

**International Master's Programs of Chemical Engineering in the Graduate School of Engineering,  
Kyushu University (Academic Year from October, 2026)**

Subject : Math (1 sheet)

1. (25 points)

Solve the following differential equations.

$$(1.1) \quad y'' - y' - 2y = 0$$

$$(1.2) \quad y'' - y' - 2y = e^{2x}$$

$$(1.3) \quad y'' + 4y = \sin 2x$$

$$(1.4) \quad y''' - 3y'' + 4y = 0$$

$$(1.5) \quad y''' - 3y'' + 4y = x + e^{3x}$$

2. (25 points)

Answer the following questions regarding the triple integral.

$$\iiint_D xyz dx dy dz, \quad D = \{(x, y, z) | 4 \leq x^2 + y^2 + z^2 \leq 9, x \geq 0, y \geq 0, z \geq 0\}$$

(2.1) Convert to spherical coordinates.

(2.2) Find the triple integral.