Ex: Plot each of the following complex numbers as vectors in the complex plane:

a) j

b) $e^{j\pi/2}$

c) $\dfrac{1+j}{2} - \dfrac{1-j}{2}$

d) $\dfrac{1}{j^3}$

e) $\dfrac{1+j}{1-j}$

Sol'n: All of the answers are equal to j after being simplified. The following plot is the answer for every question.
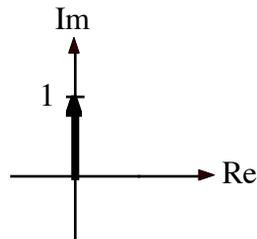
a) See above plot. Note that j has unit length and is at an angle of 90° to the real axis.

b) We use Euler's formula.
$$e^{j\pi/2} = \cos(\pi/2) + j\sin(\pi/2) = 0 + j1 = j$$

c)
$$\frac{1+j}{2} - \frac{1-j}{2} = \frac{1}{2} + j\frac{1}{2} - \frac{1}{2} + j\frac{1}{2} = j$$

d) Note that $1/j = -j$.
$$\frac{1}{j^3} = (-j)^3 = -j^3 = --1j = j$$

e) We can rationalize the value. We do this by multiplying the numerator and denominator by the conjugate of the denominator.

$$\frac{1+j}{1-j} = \frac{1+j}{1-j} \cdot \frac{1+j}{1+j} = \frac{1+j2-1}{1^2+1^2} = \frac{j2}{2} = j$$