Students are expected to complete homework assignments on their own before referring to the following pages. The answers and hints are designed to check work and clarify problems. The original intent of the layout was for display in class after assignments had been completed. Students should use the following information as help to understand the exercises and master the concepts.

Calculus D

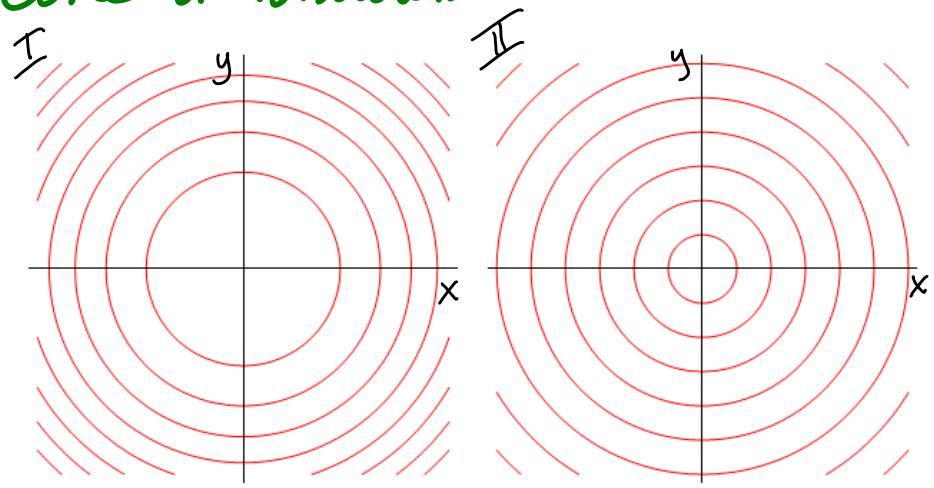
Chapter 14

Even Answers & Hints for Homework

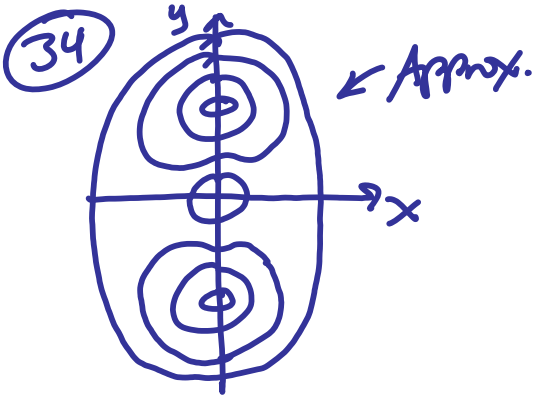
14.1 Even Answers

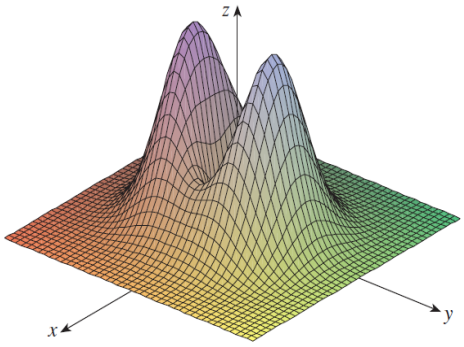
(30) (a) VI (b) V (c) I (d) IV (e) II (f) III

(32) Cone or Paraboloid?



(34)





(55) (a) C (b) II

(56) (a) A (b) IV

(57) (a) F (b) I

(58) (a) E (b) III

(59) (a) B (b) VI

(60) (a) D (b) V

14.2 & 14.3 Even Answers

14.2

(2) (a) Temp = f(longitude, latitude, time)

(b) Elevation = f(longitude, latitude, time)

(c) Cost of Taxi Ride = f(distance traveled, time)

