Chapter 5 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 41)". Continuing to hold down the mouse button and dragging the button down will change the text in the small window to something like "5.4 (6 of 41)". Releasing the mouse button at this point moves you to Figure 5.4 of Chapter 5. The (6 of 41) indicates that Figure 5.4 resides on page 6 of the 41 pages of this document.

ANIMATIONS

There are no animations in this chapter.

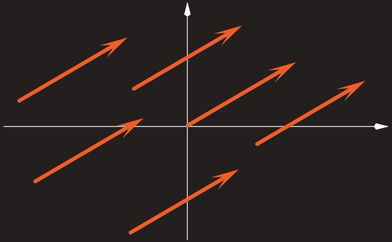

Figure 5.1
All the vectors in this figure are equal because they have the same length and same direction.

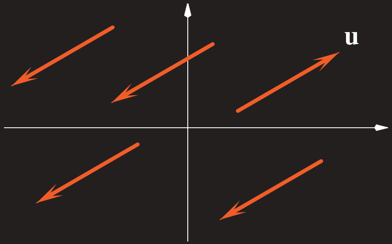

Figure 5.2
The vector -**u** points in the opposite direction of **u**. All the vectors pointing downward in the figure are equal to -**u**.

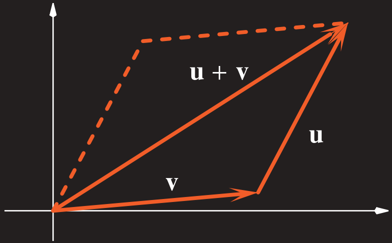

Figure 5.3
An illustration of the parallelogram law of vector addition.

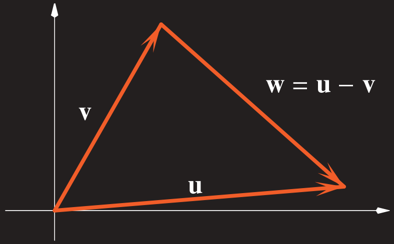

Figure 5.4
An illustration of the subtraction of two vectors. Note that **w** = **u** - **v** points from the tip of **v** to the tip of **u**.

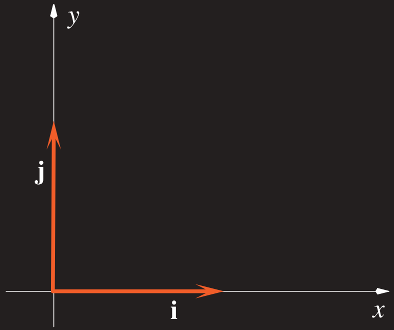

Figure 5.5
The unit vectors of a two-dimensional cartesian coordinate system.

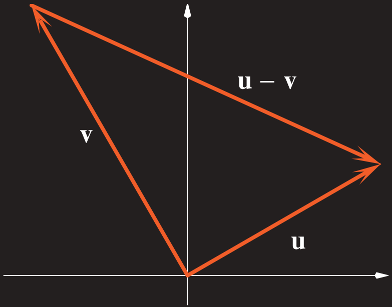

Figure 5.6

The vectors **u**, **v** and **u** - **v** where **u** and **v** are perpendicular to each other.

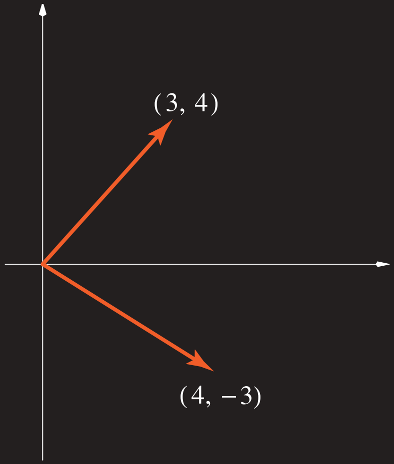

Figure 5.7
The two vectors (3, 4) and (4, -3).

