

## Outline of Chapter 12 material

- 12.1 Iterated Integrals

Be able to calculate the integral of the form  $\iint_R f(x, y) dA$  where  $R$  is a rectangular region defined by  $R = \{(x, y) | a \leq x \leq b, c \leq y \leq d\}$  or  $R = [a, b] \times [c, d]$

- 12.2 Double Integrals Over General Regions

Be able to calculate integrals of the form  $\iint_R f(x, y) dA$  where  $R$  is a type I region:

$$R = \{(x, y) | a \leq x \leq b, g_1(x) \leq y \leq g_2(x)\}$$

or a type II region:

$$R = \{(x, y) | c \leq y \leq d, h_1(y) \leq x \leq h_2(y)\}$$

Given a double integral of the form

$$\int_a^b \int_{g_1(x)}^{g_2(x)} f(x, y) dy dx$$

be able to sketch the region over which the function is integrated and then change the double integral to an equivalent integral of the form

$$\int_c^d \int_{h_1(y)}^{h_2(y)} f(x, y) dx dy$$

(i.e. switch the order of integration, see homework problems 31, 33, and 35)

Given a description of a bounded region  $R$  in the  $xy$ -plane, be able to set up an appropriate double integral (with correct bounds) used to integrate a function  $f$  over  $R$ .

- 12.3 Double Integrals In Polar Coordinates

Be able to use polar coordinates to describe a bounded region  $R$  in the plane and then set up an appropriate double integral (with correct polar bounds) to integrate a function over the described region.

- 12.4 Applications of Double Integrals

Given a density function  $\rho(x, y)$  for a lamina defined over a region  $R$ , be able to calculate its mass, its moment about the  $x$ -axis,  $M_x$ , and its moment about the  $y$ -axis,  $M_y$ . Also, be able to calculate its center of mass in the  $x$  direction,  $\bar{x}$  and its center of mass in the  $y$  direction,  $\bar{y}$ . Also be able to calculate the  $2^{nd}$  moment about the  $x$ -axis and the  $2^{nd}$  moment about the  $y$ -axis. Actually, you should be able to calculate  $n^{th}$  moments as well.

- 12.5 Triple Integrals

Be able to perform a triple integration with function bounds.