MAT103

Mathematical Methods – I

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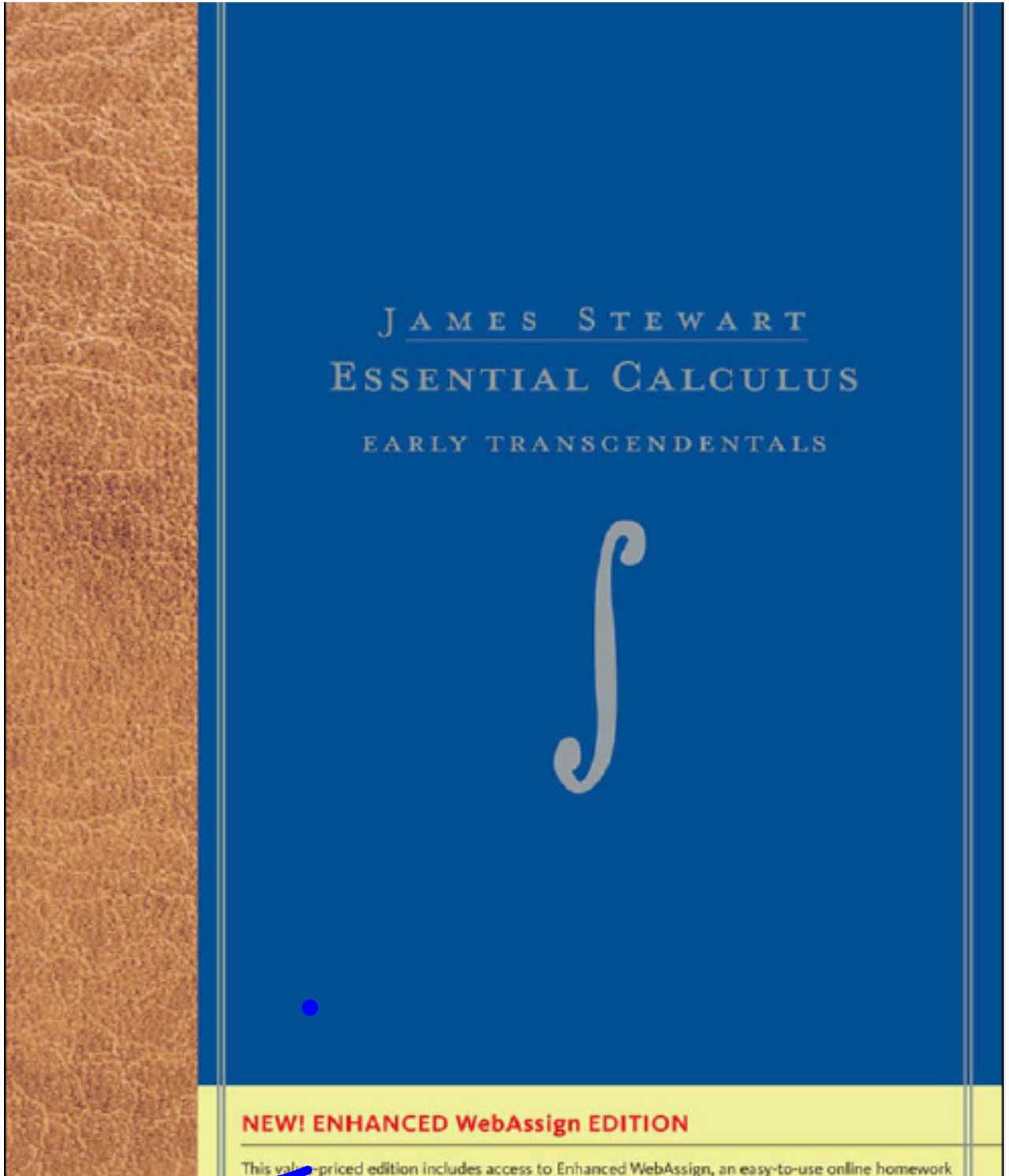
& Teaching Assistants (TAs)

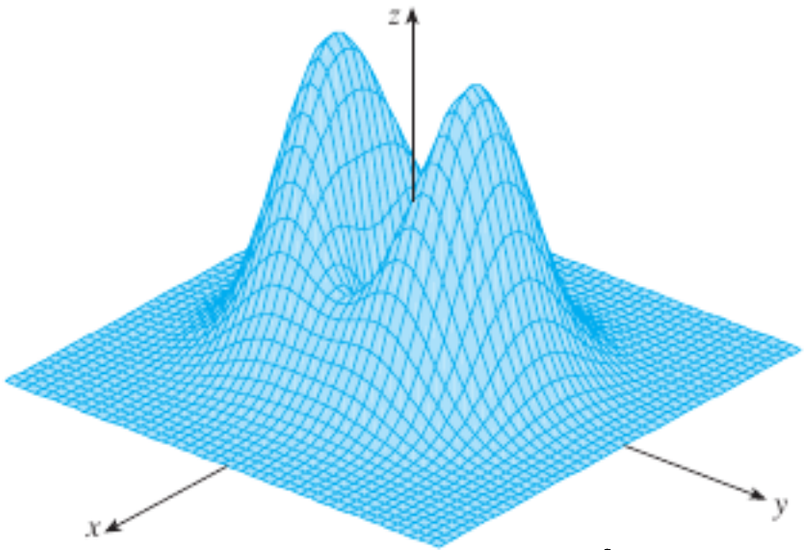


1 FUNCTIONS AND LIMITS
2 DERIVATIVES
3 INVERSE FUNCTIONS: Exponential, Logarithmic, a...
4 APPLICATIONS OF DIFFERENTIATION
5 INTEGRALS
6 TECHNIQUES OF INTEGRATION
7 APPLICATIONS OF INTEGRATION
8 SERIES
9 PARAMETRIC EQUATIONS AND POLAR COORDIN...
10 VECTORS AND THE GEOMETRY OF SPACE
11 PARTIAL DERIVATIVES
12 MULTIPLE INTEGRALS
13 VECTOR CALCULUS

