Chapter 7 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 23)". Continuing to hold down the mouse button and dragging the button down will change the text in the small window to something like "7.4 (6 of 23)". Releasing the mouse button at this point moves you to Figure 7.4 of Chapter 7. The (6 of 23) indicates that Figure 7.4 resides on page 6 of the 23 pages of this document.

ANIMATIONS

Figure 7.5 has an associated animated figure that requires QuickTime™ for display. This animation is named Anim7_5.mov and must be independently downloaded from the server.

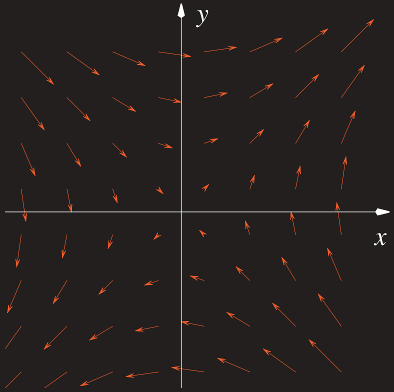


Figure 7.1
A pictorial representation of the vector field described by $\mathbf{v} = y\,\mathbf{i} + x\,\mathbf{j}$.

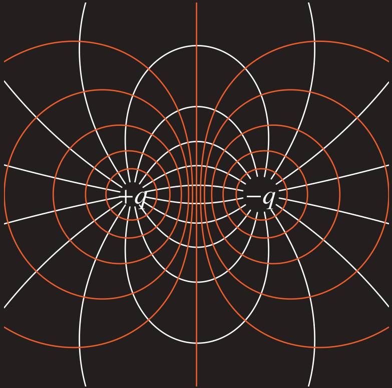


Figure 7.2
The equipotentials (color) and the electric field lines (black) due to an electric dipole situated at the origin and oriented in the *x* direction.

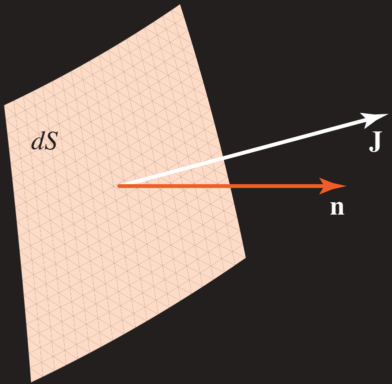


Figure 7.3
An area element dS whose orientation is specified by the normal vector $\mathbf{n}$. The vector $\mathbf{J}$ is a flux acoss $d\mathbf{S} = \mathbf{n}\, dS$.

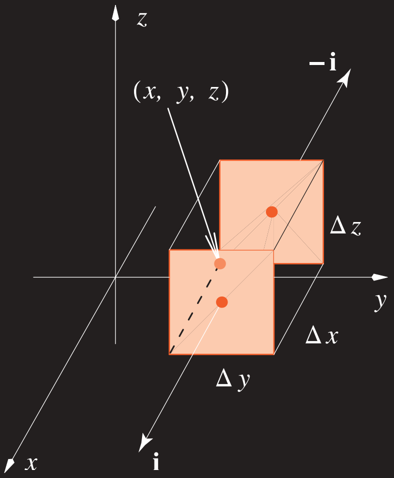


Figure 7.4
The geometry used for a derivation of the divergence theorem.

