(14pts) 1. The temperature at each point of the circular disk
\[ D = \{(x, y) : x^2 + y^2 \leq 4\} \]

is given by \( T = x^2 + 2y^2 - 2y \). Find the hottest and the coldest points of the disk.
(14 pts) 2. Use the method of Lagrange multipliers to answer the following question: What point of the surface \( \frac{1}{x} + \frac{1}{y} + \frac{1}{y} = 1 \) is closest to the origin? (Hint: Consider the square of the distance.)
(12pts) 3. Evaluate the iterated integral \( \int_0^1 \int_x^1 e^{-y^2} \, dy \, dx \). (Hint: Reverse the order of integration.)

(12pts) 4. Use double integration to find the area of region bounded by curves \( y = \frac{1}{\sqrt{x + 1}} \), \( y = x + 1 \) and \( y = 2 \).
(12pts) 5. Evaluate the double integral \( \iint_D e^{x^2+y^2} \, dA \) where \( D \) is the ring described by \( 1 \leq x^2 + y^2 \leq 4 \).

(12pts) 6. Use double integration to find the area of the region bounded by the polar curve \( r = 2(1 + \cos \theta) \).
(12pts) 7. Use double integration to find the area of the plane $2x + 2y + z = 1$ above the parallelogram region whose vertices are $(0, 0), (1, 1), (3, 1)$ and $(2, 0)$.

(12pts) 8. The density at each point of a solid right circular cylinder of radius $a$ and altitude $h$ is proportional to the depth. Find the mass.