Chapter 8 Figures 1 To 20 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 22)". Continuing to hold down the mouse button and dragging the button down will change the text in the small window to something like "8.4 (6 of 22)". Releasing the mouse button at this point moves you to Figure 8.4 of Chapter 8. The (6 of 22) indicates that Figure 8.4 resides on page 6 of the 22 pages of this document.

ANIMATIONS

There are no animations in this chapter.

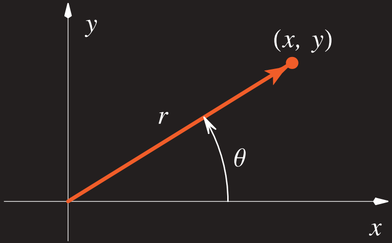

Figure 8.1
The specification of the location of a point in a plane by polar coordinates (r, θ).

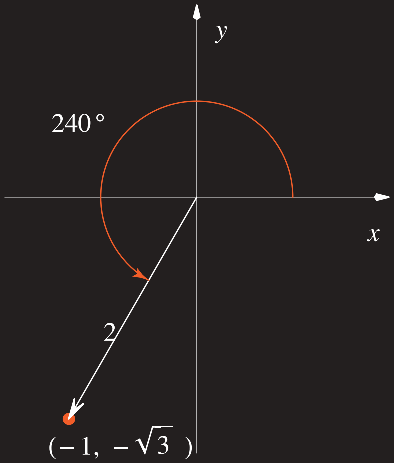

Figure 8.2
The point $x = -1$, $y = -\sqrt{3}$.

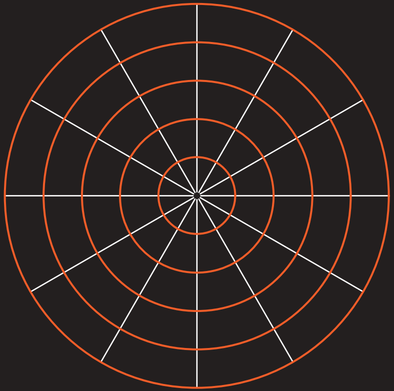

Figure 8.3
A polar grid of coordinates for plotting functions expressed in polar coordinates.

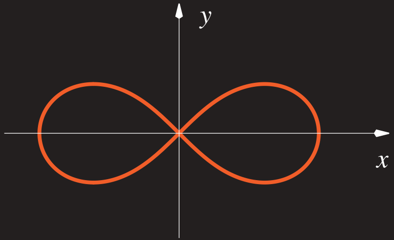

Figure 8.4
The lemniscate of Bernoulli, $r^2 = \cos 2\theta$.

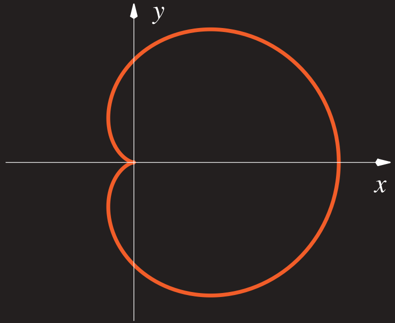

Figure 8.5
A cardioid, $r = a\,(\cos\theta + 1)$.

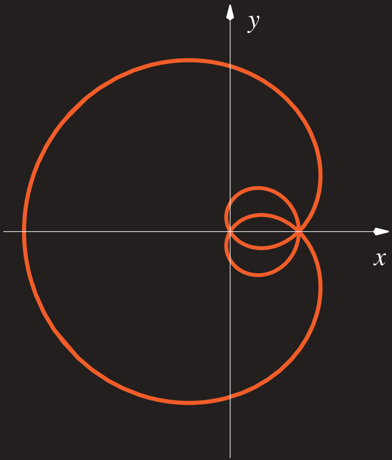

Figure 8.6

Freeth's nephroid, the polar equation is $r = a(1 + 2\sin\theta/2)$. In this plot, r is allowed to take on negative values.

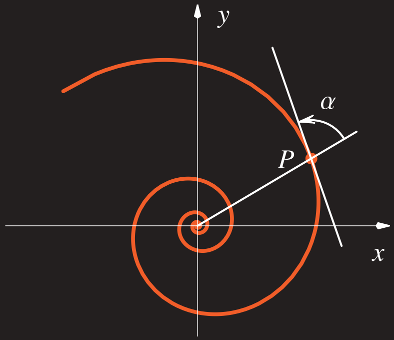

Figure 8.7
A logarithmic spiral, $r = e^{\beta\theta}$.