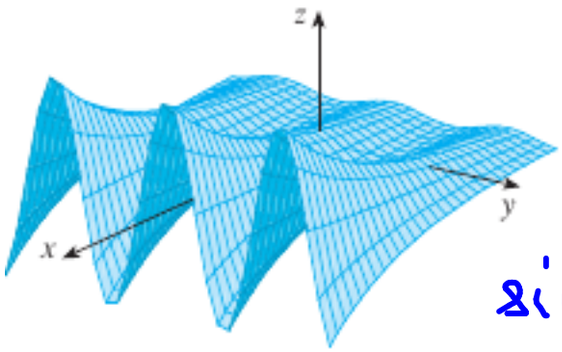
our focus

multivariable calculus

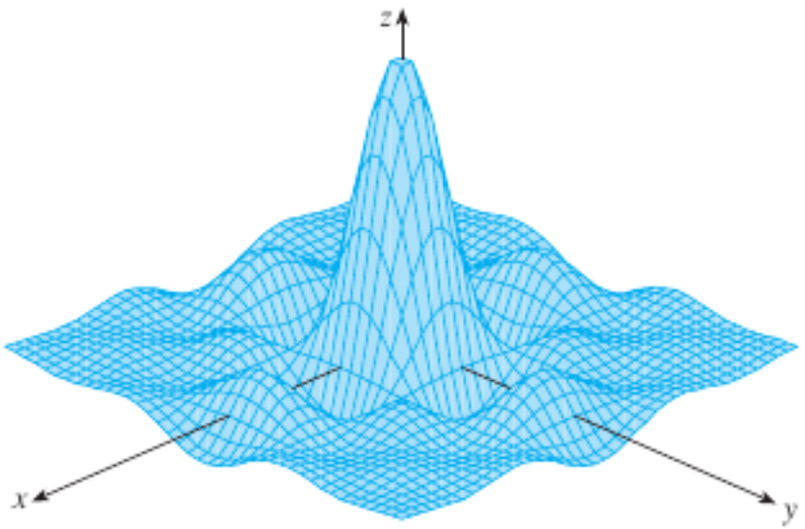
Chapter (11) Graphs,



(a) $f(x, y) = (x^2 + 3y^2)e^{-x^2-y^2}$

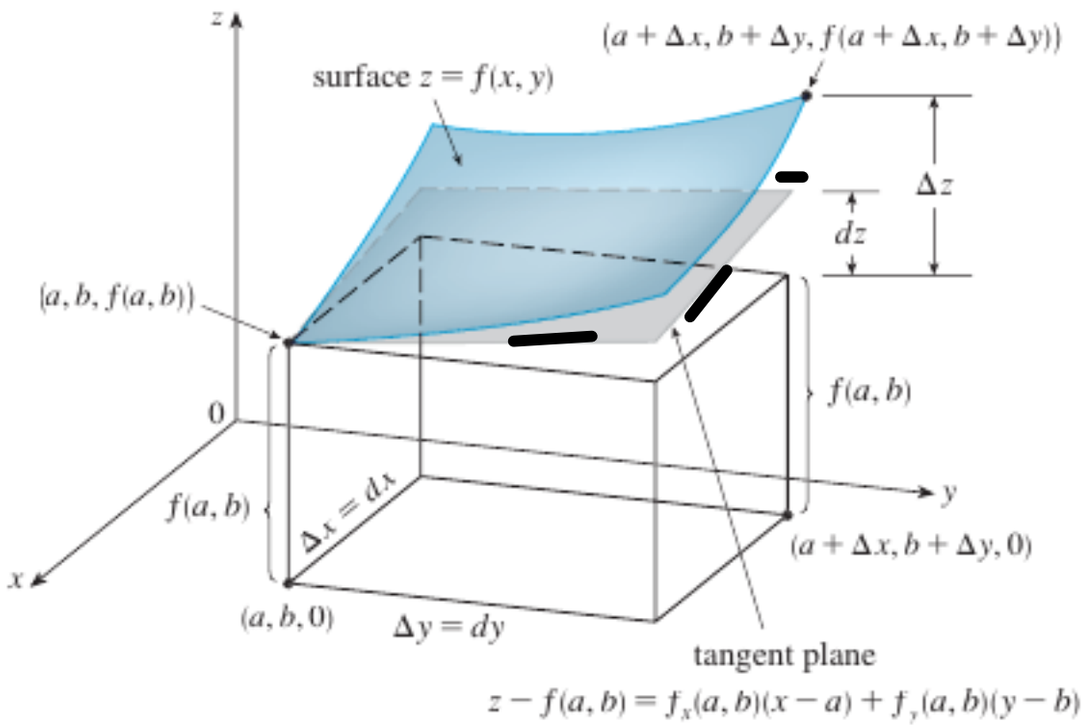


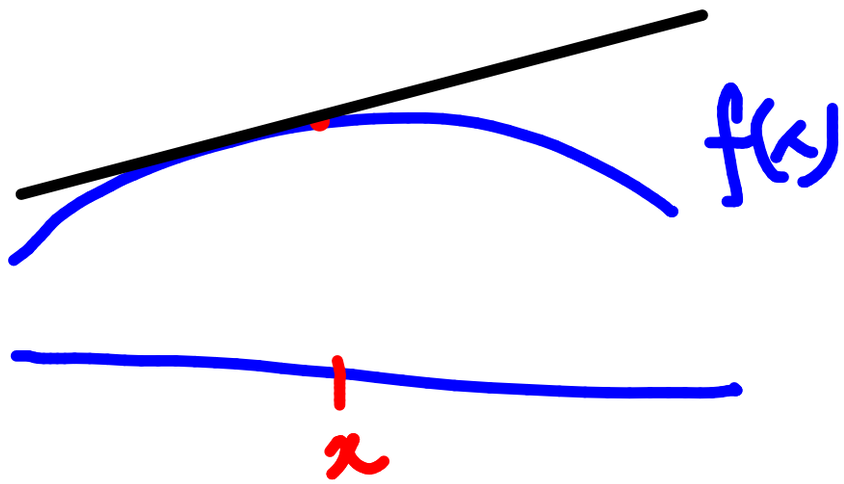
sin( )



