Prelab 1

Ravitashaw
(xb369)

1) (a) $(1 + 3j) - (-6 + 4j)$

$= 1 + 3j + 6 - 4j = \underline{7 - 1j}$

(b) $\frac{3 - j}{5j} = \frac{(3 - j)j}{5j \times j} = \frac{3j - j^2}{5j^2}$

$= \frac{3j - (-1)}{5 \times (-1)} = \underline{\frac{-1}{5} - \frac{3}{5}j}$

(c) $(-4 - \sqrt{-9})(4 + \sqrt{-25})$

$= (-4 - 3j)(4 + 5j)$

$= -16 - 20j - 12j + 15$

~~$= -1 - 32j$~~

$= \underline{-1 - 32j}$

2) (a) $u + v = \underline{(a + c) + (b + d)j}$

(b) $u \times v = \underline{(ac - bd) + (ad + bc)j}$

(c) $uu^* = (a + bj)(a - bj)$

$= \underline{a^2 + b^2}$

2)

(d) $\frac{1}{u} = \frac{1}{a+bj} = \frac{(a-bj)}{(a+bj)(a-bj)}$

$= \frac{(a-bj)}{(a^2+b^2)} = \frac{a}{a^2+b^2} - \frac{bj}{a^2+b^2}$

(e) $\frac{u}{v} = \frac{a+bj}{c+dj} = \frac{(a+bj)(c-dj)}{(c+dj)(c-dj)}$

$= \frac{(ac+bd) + (bc-ad)j}{c^2+d^2}$

or, $\frac{(ac+bd)}{(c^2+d^2)} + \frac{(bc-ad)}{(c^2+d^2)} j$

3)

(a) $j^3 = j^2 \cdot j = -j$

(b) $j^4 = (j^2)^2 = (-1)^2 = 1$

(c) $j^5 = (j^2)^2 \cdot j = 1 \cdot j = j$

(d) $j^6 = (j^2)^3 = (-1)^3 = -1$

(e) $j^{2001} = (j^2)^{1000} \cdot j = (-1)^{1000} \cdot j = j$

4) (a) $z = 0 + j2$

$r = \sqrt{x^2+y^2} = \sqrt{0^2+2^2} = 2$

$\theta = \tan^{-1}(2/0) = \tan^{-1}(\infty) = \pi/2$

$z = re^{j\theta}$

$= 2e^{j(\pi/2)}$

(b) $z = -3 - j\times 4$

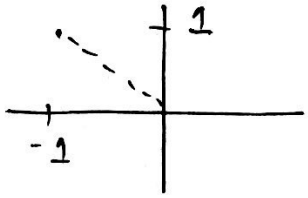
$r = \sqrt{(-3)^2+(-4)^2} = 5$

$\theta = \tan^{-1}(-4/3) = 0.927$ radians

$z = re^{j\theta}$

$= 5e^{j\times 0.927}$

(c) $z = (-1, 1)$



$r = \sqrt{(-1)^2+(1)^2} = \sqrt{2}$

$\theta = \tan^{-1}(1/-1) = \tan^{-1}(-1) = -\pi/4$

$z = re^{j\theta} = \sqrt{2}e^{-j\pi/4}$

(d) $z = (0, -1)$

$r = \sqrt{0^2 + (-1)^2} = 1$

$\theta = \tan^{-1}(-1/0) = \tan^{-1}(-\infty) = -\pi/2$

$z = re^{j\theta}$

$= 1 \cdot e^{-j\pi/2}$

5) $u = 3+4j$

$v = 1+12j$

$w = 7-5j$

$ux + v = w$

$(3+4j)x + (1+12j) = 7-5j$

$(3+4j)x = 6-17j$

$x = \frac{(6-17j)}{(3+4j)} \times \frac{(3-4j)}{(3-4j)}$

$= \frac{18-24j-51j-68}{3^2-(4j)^2} = \frac{-50-75j}{25}$

$= -2-3j$

$\therefore \boxed{x = -2-3j}$