Chapter 4 Figures From

MATHEMATICAL METHODS for Scientists and Engineers

Donald A. McQuarrie

For the Novice Acrobat User or the Forgetful

When you opened this file you should have seen a slightly modified cover of the book *Mathematical Methods for Scientists and Engineers* by Donald A. McQuarrie, a menu bar at the top, some index markers at the left hand margin, and a scroll bar at the right margin.

Select the **View** menu item in the top menu and be sure **Fit in Window** and **Single Page** are selected. Select the **Window** menu item and be sure **Bookmarks** and **Thumbnails** ARE NOT selected.

You can and probably should make the top menu bar disappear by pressing the function key F9. Pressing this key (F9) again just toggles the menu bar back on. You may see another tool bar that is controlled by function key F8. Press function key F8 until the tool bar disappears.

In the upper right hand corner margin of the window containing this text you should see a few small boxes. DO NOT move your mouse to the box on the extreme right and click in it; your window will disappear! Move your mouse to the second box from the right and click (or left click); the window containing this text should enlarge to fill the screen. Clicking again in this box will shrink the window; clicking again will return the display to full screen.

The prefered means of navigation to any desired figure is controlled by the scroll bar in the column at the extreme right of the screen image. Move your mouse over the scroll bar slider, click, and hold the mouse button down. A small window will appear with the text "README (2 of 28)". Continuing to hold down the mouse button and dragging the button down will change the text in the small window to something like "4.4 (6 of 28)". Releasing the mouse button at this point moves you to Figure 4.4 of Chapter 4. The (6 of 28) indicates that Figure 4.4 resides on page 6 of the 28 pages of this document.

ANIMATIONS

There are no animations in this chapter.

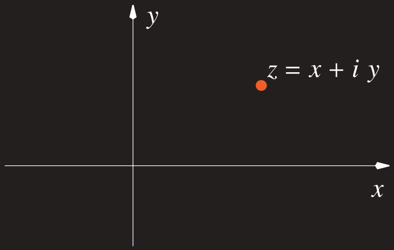

Figure 4.1
The complex plane. The real part of $z = x + i\,y$ is plotted along the horizontal axis and the imaginary part is plotted along the vertical axis.

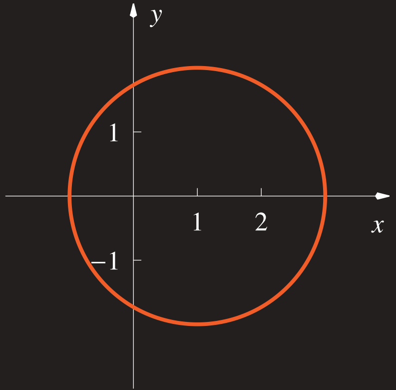

Figure 4.2
The graph of $|z - 1| = 2$ or $(x - 1)^2 + y^2 = 4$, in the complex plane.

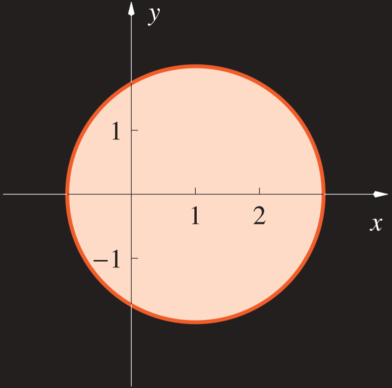

Figure 4.3
The region in the complex plane described by $|z - 1| \le 2$, or $(x - 1)^2 + y^2 \le 4$.

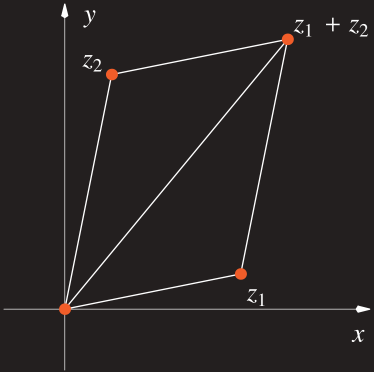

Figure 4.4
A geometrical interpretation of the addition of two complex numbers, z_1 and z_2.