(d) $f(x, y) = \dfrac{\sin x \, \sin y}{xy}$

next : Derivatives of multivar functions



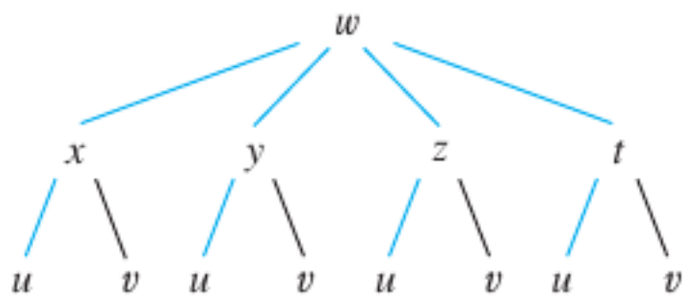


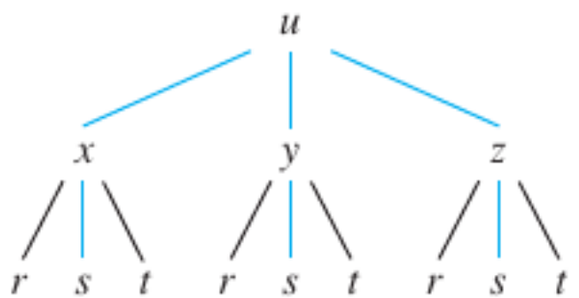
THE CHAIN RULE

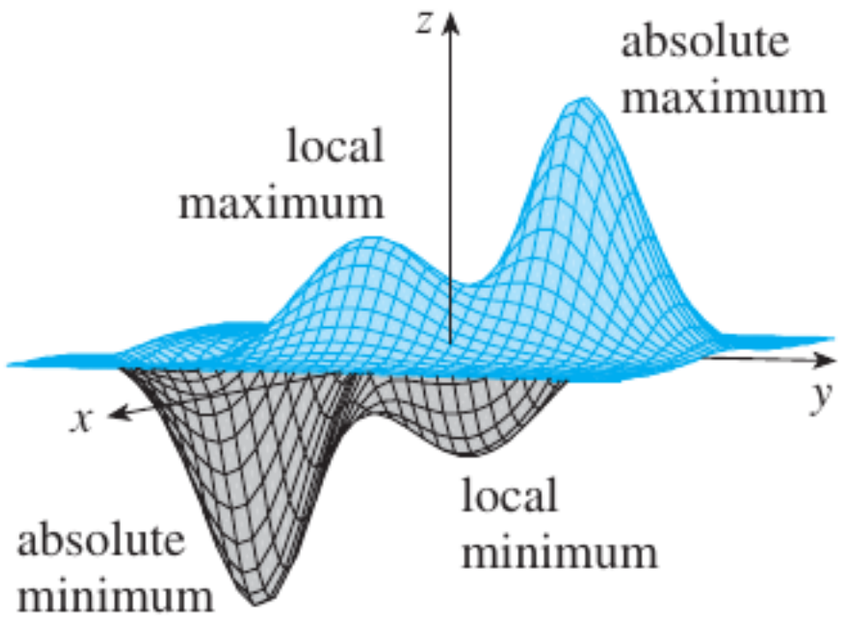
$\sin(x, y)$

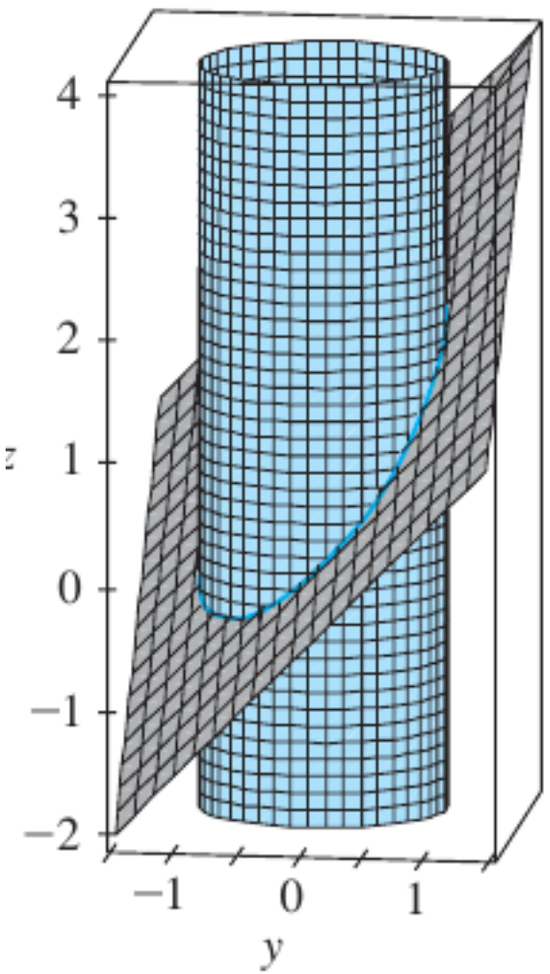
