Office Hours 4

1. Find the work done from point A to point B along the three paths shown in Fig. 1. Use:

$$W(A \to B) = \int_A^B \vec{F} \cdot d\vec{r} \tag{1}$$

where

$$\vec{F} = xy\hat{x} + x^2\hat{y} \tag{2}$$

Useful integral:

$$\int xe^x dx = (x-1)e^x + C \tag{3}$$

$$\int x^2 e^x dx = (x^2 - 2x + 2)e^x + C \tag{4}$$

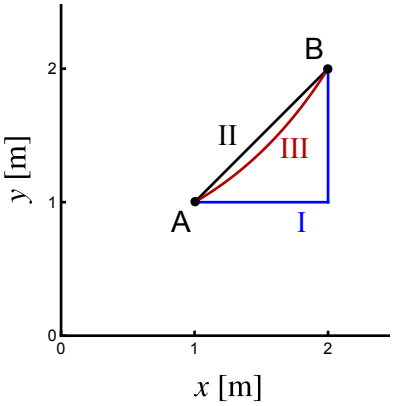

Figure 1: The paths the force acts along. Path II is defined by $y = x$ and path III is defined by $y = e^x - 1$

2. Calculate the moment of inertia for the following objects:

   (a) A cone of mass M, radius R, and height h with **non**-uniform density $\rho(z) = \alpha z$ where $\alpha = 4M/(\pi R^2 h^2)$ bout its vertical axis.

   (b) A cube of mass M and uniform density with sides of length l about an axis that goes through the center.

   (c) A cube of mass M and density $\rho = \alpha x^2 y z^3$ with sides of length l, about the z-axis. Here, $\alpha = 24M/l^9$.

   (d) A cylinder of mass M, radius R and length L about its axis. The density is $\rho = \alpha s$, where s is the distance from the z-axis, and $\alpha = 3M/(2L\pi R^3)$.

   (e) A cone of mass M, base radius R and height h about its axis. The density is $\rho = \alpha s$, where s is the distance from the z-axis, and $\alpha = 6M/(h\pi R^3)$.