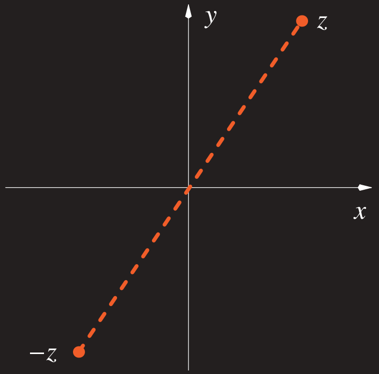

Figure 4.5
The negative of a complex number is its reflection through the origin.

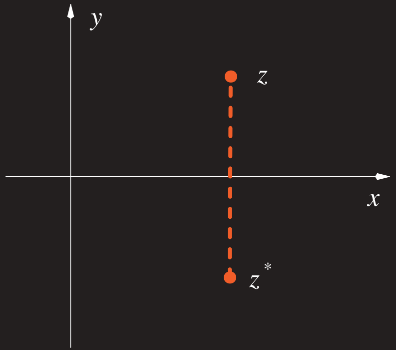

Figure 4.6
The complex conjugate of a complex number is its reflection through the x axis.

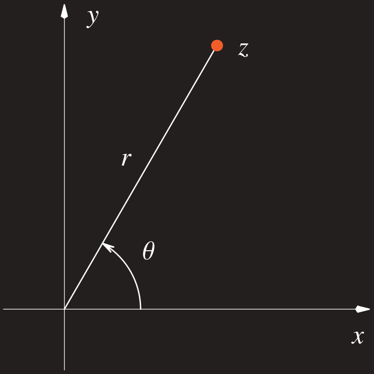

Figure 4.7
The polar form of z locates the point z by specifying r and θ.

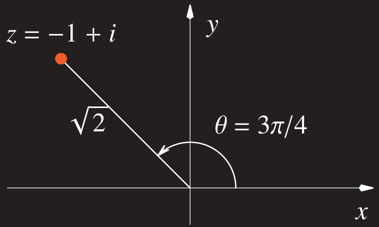

Figure 4.8
The complex number $z = -1 + i$ in polar form.

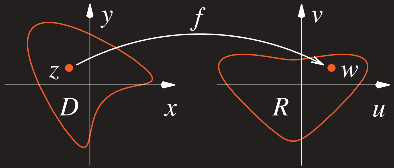

Figure 4.9
An illustration of a mapping from the z-plane to the w-plane. D represents the domain of w and R represents the range of w.

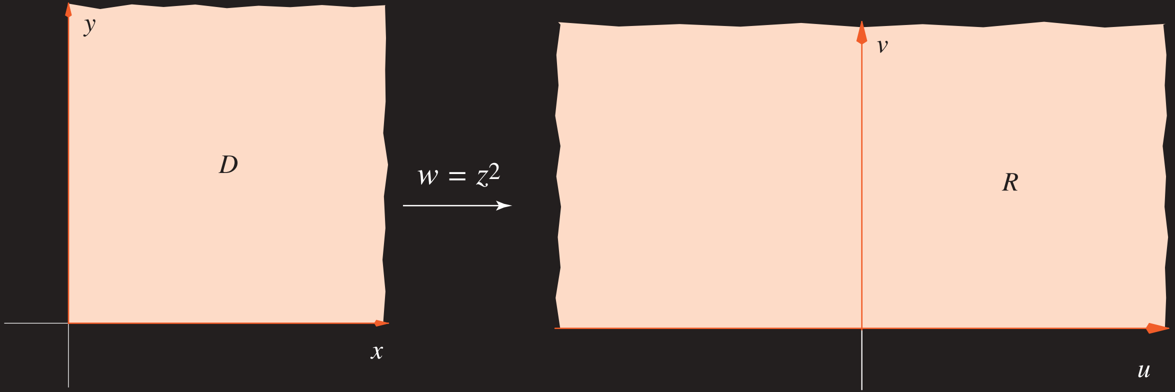

Figure 4.10
The domain and range of the mapping $w = f(z) = z^2$ for $0 < x < \infty$ and $0 < y < \infty$.