$x = \log u$

$y = e^{*}$

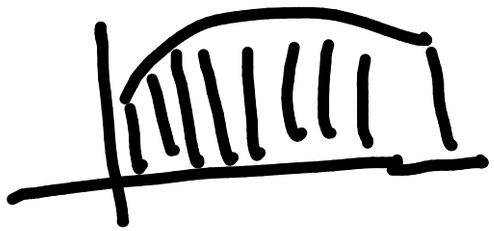




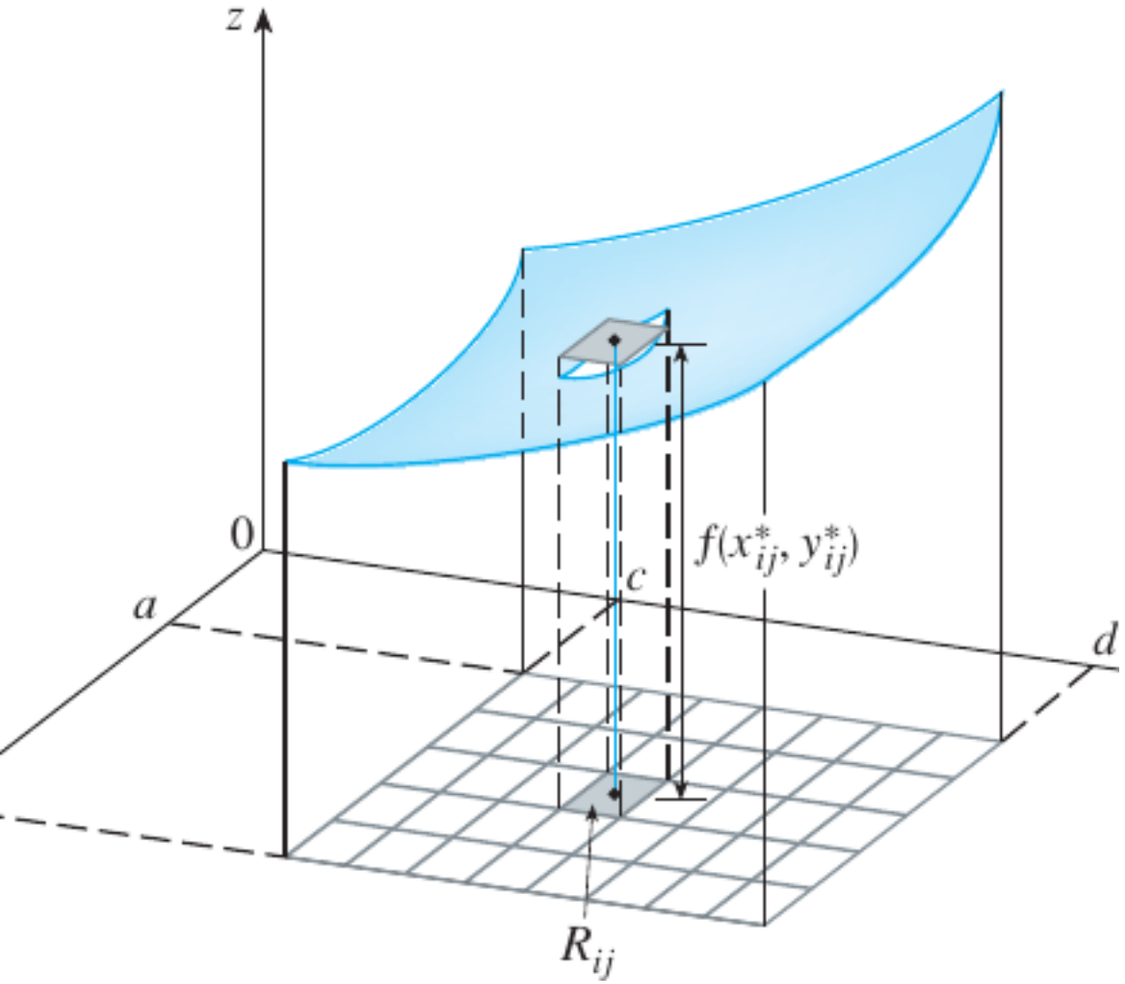

z
absolute
maximum
local
maximum
x
y
local
minimum
absolute
minimum

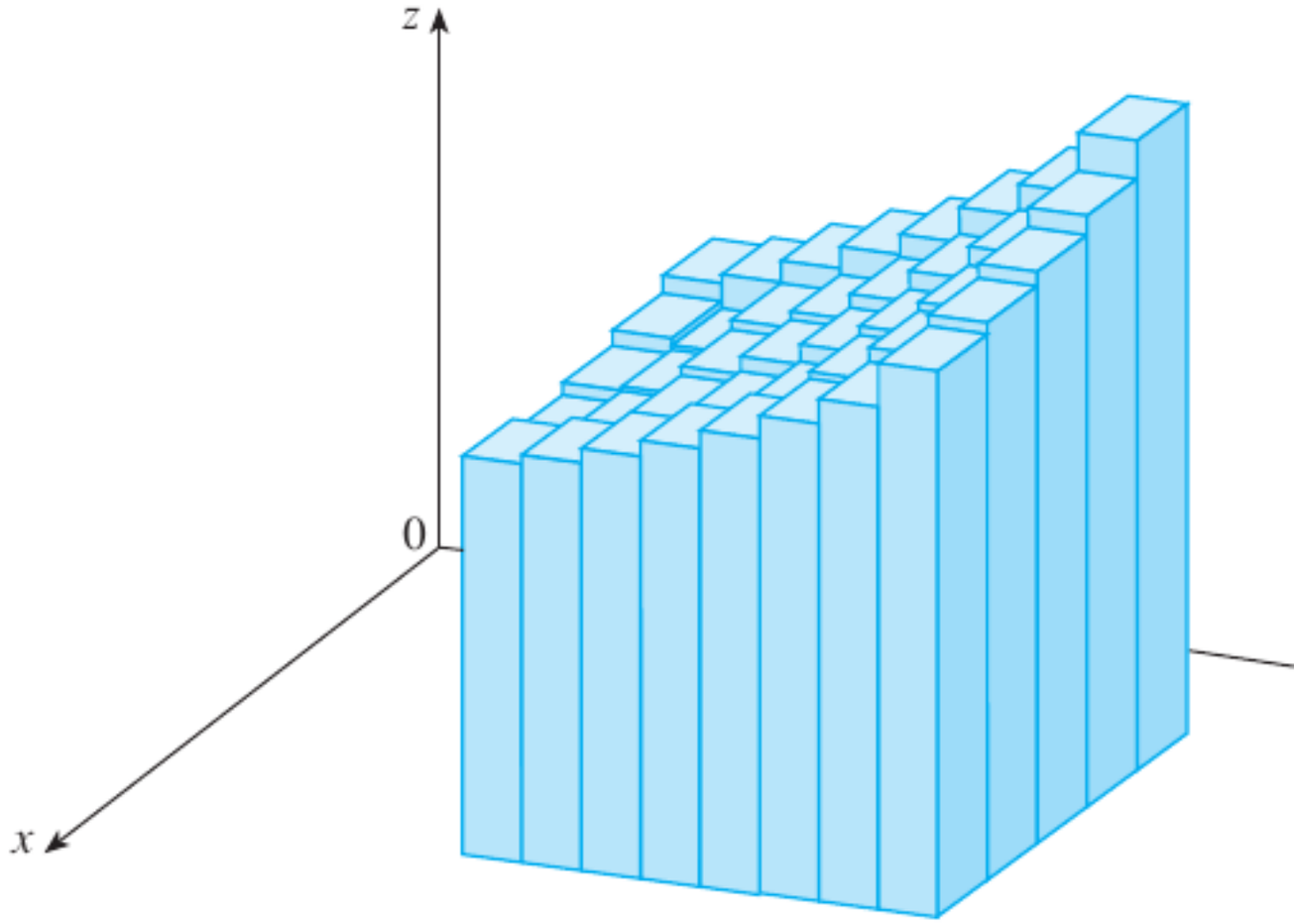

4
3
2
z
1
0
−1
−2
−1
0
1
y

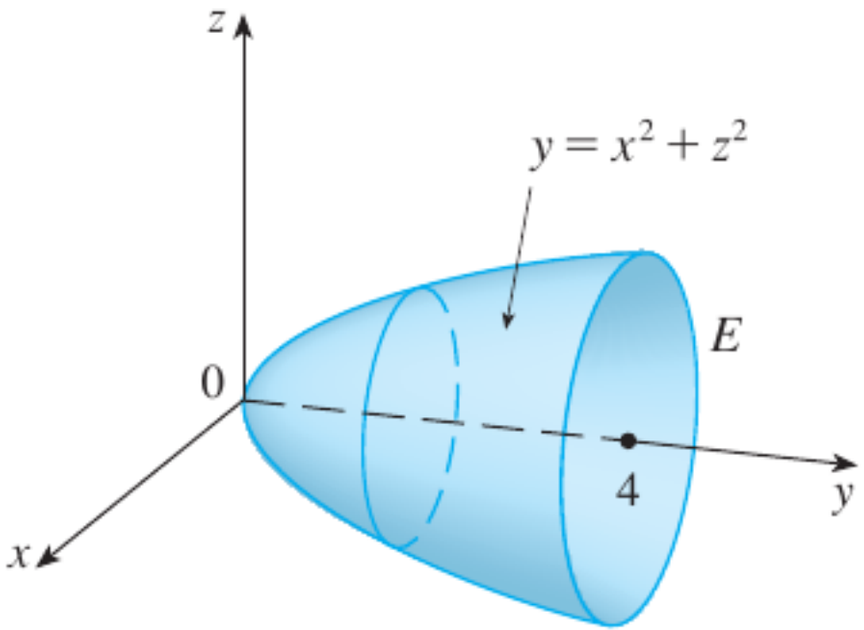