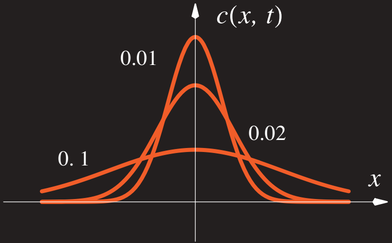
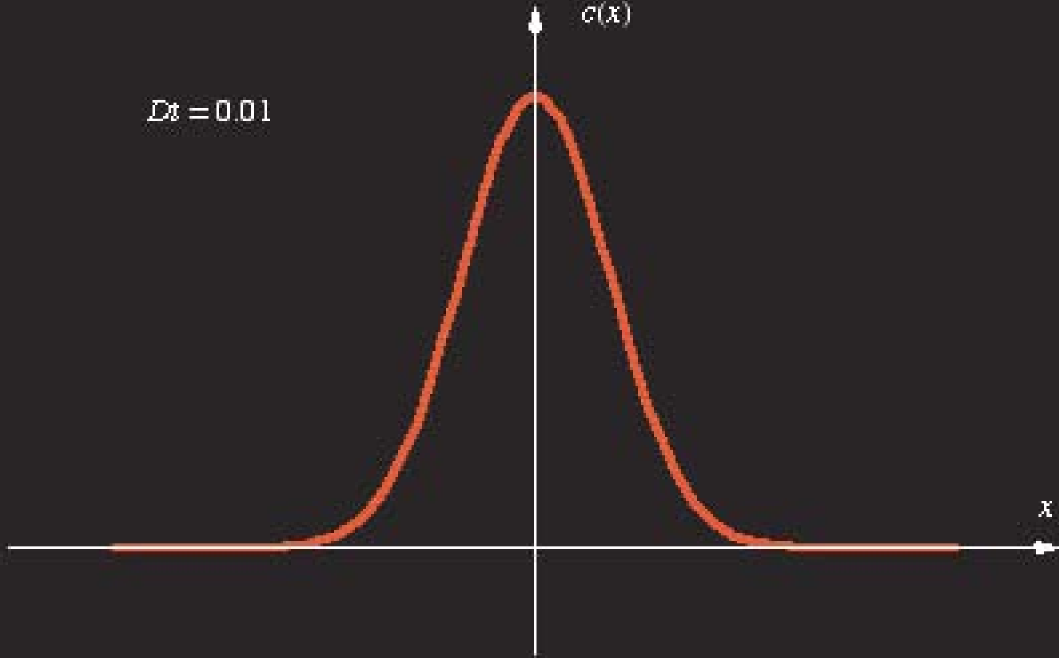


Figure 7.5
The solution to the diffusion equation given in Example 2 plotted for various values of Dt.



Animation 7.5

The solution to the diffusion equation given in Example 2 plotted for various values of Dt.

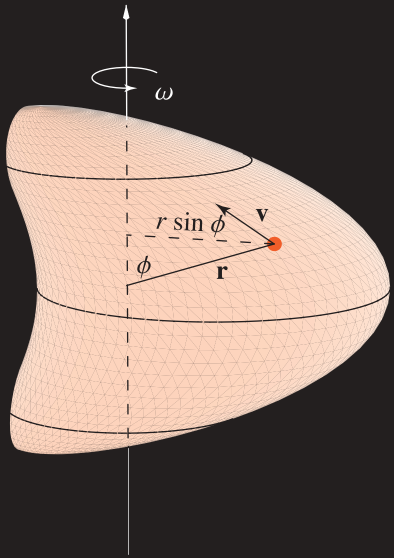


Figure 7.6
The rotation of a rigid body about the $\boldsymbol{\omega}$ axis, illustrating that $\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}$.

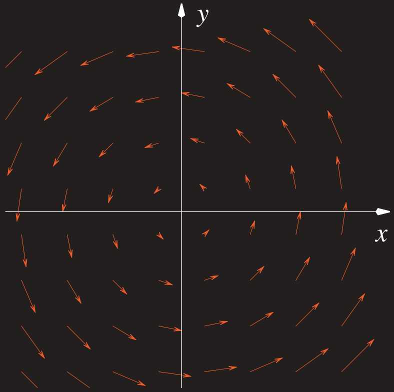


Figure 7.7
A pictorial representation of the vector field described by $\mathbf{v} = -\,\omega\, y\,\mathbf{i} + \omega\, x\,\mathbf{j}$.

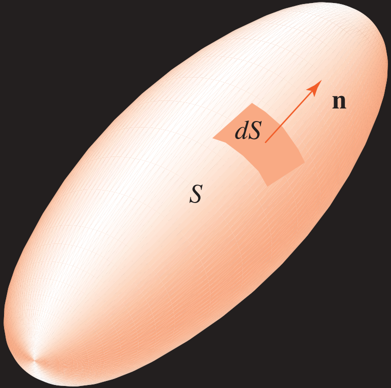


Figure 7.8
The geometry associated with the fundamental definition of the gradient presented in Problem 16.