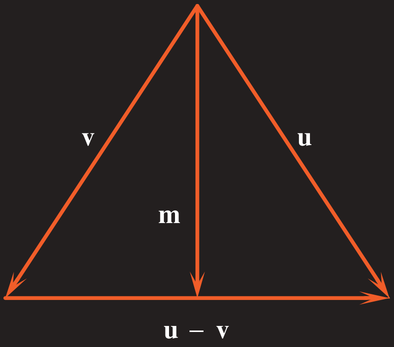

Figure 5.8
A pictorial aid to Example 2.

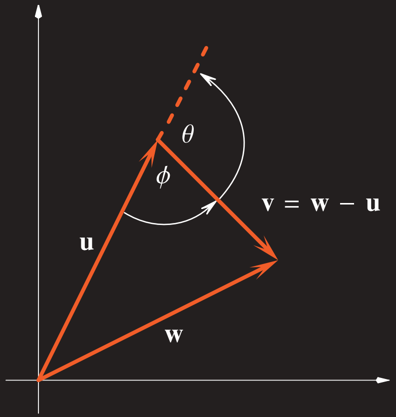

Figure 5.9
The geometry associated with Example 3.

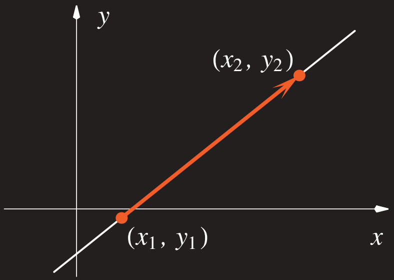

Figure 5.10
If (x_1, y_1) and (x_2, y_2) are two points on the line expressed by $ax + by + c = 0$, then the vector $(x_2 - x_1)\mathbf{i} + (y_2 - y_1)\,\mathbf{j}$ is coincident with the line.

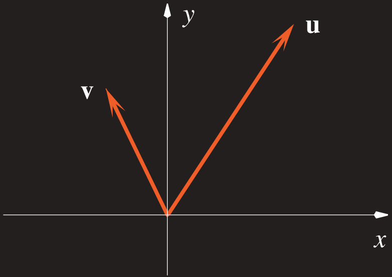

Figure 5.11
The vectors used in Problem 4.

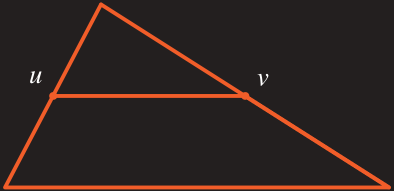

Figure 5.12
A pictorial aid to Problem 9.

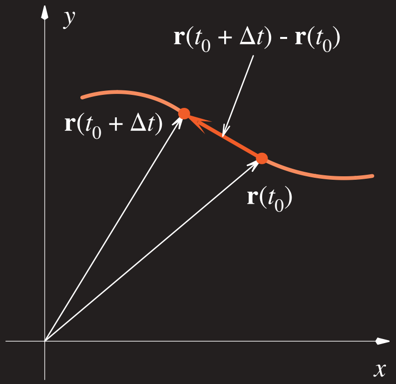

Figure 5.13
An illustration that $\mathbf{r}'(t)$ is tangent to the curve generated by $\mathbf{r}$.

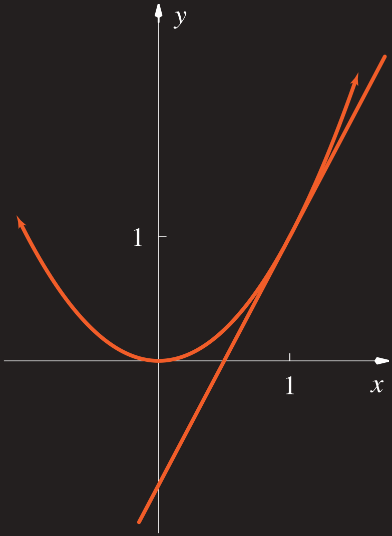

Figure 5.14
The parametric curve $x = t$, $y = t^2$ and the tangent line at the point $t = 1$.

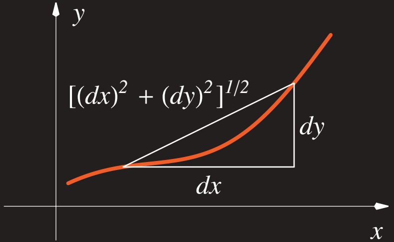

Figure 5.15
A geometric aid to the calculation of the arc length of a curve. Note that $ds^2 = dx^2 + dy^2$.