Chapter 12

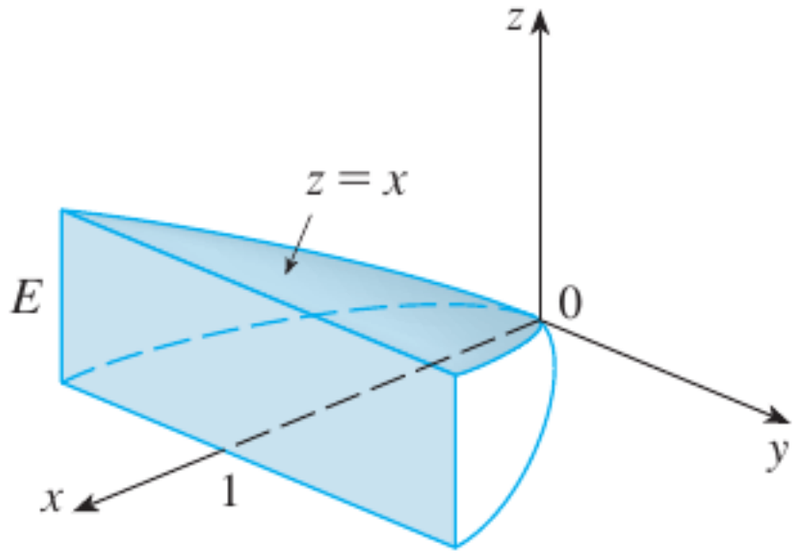


Integrals

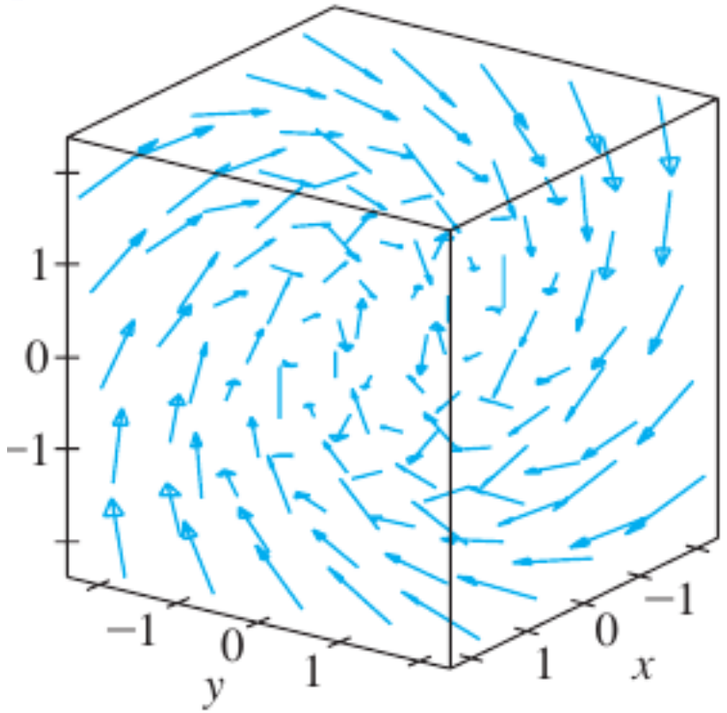


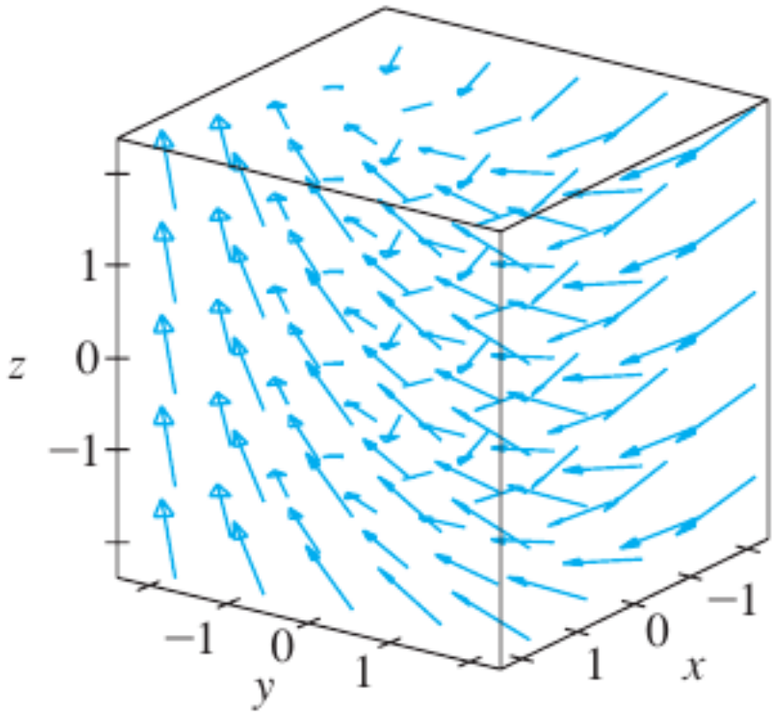


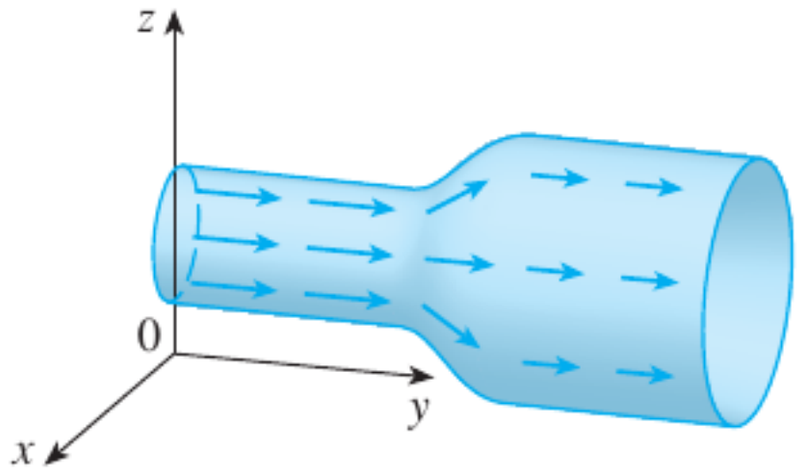

z
y = x² + z²
E
0
4
y
x

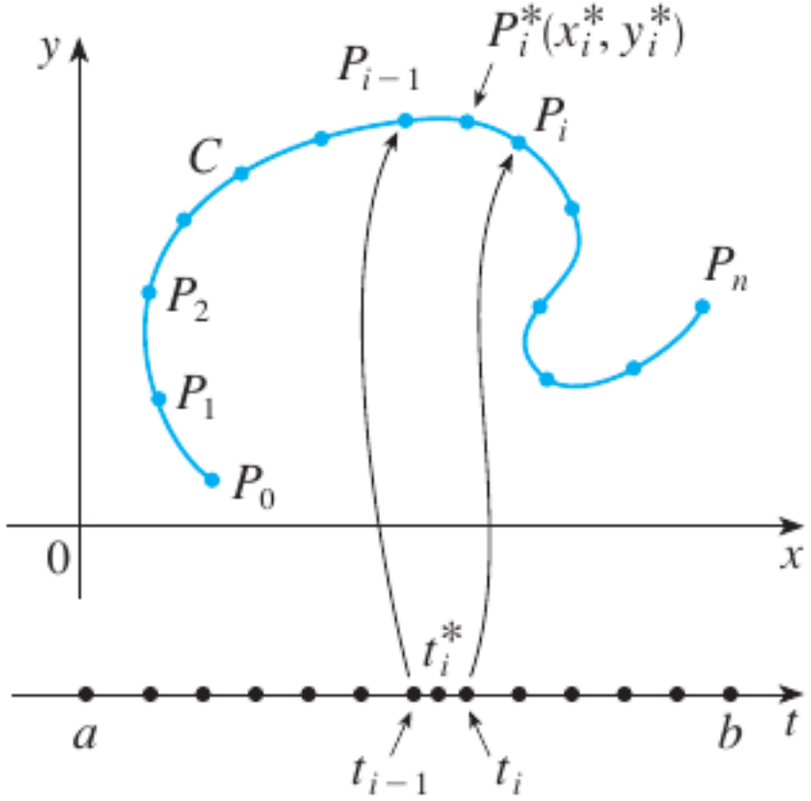

z
z = x
E
0