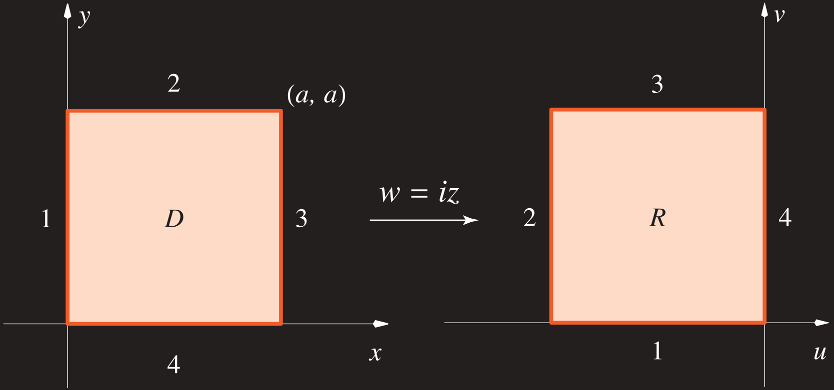

Figure 4.11
The domain and range of the mapping $w = f(z) = i\,z$ for $0 < x < a$ and $0 < y < a$.

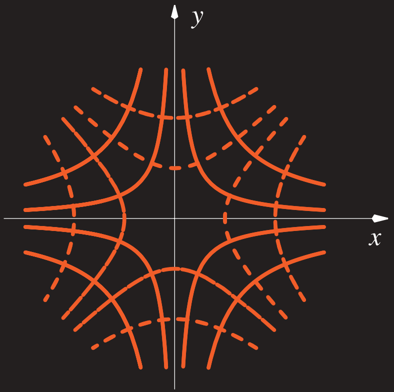

Figure 4.12

The two families of curves, $x^2 - y^2 = u_0$ (dashed) and $2xy = v_0$ (solid).

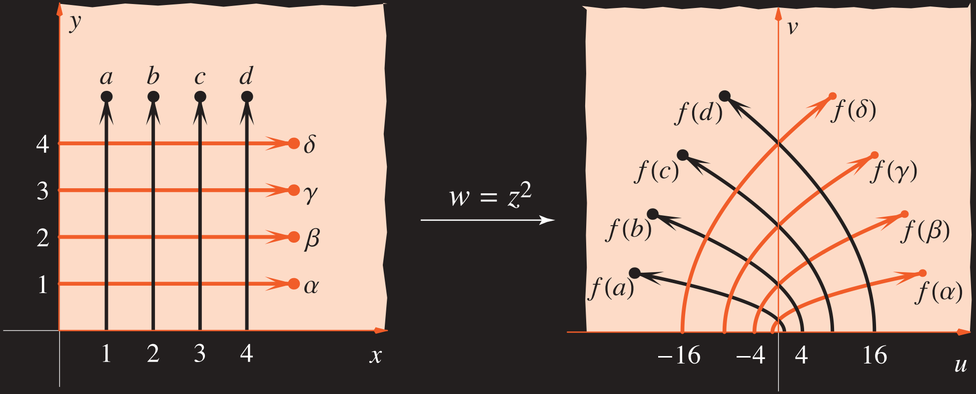

Figure 4.13

The lines in the z-plane that are to be mapped into lines in the w-plane in Problem 16 are shown on the left. The images in the w-plane are show on the right.

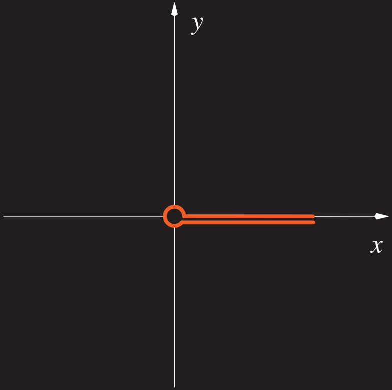

Figure 4.14
An illustration of a branch cut for the function $\theta(z) = \arg z$.

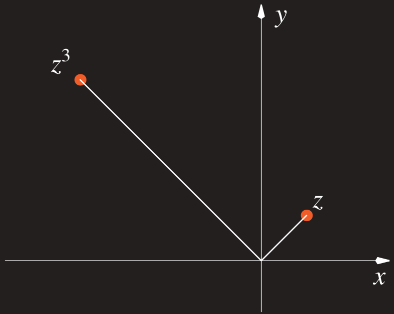

Figure 4.15
The relation between z and z^3 in the complex plane for $z = 1 + i$.

