> A phasor is a complex number that represents the amplitude and phase of a sinusoid.

A complex number z can be written in rectangular form as,

$$z = x + jy$$

x is the real part of *z*; *y* is the imaginary part of *z*. In this context, the variables *x* and *y* do not represent a location as in two-dimensional vector analysis but rather the real and imaginary parts of *z* in the complex plane. Nevertheless, we note that there are some resemblances between manipulating complex numbers and manipulating two-dimensional vectors.

The complex number *z* can also be written in polar or exponential form as

$$z = r\angle\phi = re^{j\phi}$$

The relationship between the rectangular form and the polar form is shown in Fig. 4.10, where the *x* axis represents the real part and the *y* axis represents the imaginary part of a complex number. Given *x* and *y*, we can get *r* and f as

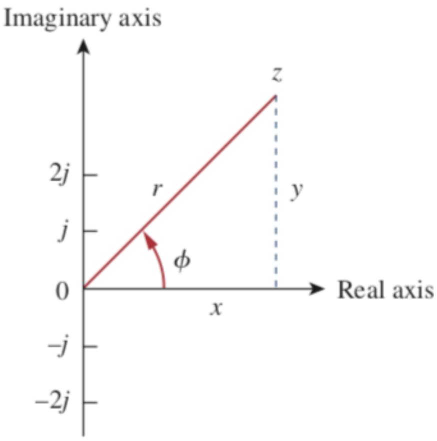

Figure 5.1

$$r = \sqrt{x^2 + y^2}, \quad \phi = \tan^{-1}\frac{y}{x}$$

Given a sinusoid

$$v(t) = V_m \cos(\omega t + \phi)$$

we obtain the corresponding phasor as

$$V = V_m\angle\phi$$

Table 5.1

Sinusoid-phasor transformation.

Time domain representation	Phasor domain representation
$V_m \cos(\omega t + \phi)$	$V_m \underline{/\phi}$
$V_m \sin(\omega t + \phi)$	$V_m \underline{/\phi - 90^\circ}$
$I_m \cos(\omega t + \theta)$	$I_m \underline{/\theta}$
$I_m \sin(\omega t + \theta)$	$I_m \underline{/\theta - 90^\circ}$

Transform these sinusoids to phasors:

$$i = 6\cos(50t - 40^\circ)A$$
$$v = -4\sin(30t + 50^\circ)V$$

(a)

$$I = 6\angle - 40^\circ A$$

(b)

$$-\sin A = \cos(A + 90^\circ)$$
$$v = -4\sin(30t + 50^\circ) = 4\cos(30t + 50^\circ + 90^\circ)$$
$$= 4\cos(30t + 140^\circ)V$$

Thus, the phasor form of *v* is

$$V = 4\angle 140^\circ V$$