y
x
1

Chapter 13 Vector Calculus



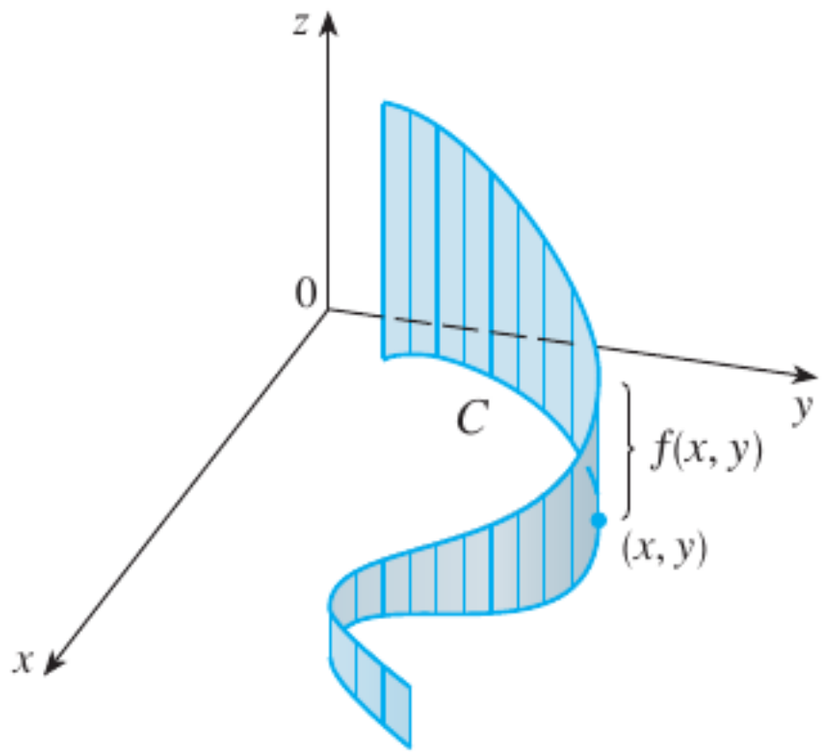




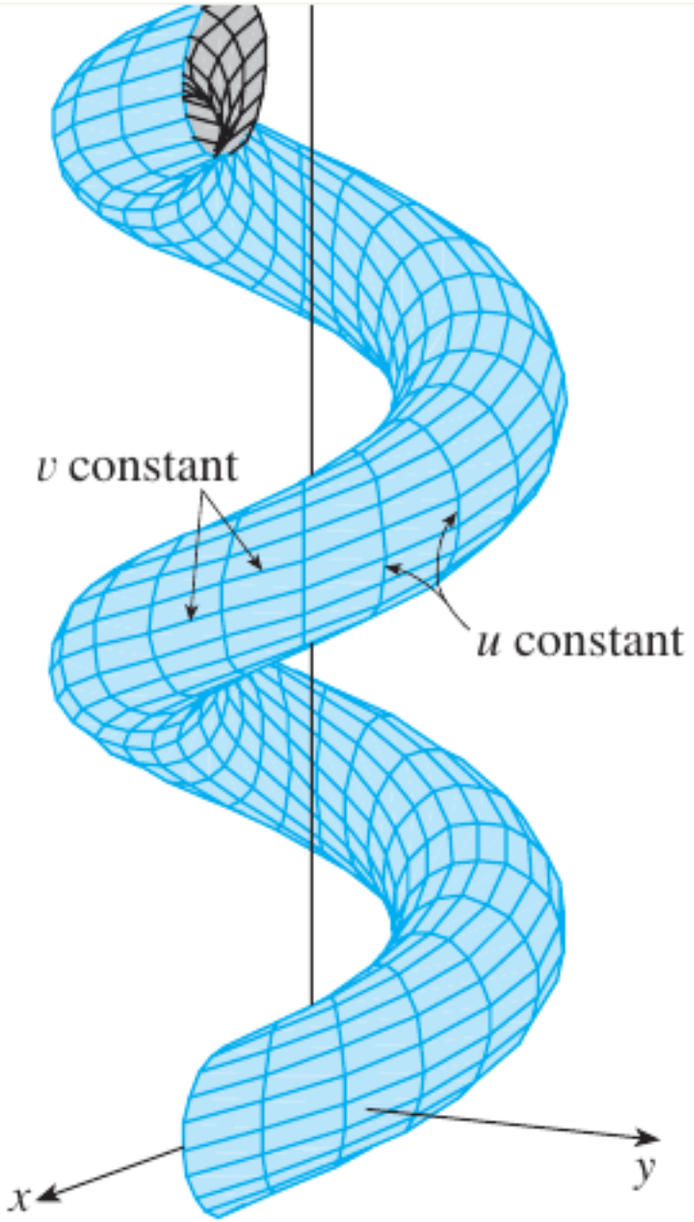


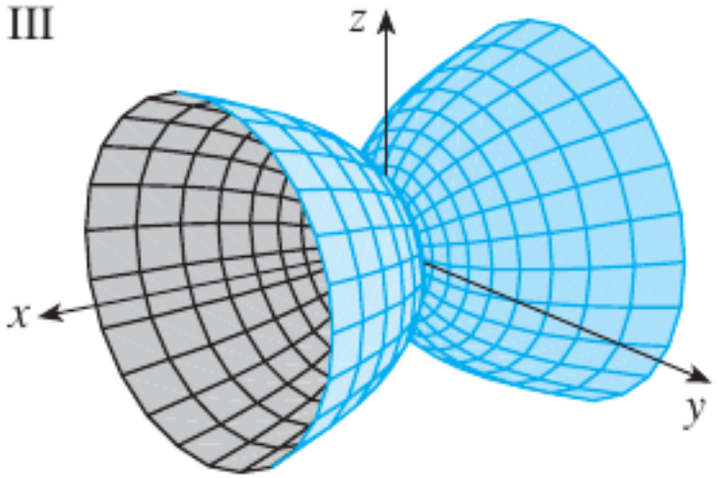
length of C

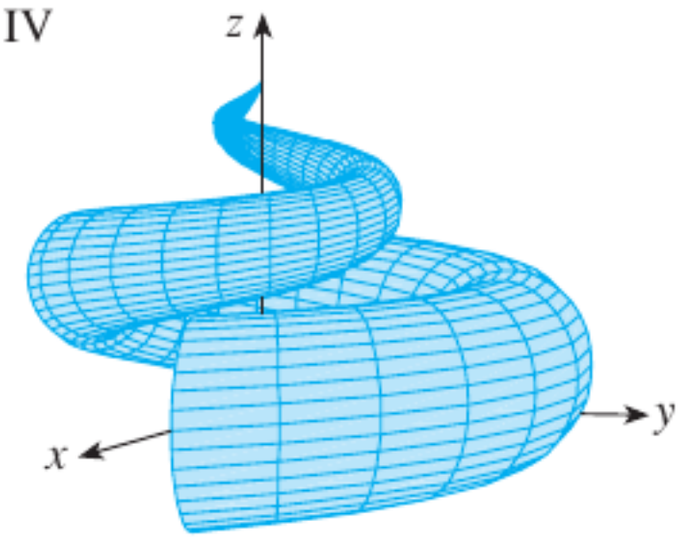
$$L = \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$$