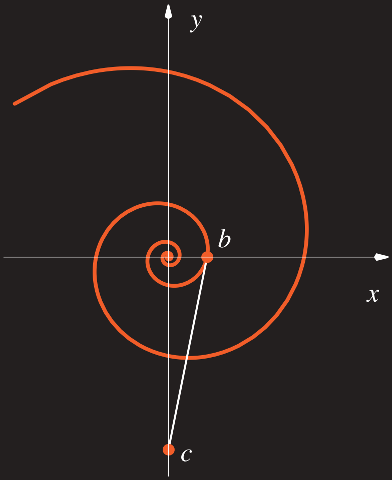

Figure 8.8
The tangent line to a logarithmic spiral at $\theta = 2\pi n$ (n = integer).

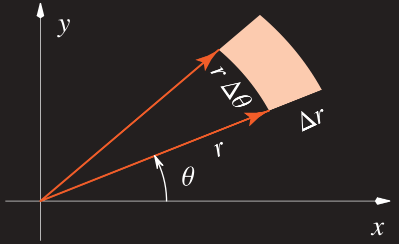

Figure 8.9
A differential area element in polar coordinates generated by varying r by Δr and θ by $\Delta\theta$.

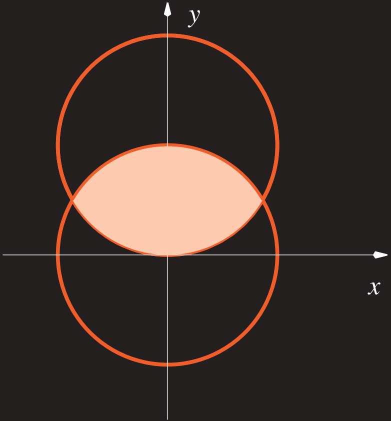

Figure 8.10
The area between the curve given by $r^2 = 4\,\sin^2\theta$ and the circle given by $r = 1$.

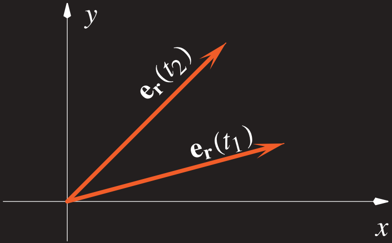

Figure 8.11
The unit vector $\mathbf{e}_r = \mathbf{e}_r(t)$ in polar coordinates at two different times.

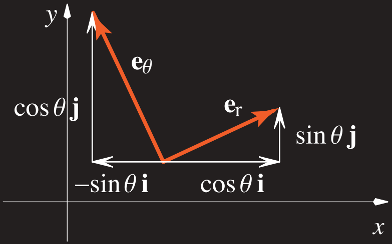

Figure 8.12
The polar coordinate unit vectors $\mathbf{e}_r = \cos\theta\,\mathbf{i} + \sin\theta\,\mathbf{j}$ and $\mathbf{e}_\theta = -\sin\theta\,\mathbf{i} + \cos\theta\,\mathbf{j}$ expressed in terms of the cartesian coordinate unit vectors $\mathbf{i}$ and $\mathbf{j}$.

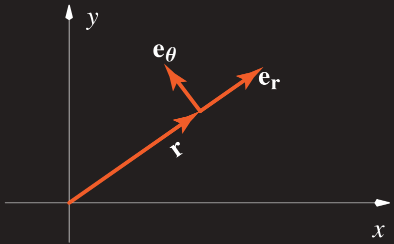

Figure 8.13
A pictorial argument that $\mathbf{e}_r$ and $\mathbf{e}_\theta$ are independent of r.

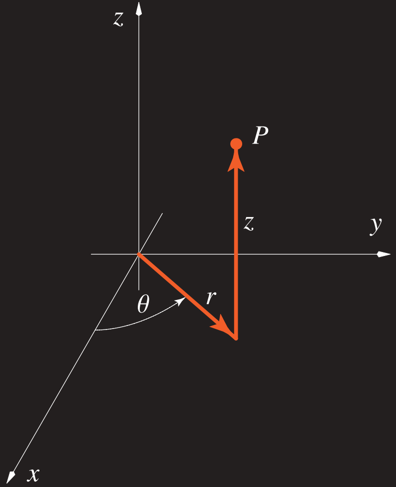

Figure 8.14
A point specified by the cylindrical coordinates r, θ, and z.