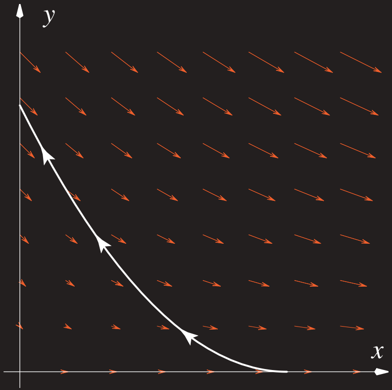


Figure 7.9
A pictorial representation of the force field and the path of integration in Example 1.

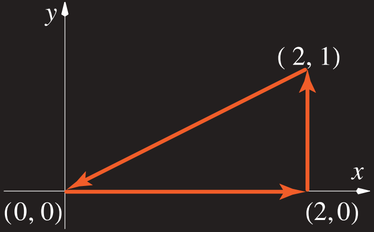


Figure 7.10
A triangular path used for the evaluation of $\int_C \mathbf{A}\cdot d\mathbf{r}$ where $\mathbf{A} = (x - y)\,\mathbf{i} + (x + y)\,\mathbf{j}$.

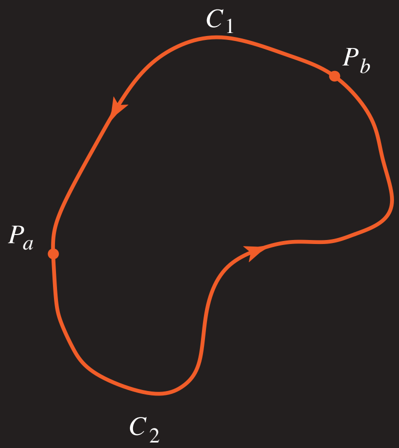


Figure 7.11
An aid to the proof that if $\oint \mathbf{A}\cdot d\mathbf{r} = 0$ for all closed paths in a domain D, then $\int \mathbf{A}\cdot d\mathbf{r}$ is path independent.

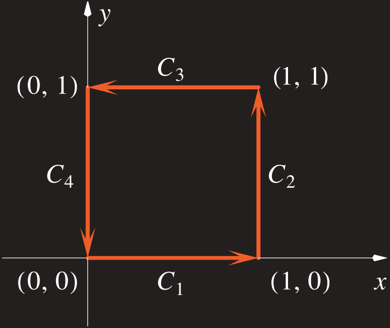


Figure 7.12
The closed path used to evaluate $\oint \mathbf{A}\cdot d\mathbf{r}$ in Example 3.

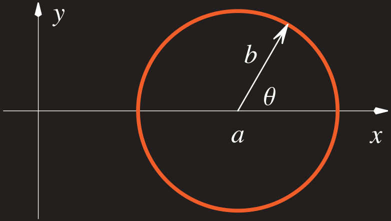


Figure 7.13
A circle of radius b centered at the point $(a, 0)$, described by the parametric equations $x = a + b\cos\theta$ and $y = b\sin\theta$ for $0 \le \theta \le 2\pi$.

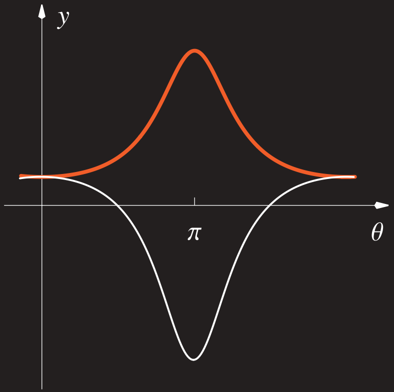


Figure 7.14
The functions $1/(a^2 + b^2 + 2ab \cos\theta)$ (color) and $\cos\theta/(a^2 + b^2 + 2ab \cos\theta)$ (black) plotted against θ (a ≠ b).

Figure 7.15. An illustration of (a) a simply connected region and (b) a region that is not simply connected.