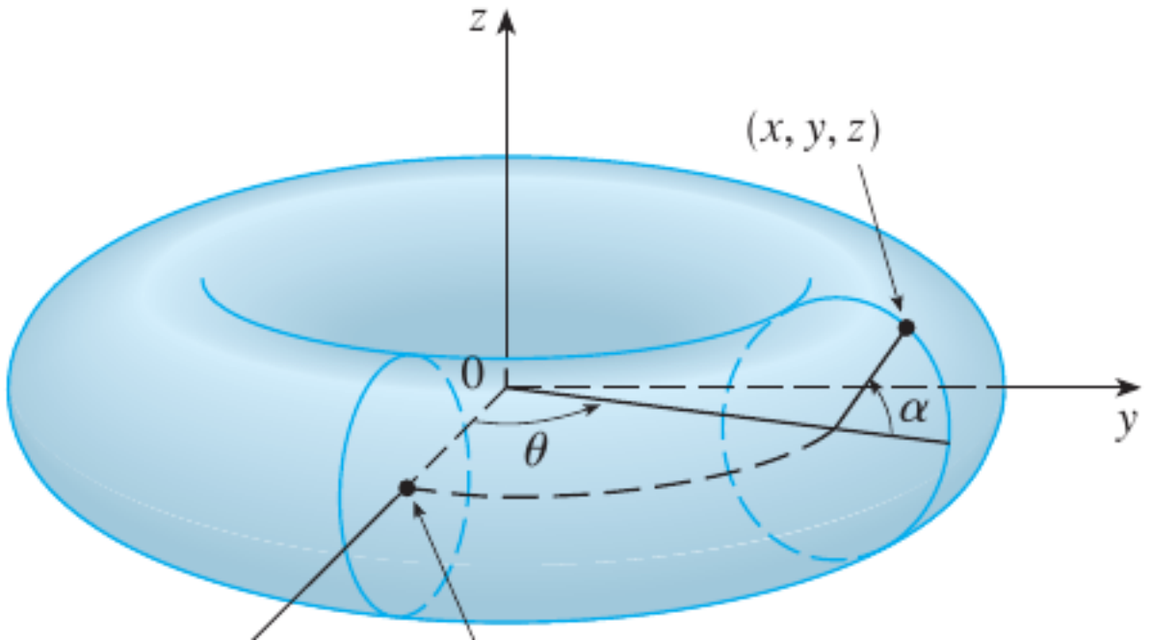

z
0
y
C
f(x, y)
(x, y)
x

PARAMETRIC SURFACES

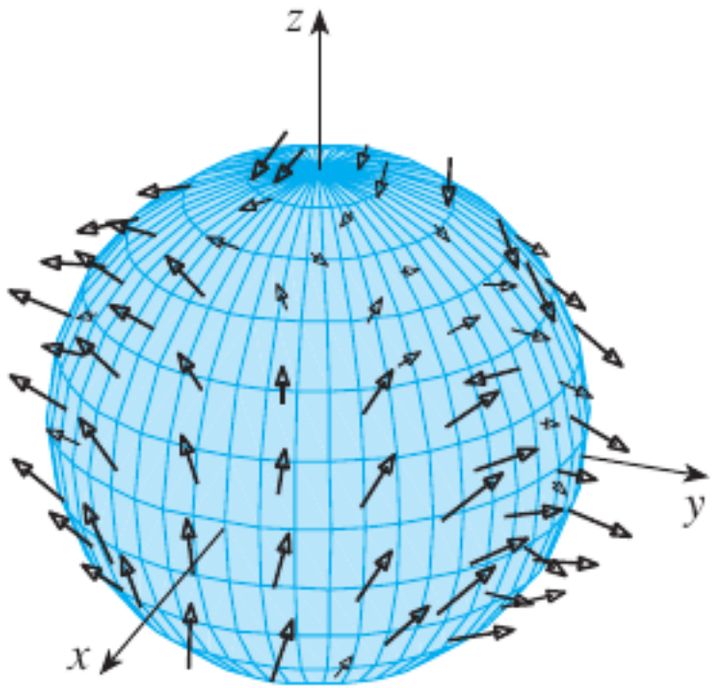








flux



11 PARTIAL DERIVATIVES

11.1 FUNCTIONS OF SEVERAL VARIABLES

functions of one var

$f(x) = x$

x^2

$\sin(x)$

$\cos(x)$

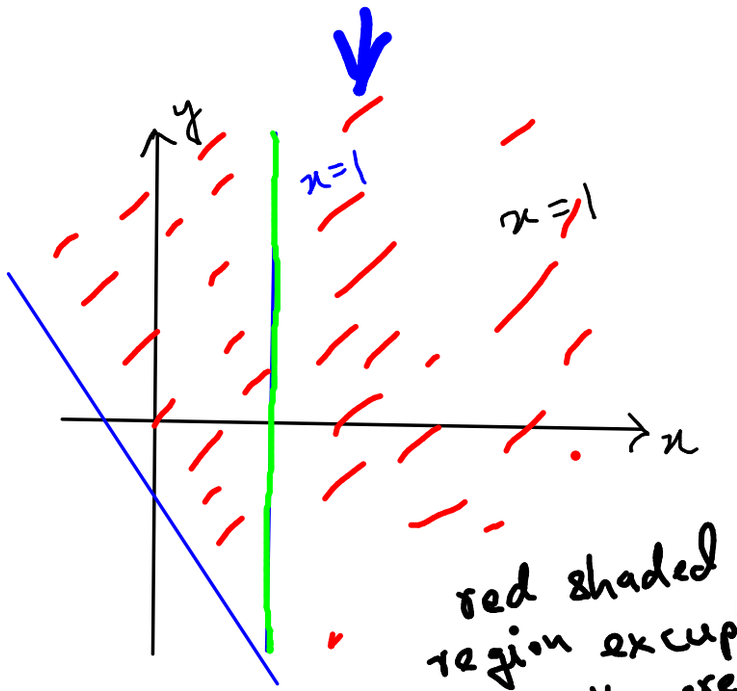
$f(x,y) = x^2 + y^2$

$= x + y$

$=$

EXAMPLE 1 Find the domains of the following functions and evaluate $f(3, 2)$.