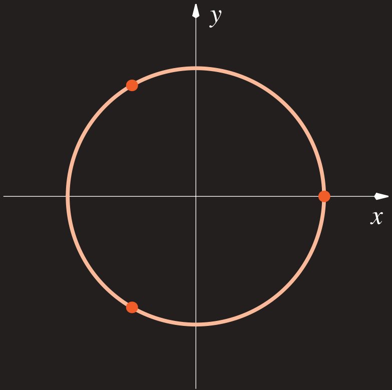

Figure 4.16
The three roots of unity plotted in the complex plane.

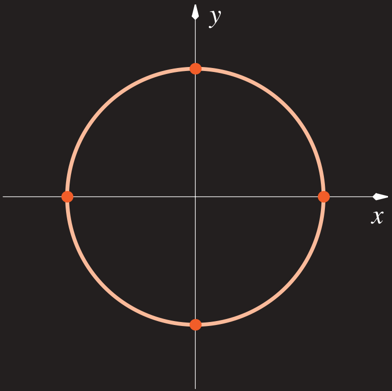

Figure 4.17
The four 4th roots of unity plotted in the complex plane.

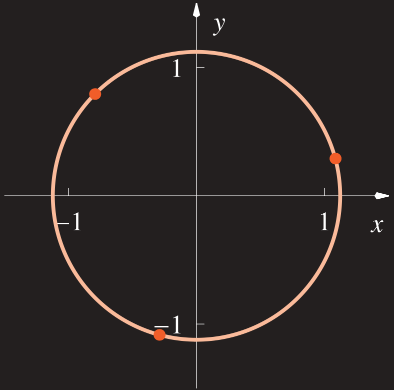

Figure 4.18
The three cube roots of $z = 1 + i$ plotted in the complex plane. The radius of the circle in this case is $2^{1/6}$.

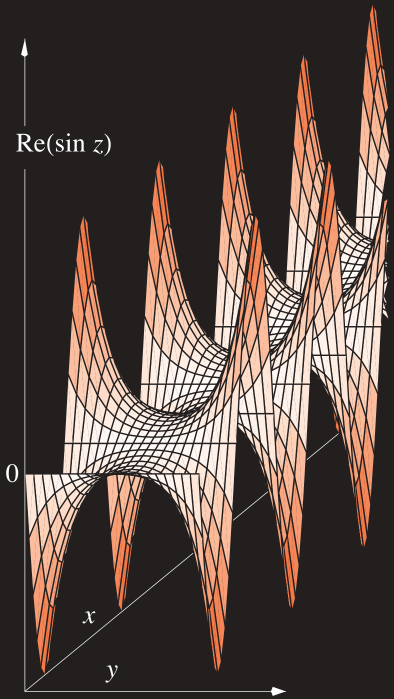

Figure 4.19
The real part of sin z plotted against x and y. Note the periodicity in the x direction and the exponential growth in the y direction.

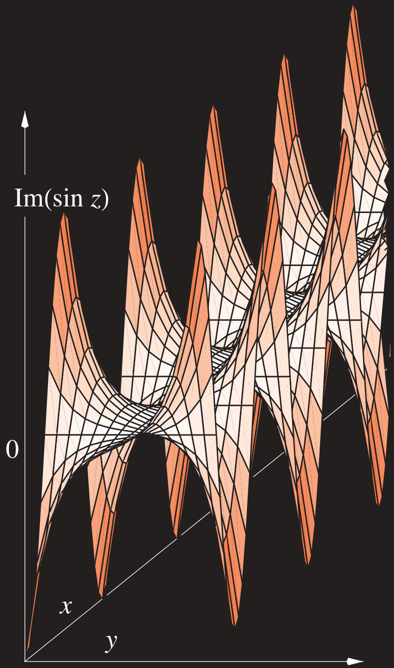

Figure 4.20
The imaginary part of sin z plotted againsy x and y. Note the periodicity in the x direction and the exponential growth in the y direction.