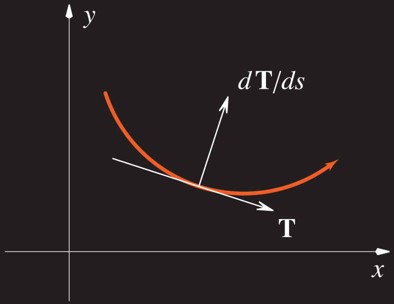

Figure 5.16

The vectors $\mathbf{T}(s)$ and $d\mathbf{T}/ds$ are perpendicular to each other. $d\mathbf{T}/ds$ measures the rate of change of the direction of $\mathbf{T}(s)$ as a function of arc length s.

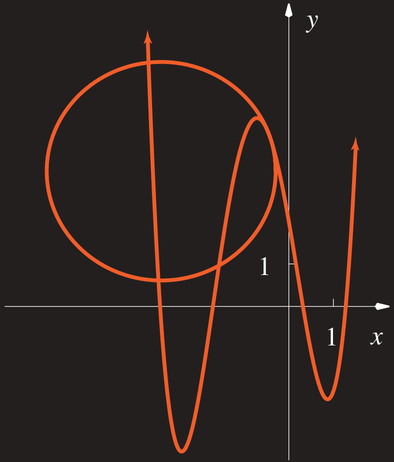

Figure 5.17
An illustration of an osculating circle.

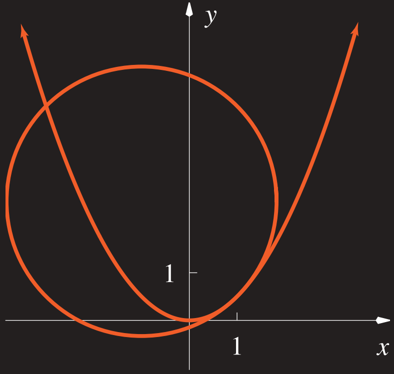

Figure 5.18
The osculating circle calculated in Example 4.

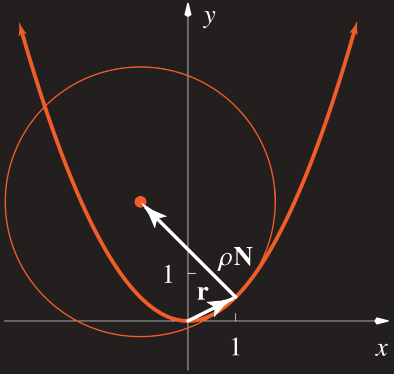

Figure 5.19
An illustration of the center of curvature.

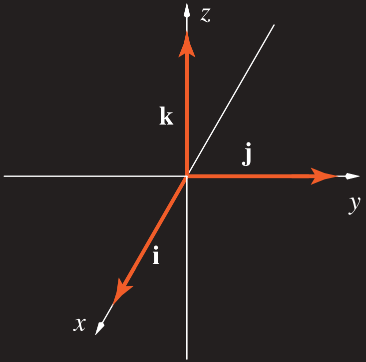

Figure 5.20
The unit vectors of a three-dimensional Cartesian coordinate system.

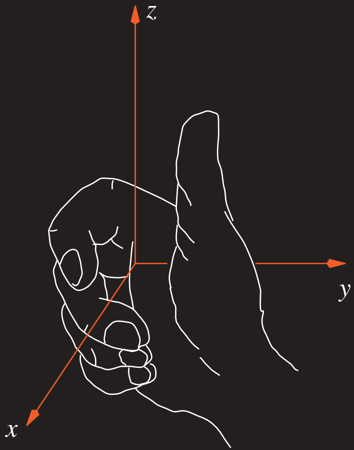

Figure 5.21
An illustration of the right-hand rule.

