This assignment is in two parts. The answers to problems in Part I are generally in the book. It is advisable to make every effort to solve the problem before consulting the answer. The numbers in parentheses refer to the previous edition of the textbook.

Part I

Section 12.6

1. p.893, #7, 23 (p.875, 7, 27).

2. p.894, #63 (p.875, #53).

Section 12.7

3. p.903, #33 (p.884, #29).

Section 12.8-12.9

4. p.918, #15 (p.899, #15).

5. (MAPLE) p.911, #18 (p.892, #23). Method: Use the Maple command \texttt{diff} in each variable to find the gradient of $f$. Set $\nabla f = 0$ to obtain the critical points. For instance, type

\begin{verbatim}
> soln:=solve ({diff(f,x)=0, diff(f,y)=0},{x,y});
\end{verbatim}

Use the command \texttt{hessian} to test the nature of the critical points. This can be done using the commands

\begin{verbatim}
> with(linalg): H:=hessian(f,[x,y]):
> d:=det(H); fxx:=H[1,1];
\end{verbatim}

and then using the \texttt{subs} command as was done in class. A sample problem is posted on the course website http://eaton.math.rpi.edu/CourseMaterials/Spring03/1H2010/ under COURSE NOTES: Critical Points. Note: You should find that the surface has a relative maximum at (0,0,1) and saddle points at (0,2,-3) and $(\sqrt{3},-1,-3)$. Graph the surface using Maple.

Part II

Section 12.6

6. (a) p.894, #64

(b) What angle to the horizontal will the climber make moving in the direction of part (a)? Suggestion: On the course website under COURSE NOTES, see Mountain Climbing. More information on the gradient function and animated applications to skiing may be found at the Links website http://links.math.rpi.edu/devmodules/gradient/.

(over)
Section 12.7

7. (a) p.902, #12 (p.883, #8)
(b) Find the angle of inclination $\theta$ of the tangent plane to the surface

$$2xy - z^3 = 0$$

at the point $(2, 2, 2)$ on the surface.

Section 12.8

8. (a) Locate and classify the critical points of the function

$$f(x, y) = 3x^2y - y^3 + y.$$ 

(b) Use the second derivative test to prove that for any function $u = f(x, y)$ (with continuous second partial derivatives) which satisfies Laplace's equation $u_{xx} + u_{yy} = 0$, with $d \neq 0$, every critical point must be a saddle point. Show that the function of part (a) satisfies this theorem.