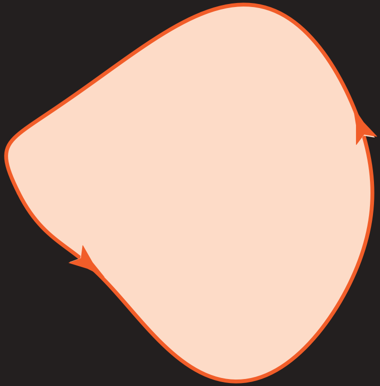


Figure 7.16
A closed region in the *xy*-plane and its boundary curve.

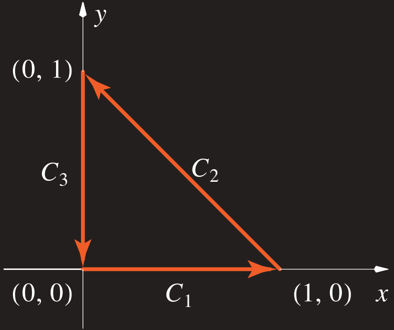


Figure 7.17
A triangular region in the *xy*-plane with vertices at the points (0, 0), (0, 1), and (1, 0).

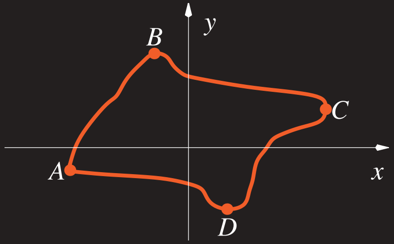


Figure 7.18
The region used in Problem 15 to prove Green's theorem in the plane.

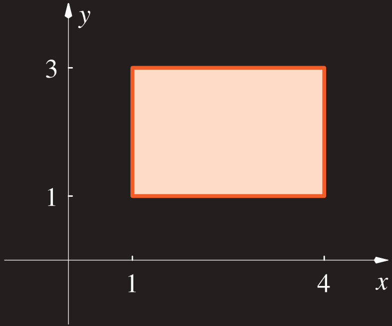


Figure 7.19
The region and boundary curve used in Problem 16.

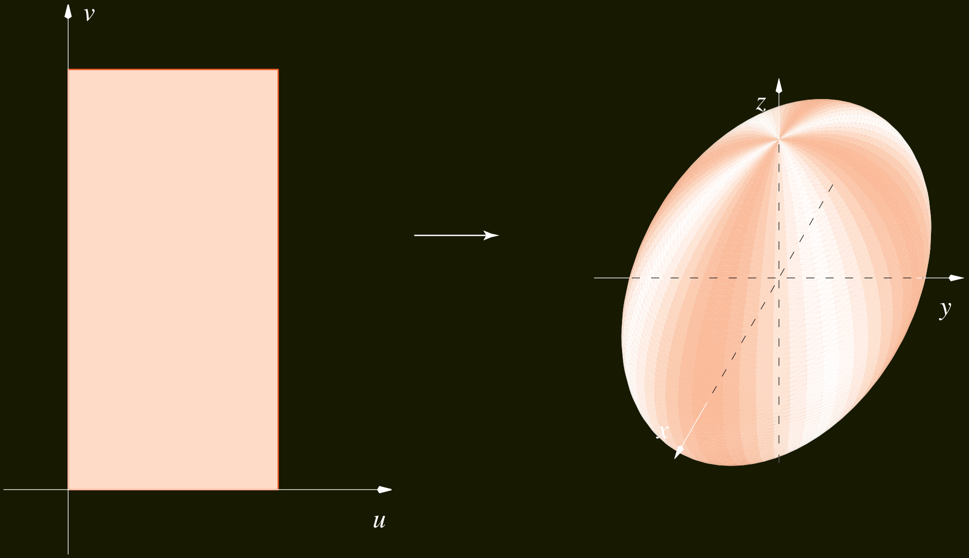


Figure 7.20

A mapping from the uv-plane to x, y, z space. In particular, this mapping is from $0 \le \phi \le 2\pi$, $0 \le \theta \le \pi$ to a sphere by the mapping $x = a \sin\theta \cos\phi$, $y = a \sin\theta \sin\phi$, and $z = a \cos\theta$.