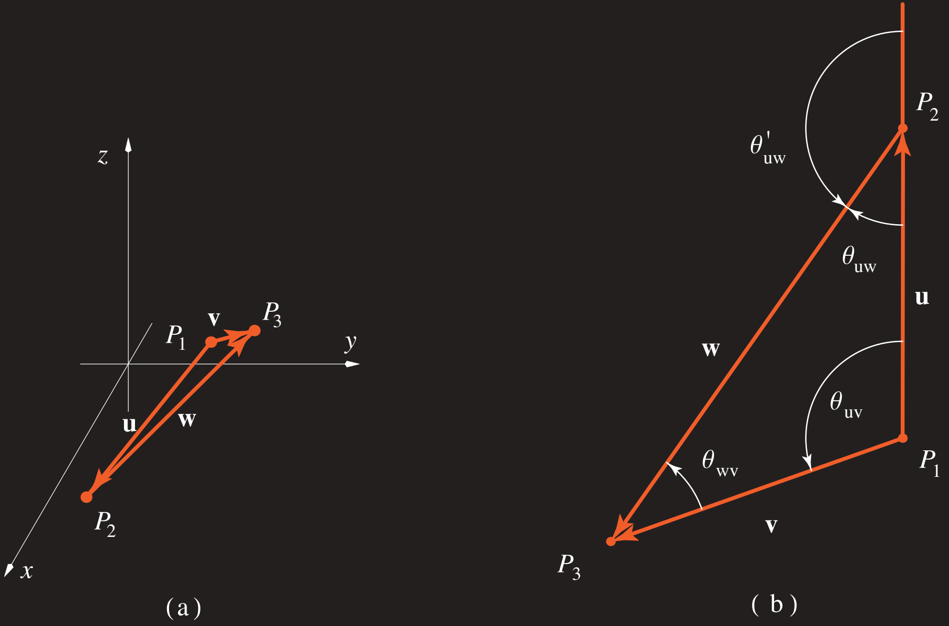

Figure 5.22
(a) The vectors **u**, **v** and **w** in Example 2. (b) The vectors **u**, **v** and **w** in Example 2 viewed normal to the plane of the triangle that they form.

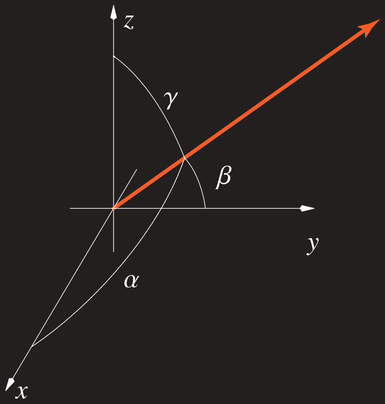

Figure 5.23
The direction angles of a vector **u.**

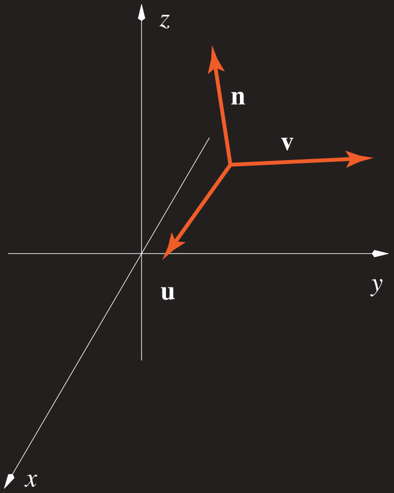

Figure 5.24
The unit vector **n** in the direction **u×v**.

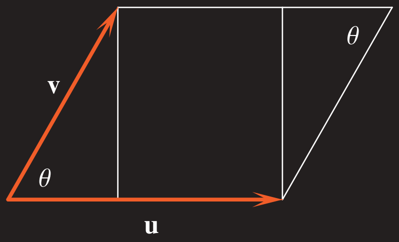

Figure 5.25
An illustration of the geometric interpretation of $\mathbf{u} \times \mathbf{v}$.

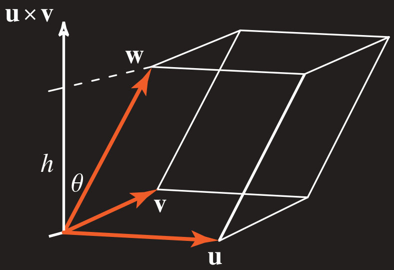

Figure 5.26
A parallepiped with sides **u**, **v**, and **w**.

