

Class 20: Density, Again

Calculus II

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1. A certain type of plankton¹ likes to live on the bottom of the ocean. The density of the plankton decreases as the distance z from the bottom of the ocean increases. The density of the plankton is given by

$$\rho(z) = 10e^{-z} , \tag{1}$$

where ρ has units of kg/m^3 , and z , the vertical distance up from the ocean floor, is measured in meters.

Consider a circular patch of ocean floor with a radius of 0.5 meters.

- (a) What is the total mass of the plankton in a 2 meter tall column of water above this patch of ocean floor?
- (b) Suppose the sea was infinitely deep. In that case, what would be the total plankton mass above the patch of ocean floor?
- (c) What is the total mass of the plankton in the column of water *exactly* 4 meters above the ocean floor?

¹Not actual biology. I'm pretty sure there aren't plankton like this. But this is a math class so it's ok.