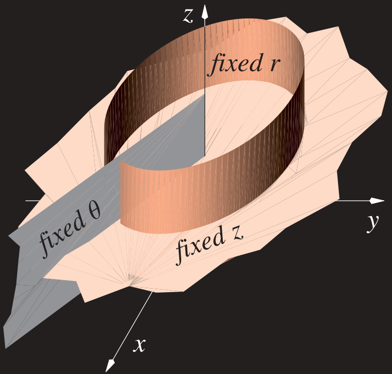

Figure 8.15
The surfaces r = constant, θ = constant, and z = constant in cylindrical coordinates.

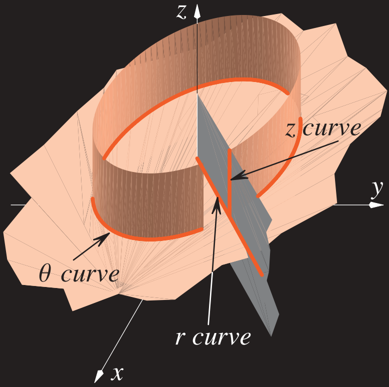

Figure 8.16
An r curve, a θ curve, and a z curve for a cylindrical coordinate system.

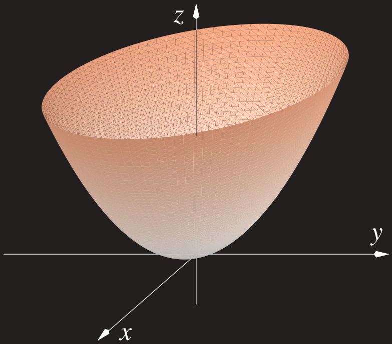

Figure 8.17
A circular paraboloid expressed in cylindrical coordinates by $z = r^2$ or $z = x^2 + y^2$ in cartesian coordinates.

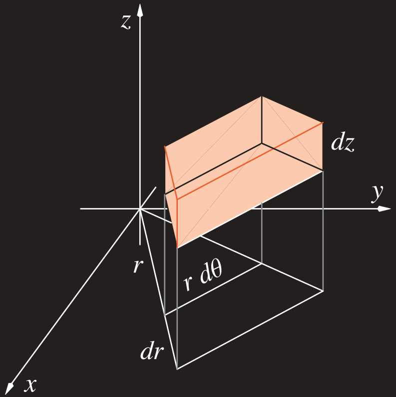

Figure 8.18

A pictorial argument that the volume element in cylindrical coordinates is given by $dV = r dr d\theta dz$.

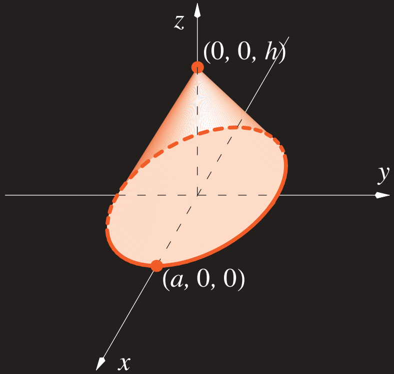

Figure 8.19

A right circular cone with base $x^2 + y^2 \leq a^2$ and apex at $(0, 0, h)$.

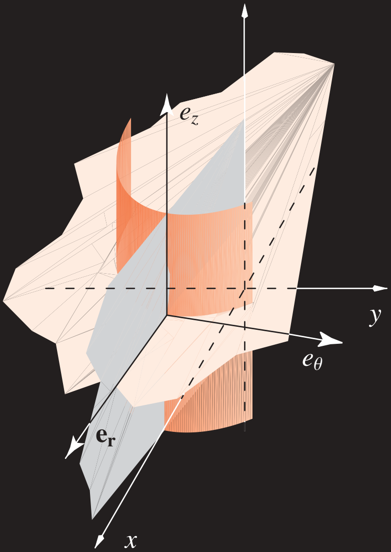

Figure 8.20
The unit vectors $\mathbf{e}_r$, $\mathbf{e}_\theta$, and $\mathbf{e}_z$, of a cylinderical coordinate system. Note that they form a right-handed coordinate system.