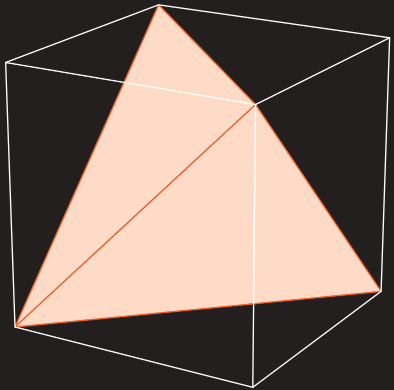

Figure 5.27
The relation between a tetrahedron and a cube.

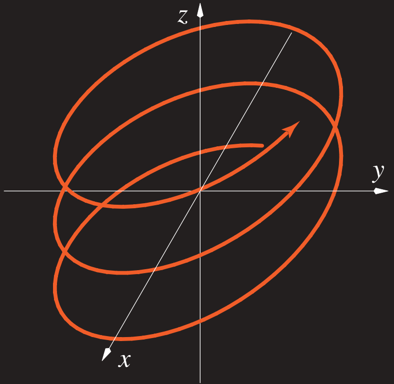

Figure 5.28

The helix described by x = a cos qBt/m, y = sin qBt/m, $z = bt$.

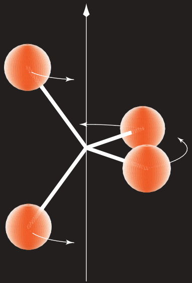

Figure 5.29
A rigid body represented by a collection of masses rigidly separated from each other.

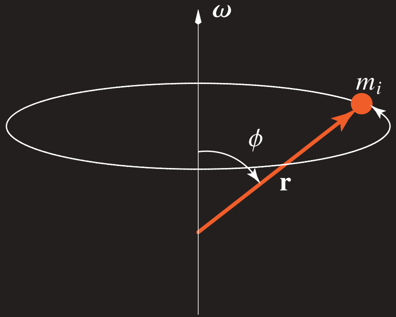

Figure 5.30
The rotation of mass m_i about an axis of rotation ω.

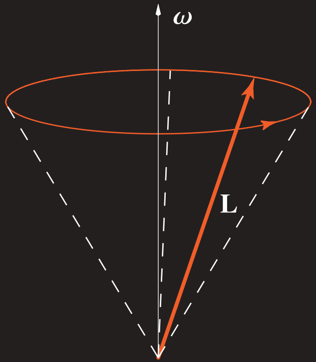

Figure 5.31
An illustration of the precession of the angular momentum vector **L** about the rotation axis ω.

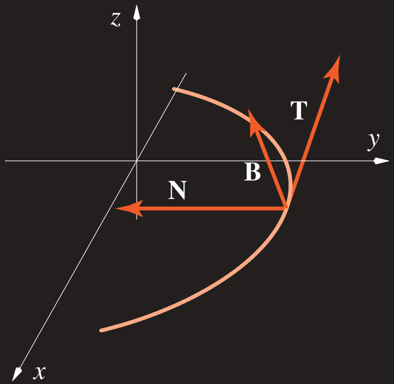

Figure 5.32
The (right-handed) cartesian coordinate system formed by the unit tangent vector **T**, the principal normal vector **N**, and the binormal vector **B**.

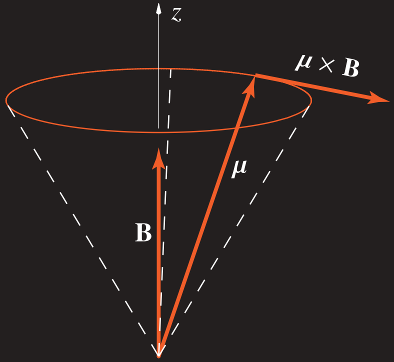

Figure 5.33
The precession of the tip of the magnetic moment vector $\boldsymbol{\mu}$ along the circle of a cone.

