each of these complex numbers on the complex plane

(a) $2+3i$ (b) $2(cos(\pi/4)+isin(\pi/4))$ (c) $3e^{5\pi i/4}$

2. Plot each of these complex numbers on the complex plane. What happens to the angle they make with the positive x-axis when multiplied together?

(a) $e^{7\pi i/8}$ (b) $e^{\pi i/4}$ (c) $e^{7\pi i/8}e^{\pi i/4}$

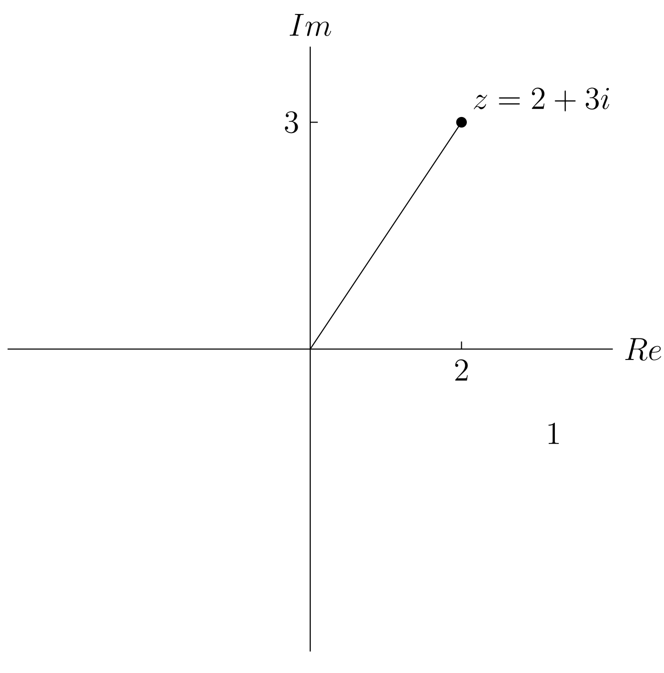
3. Represent each of these numbers in polar and exponential form

(a) $1+i$ (b) $i$ (c) $-1$

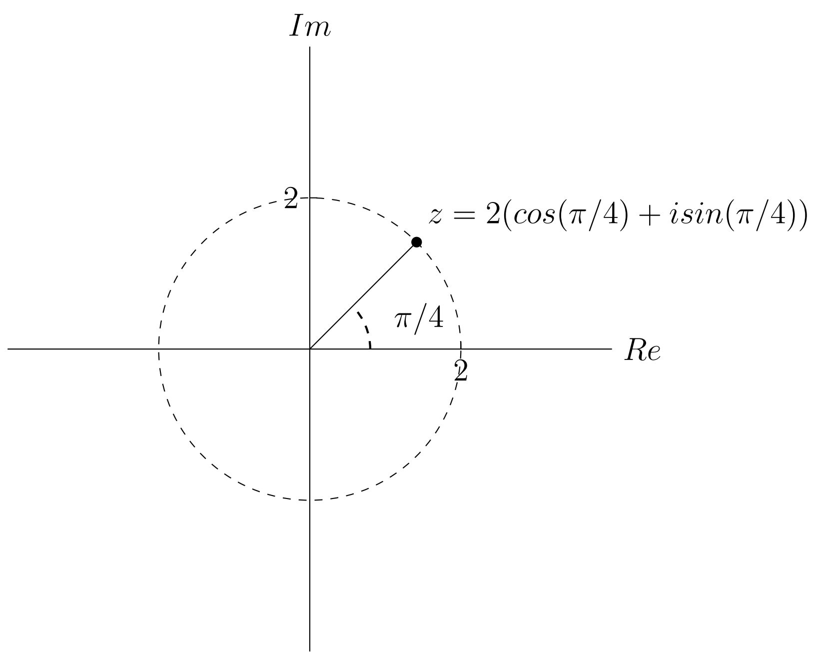
4. Plot $1+i$ on the complex plane then plot $i(1+i) = -1+i$ on the complex plane. In Q3 we found $i = e^{i\pi/2}$, what happens when we multiply a complex number by $i$?

**Answers**

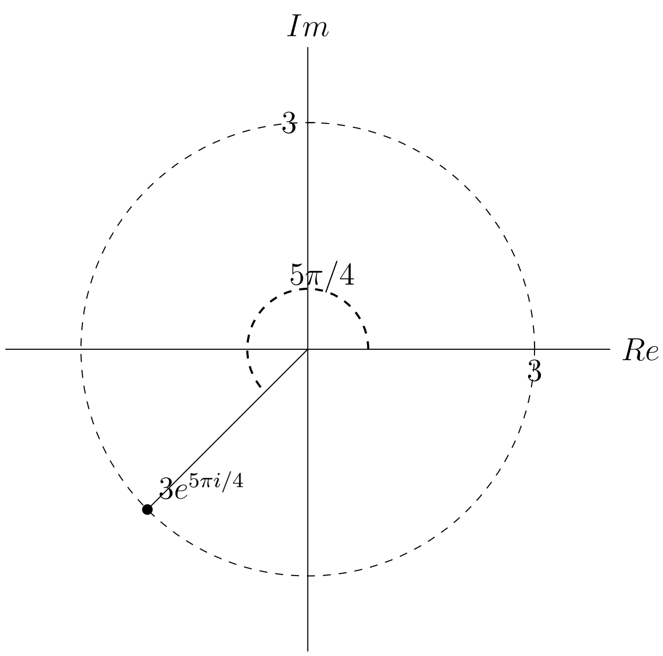
1.




(a)




(b)




(c)

2. When multiplying two complex numbers the angle adds together, $e^{i\theta}e^{i\phi} = e^{i(\theta+\phi)}$

3.

(a) $1 + i = \sqrt{2}(cos(\pi/4) + isin(\pi/4)) = \sqrt{2}e^{i\pi/4}$

(b) $i = cos(\pi/2) + isin(\pi/2) = e^{i\pi/2}$

(c) $-1 = cos(\pi) + isin(\pi) = e^{i\pi}$

4. When we multiply a complex number by $i$, geometrically we are rotating that complex number anti-clockwise by $\pi/2$ radians.