1. Consider the region bounded by the $x$-axis, $x = e$, and the graph of $y = \ln x$; the shaded region in the figure below.

(a) 3 Express the volume of the solid formed by rotating the region about the line $y = 2$ using the method of Disks/Washers. **Do not evaluate the integral.**

(b) 3 Express the volume of the solid formed by rotating the region about the line $y = 2$ using the method of Shells. **Do not evaluate the integral.**
2. A conical tank on the moon is filled with liquid oxygen of density \( \rho \). The gravitational constant on the moon is \( g \). The tank is 6 m tall and has radius 2 m at the base. There is a spout protruding 1 m above the top of the cone. The cone is oriented as shown in the figure below. **Please start by clearly identifying a coordinate system.**

![Diagram of a conical tank](image)

(a) If the tank is full, express the work required to empty the tank through the spout as an integral. **Do not evaluate the integral.**

(b) If the tank is ‘half’ full, i.e., the surface of the liquid oxygen is 3 m from the base, express the work required to empty the tank through the spout as an integral. **Do not evaluate the integral.** Do not reinvent the wheel, just make the needed change(s) to the integral above.