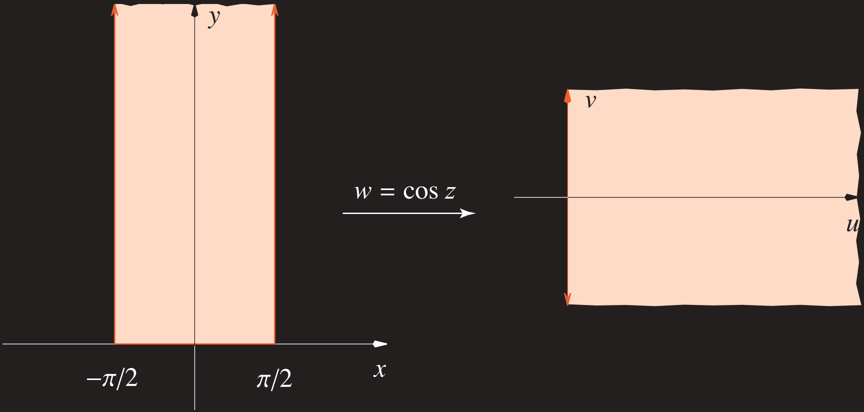

Figure 4.21
The mapping of the region $-\pi/2 \le x \le \pi/2$, $0 \le y < \infty$ in the z-plane into $w = f(z) = \cos z$ in the w-plane.

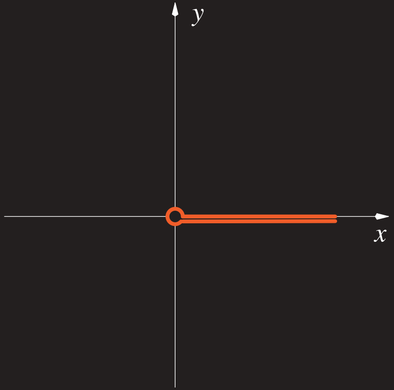

Figure 4.22
The branch cut for $\ln z$ in the complex plane that restricts $\arg z$ to the values $0 \leq \arg z < 2\pi$. The origin is also cut out because $\ln z$ is not defined at $z = 0$.

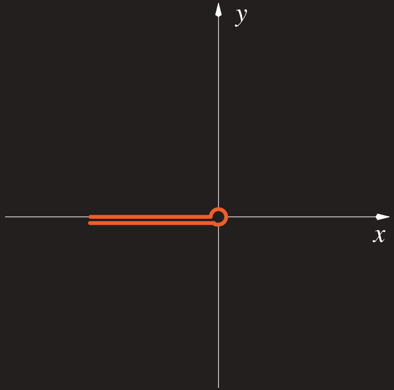

Figure 4.23
The branch cut in the complex plane that restricts arg z to the values $-\pi <$ arg $z \leq \pi$. The origin is also cut out because ln z is not defined at $z = 0$.

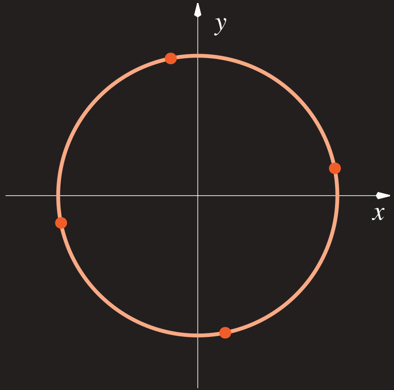

Figure 4.24
The four 4th roots of $z = 1 + i$ plotted in the complex plane. The radius of the circle is $2^{1/8}$.

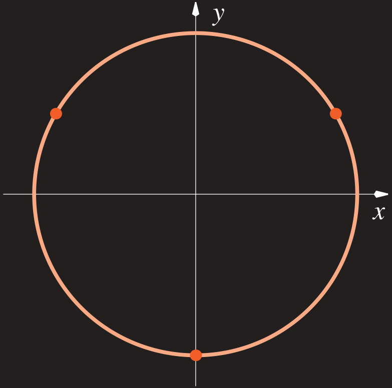

Figure 4.25
The three values of $(1 + i)^{2/3}$ plotted in the complex plane. The radius of the circle is $2^{1/3}$.

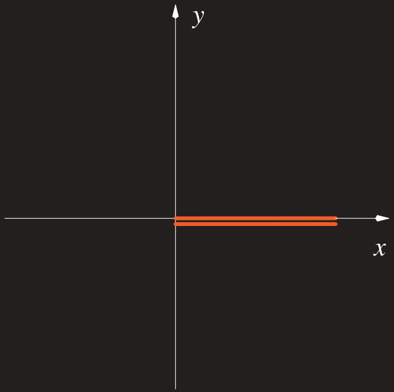

Figure 4.26
The branch cut in the z-plane for the function $w = f(z) = z^{1/2}$. This branch cut restricts w to be single-valued.