(28) $f(x,y) = \frac{1}{1-x^2-y^2}$ ← graph

14.3

(6) (a) negative, (b) negative

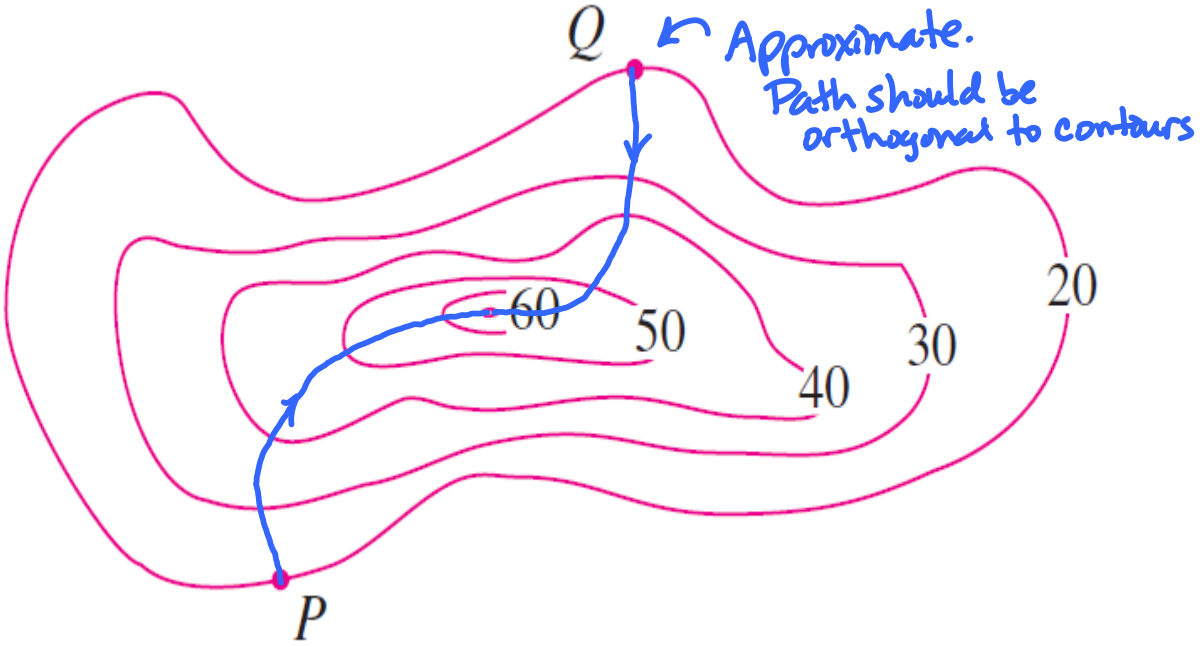
(8) (a) positive, (b) negative

(56) $V_{xx} = e^{2y+xe^y}$, $V_{xy} = V_{yx} = e^{y+xe^y}(1+xe^y)$

$V_{yy} = e^{y+xe^y}(x+x^2e^y)$

14.6 Even Answers (Part II)

(36) Draw steepest ascent path from P and Q.



14.6 Even Answers (Part III)

(40) Plane: $8(x-4)-1(y-7)-6(z-3)=0$
or $8x-y-6z=7$

Line: $\frac{x-4}{8}=\frac{y-7}{-1}=\frac{z-3}{-6}$ or $x=8t+4,\ y=-t+7,\ z=-6t+3$

(42) Plane: $1(x-(1+\pi))-2(y-1)-3(z-1)=0$
or $x-2y-3z=-4+\pi$

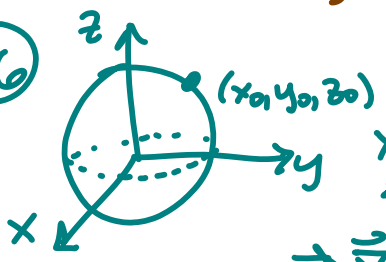
Line: $x=t+1+\pi,\ y=-2t+1,\ z=-3t+1$

(44) Plane: $-(x-0)+1(y-0)-1(z-1)=0$
or $x-y+z=1$

Line: $x=-t,\ y=t,\ z=-t+1$

(54) Show tangent planes are the same.
$3x+2y+2z=9$

(56)



Find line normal to sphere through (x_0,y_0,z_0)

$x^2+y^2+z^2=r^2 \Rightarrow F(x,y,z)=x^2+y^2+z^2-r^2=0$

$\vec{\nabla}F=\langle 2x,2y,2z\rangle$

$\Rightarrow \vec{\nabla}F(x_0,y_0,z_0)=\langle 2x_0,2y_0,2z_0\rangle$ ← vector for line

$$\left.\begin{aligned} x&=at+x_0\\ y&=bt+y_0\\ z&=ct+z_0\end{aligned}\right\}\Rightarrow\left\{\begin{aligned} x&=2x_0t+x_0\\ y&=2y_0t+y_0\\ z&=2z_0t+z_0\end{aligned}\right.$$

→ when $t=-\frac{1}{2}$ the line passes through $(0,0,0)$

(60a) $x=-4t+1,\ y=2t+2,\ z=-2t+1$

14.7 Homework – Even Answers and Hints

(4) Maximum at $(1,0,2)$
Saddle points at $(1,1,1)$, $(1,-1,1)$, $(-1,0,-2)$
Minima at $(-1,1,-3)$ and $(-1,-1,-3)$

(50) $x=\left(\frac{2}{5}V\right)^{1/3}$, $y=\left(\frac{2}{5}V\right)^{1/3}$, $z=V^{1/3}\left(\frac{5}{2}\right)^{2/3}$

HINTS

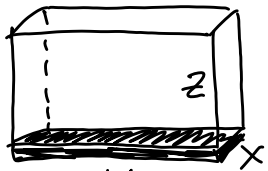
(43) Product $=P(x,y,z)=xyz$ Restriction: $x+y+z=100$
↳ Use the restriction to reduce $P(x,y,z)$ to a function of only two variables.

$z=100-x-y$

$\Rightarrow P(x,y)=xy(100-x-y)$

$P(x,y)=100xy-x^2y-xy^2$ ← Find critical points & classification for new function.

(50)



one piece of xy slate = five pieces of xy glass

Cost $=C(x,y,z)=2xz+2yz+5xy$

Restriction: Fixed volume V

$V=xyz \Rightarrow z=\frac{V}{xy}$

Make cost a function of only two variables.

$C(x,y)=2x\left(\frac{V}{xy}\right)+2y\left(\frac{V}{xy}\right)+5xy$

$C(x,y)=2Vy^{-1}+2Vx^{-1}+5xy$ (V is constant)

↑ Find critical points for this