(a) $f(x, y) = \dfrac{\sqrt{x + y + 1}}{x - 1}$



$x+y+1 \geq 0$

red shaded region except the green line

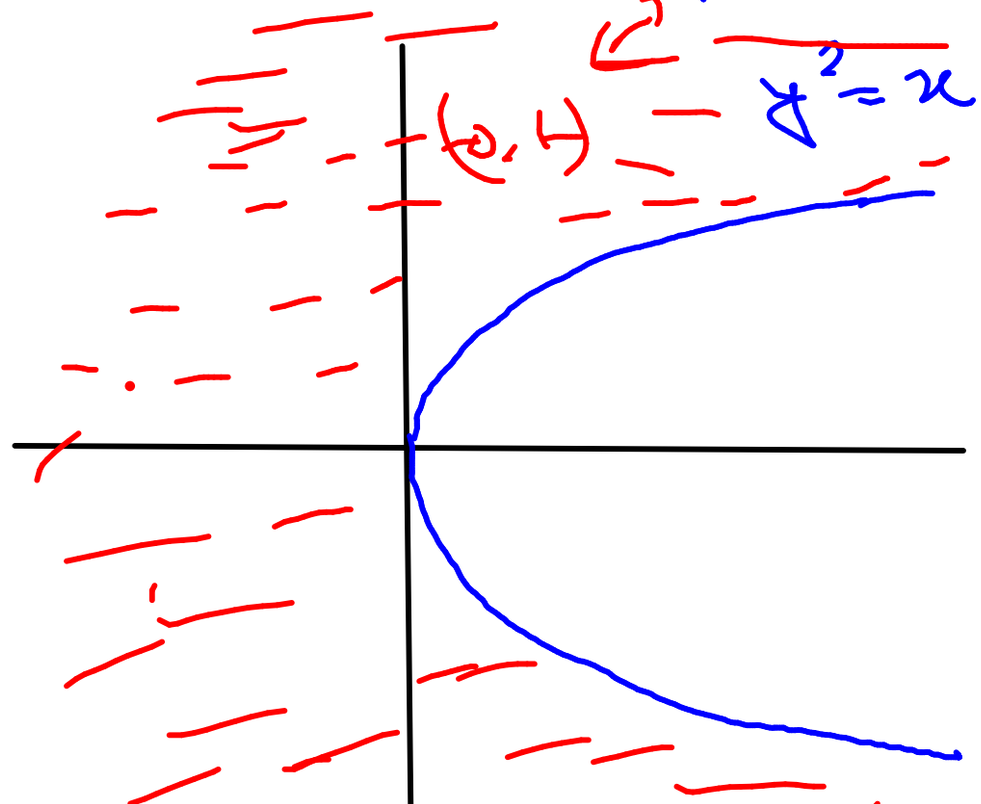
domain $= \{(x,y) \mid x \neq 1 \text{ & } x+y+1 \geq 0\}$

(b) $f(x, y) = x \ln(y^2 - x)$

$y^2 - x > 0$

$y^2 = x$

(0,1)



domain: red shaded region $= \{(x,y) \mid y^2 > x\}$

EXAMPLE 2 Find the domain and range of $g(x, y) = \sqrt{9 - x^2 - y^2}$.

GRAPHS

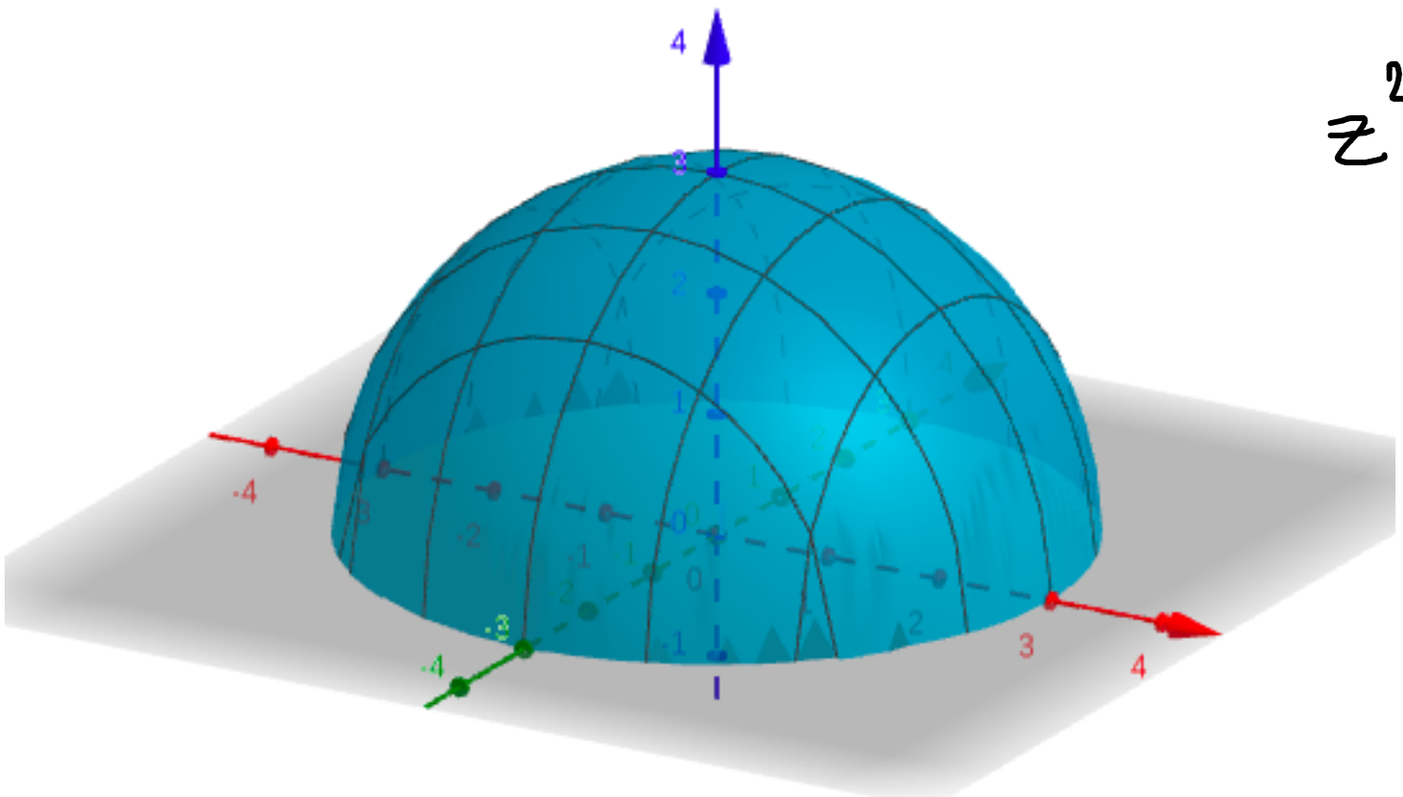
DEFINITION If f is a function of two variables with domain D, then the **graph** of f is the set of all points (x, y, z) in $\mathbb{R}^3$ such that $z = f(x, y)$ and (x, y) is in D.

EXAMPLE 4 Sketch the graph of $g(x, y) = \sqrt{9 - x^2 - y^2}$.

$$z = \sqrt{9 - x^2 - y^2}$$

$$z^2 = 9 - x^2 - y^2$$

$$x^2 + y^2 + z^2 = 9$$



https://www.geogebra.org/3d?lang=en

(a) $f(x, y) = (x^2 + 3y^2)e^{-x^2-y^2}$

(d) $f(x, y) = \dfrac{\sin x \ \sin y}{xy}$