

Areas from Double Integrals

Rectangular

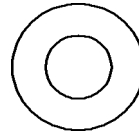
$\int_d^c \int_b^a 1 dy dx$ Area of a **rectangle** with sides of length $a - b$ and $c - d$



Polar

$\int_0^{2\pi} \int_b^a r dr dq$ Area of an **annular region** (hollow circle) with inner radius b and outer radius a

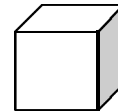
(let $b = 0$ for the area of a **circle** with radius a)



Volumes from Triple Integrals

Rectangular

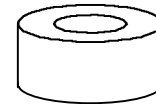
$\int_f^e \int_d^c \int_b^a 1 dz dy dx$ Area of a **rectangular solid** with edges of length $a - b$, $c - d$ and $e - f$



Cylindrical

$\int_0^{2\pi} \int_d^c \int_b^a r dz dr dq$ Volume of a **hollow cylinder** with inner radius d , outer radius c and height $a - b$

(let $d = 0$ for the volume of a **cylinder** with radius c)



Spherical

$\int_0^{2\pi} \int_0^{\pi} \int_b^a r^2 \sin \theta dr d\theta dq$ Volume of a hollow sphere with inner radius b and outer radius a

(let $b = 0$ for the volume of a **sphere** with radius a)