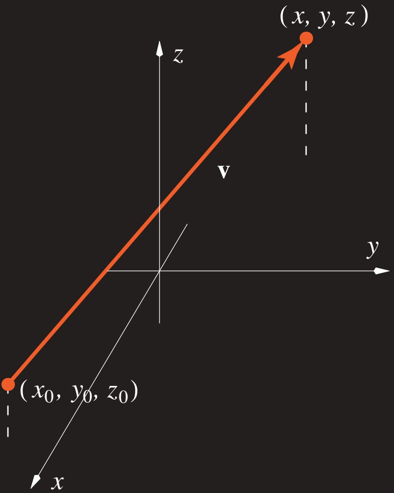

Figure 5.34
The line defined by the two points (x, y, z) and (x_0, y_0, z_0).

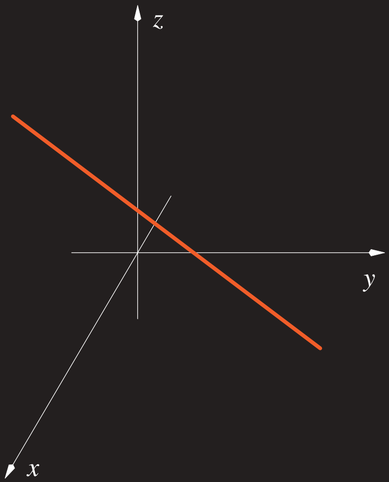

Figure 5.35
The straight line described by the parametric equations $x = 1 + 2t$, $y = 6 - 2t$, $z = -2 + 4t$.

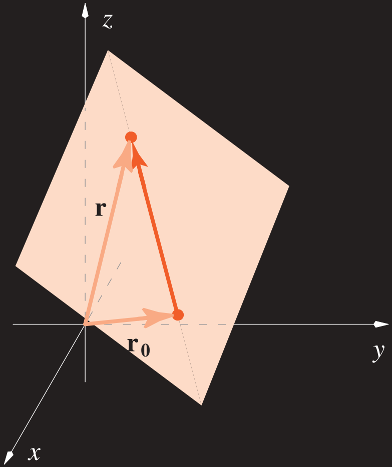

Figure 5.36
The vector $\mathbf{r} - \mathbf{r}_0$ lying in a plane.

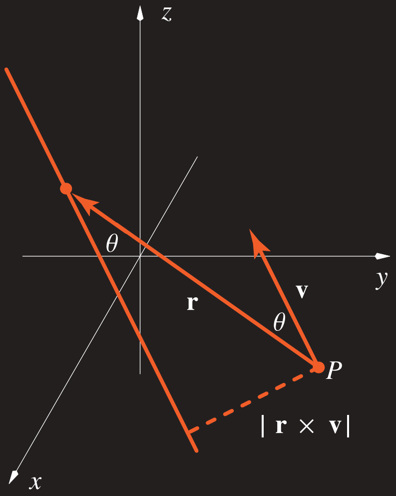

Figure 5.37
The perpendicular distance from a point P to a given line.

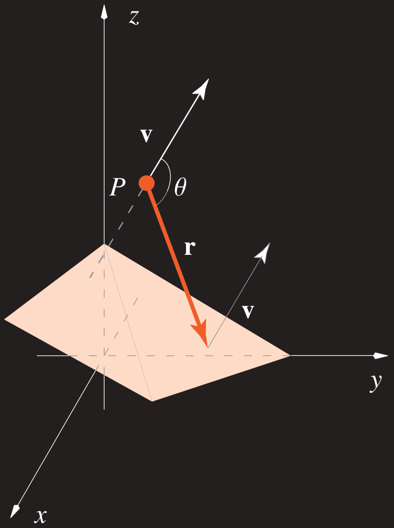

Figure 5.38
The perpendicular distance from a point P to a given plane.

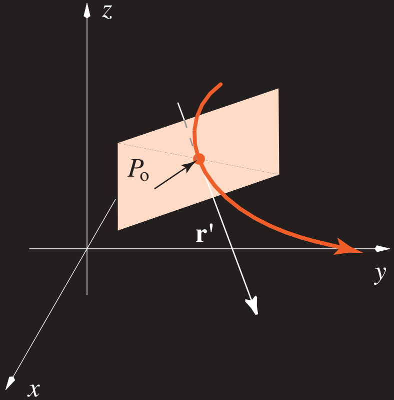

Figure 5.39
A space curve, its tangent vector **r**'(t), and its normal plane.