

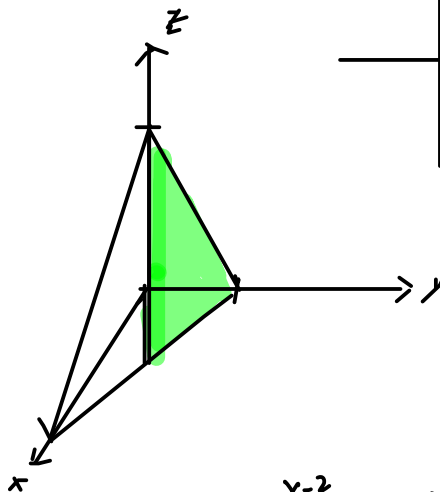
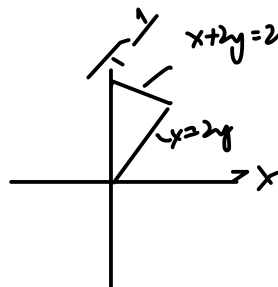
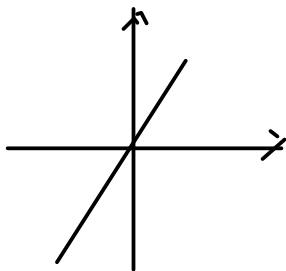
# MATH 2023 – Multivariable Calculus

Lecture #20 Worksheet      April 30, 2019

**Problem 1.** Set up the triple integrations over the solid  $E$  bounded by:

(a)

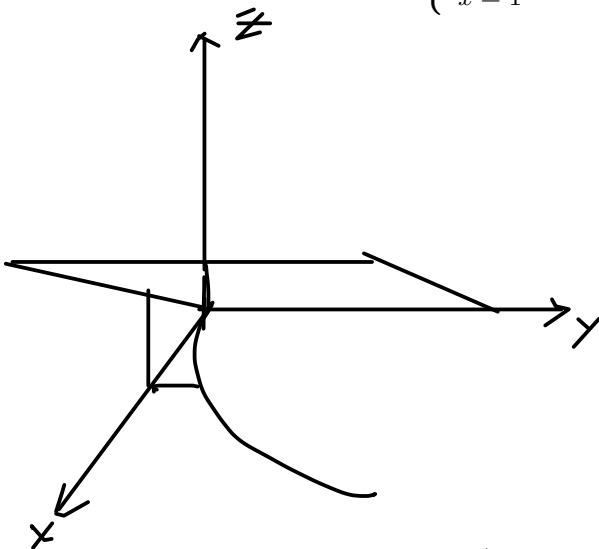
$$\begin{cases} x + 2y + z = 2 \\ x = 2y \\ x = 0 \\ z = 0 \end{cases}$$



(b)

$$\begin{cases} x = y^2 \\ x = z \\ z = 0 \\ x = 1 \end{cases}$$

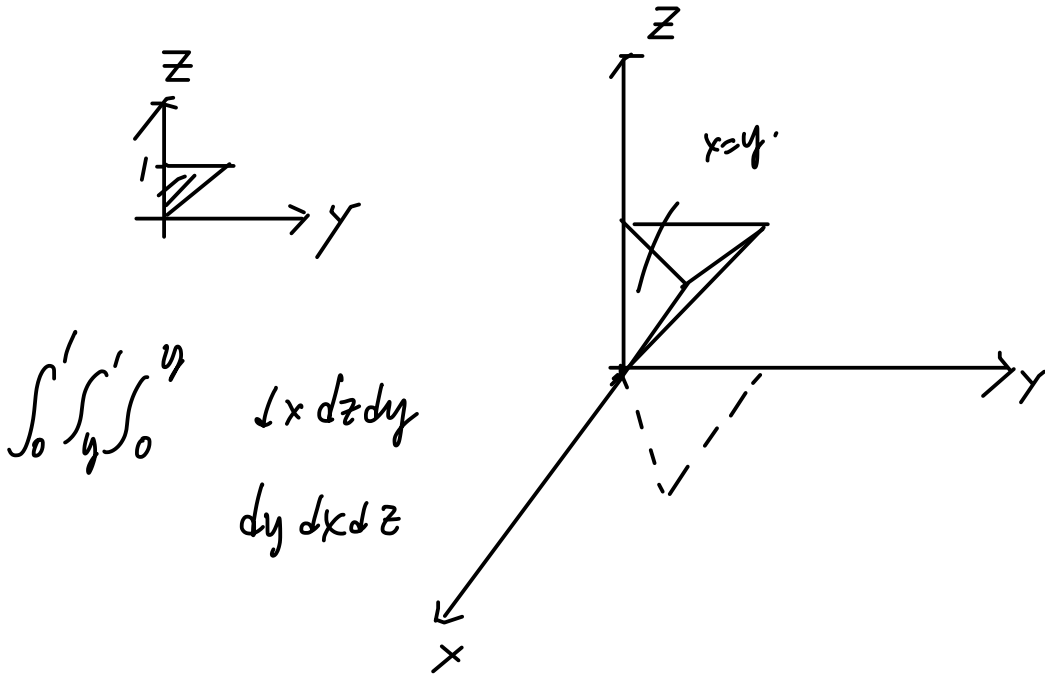
$$\int_0^1 \int_{\frac{x-2}{2}}^{\frac{x-2}{2}} \int_0^{2-x-2y} dz dy dx$$



**Problem 2.** Change the order of integration

$$\int_0^1 \int_0^z \int_0^y f(x, y, z) dx dy dz$$

from  $dx dy dz$  to  $dz dy dx$



**Problem 3.** Sketch the solid of integration, and rewrite it in the 5 other orders.

(a)

$$\int_0^1 \int_{\sqrt{x}}^1 \int_0^{1-y} dz dy dx$$

Sketch the solid of integration, and rewrite it in the 5 other orders.

(b)

$$\int_0^1 \int_0^{1-x^2} \int_0^{1-x} dydzdx$$

**Problem 4.** Evaluate

$$\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{\sqrt{x^2+y^2}}^2 (x^2 + y^2) dz dy dx$$

**Problem 5.** Find the volume of the solid given by intersecting 3 cylinders of radius  $R$  perpendicularly.