

# Chapter 8.2 & 8.4: Arc Length and Density

## Calculus II

Spring 2021

College of the Atlantic

1. Use the arc length formula to calculate the arc length of  $f(x) = (4/3)x + 2$  from  $x = 3$  to  $x = 6$ . Explain why your answer is comforting. It's probably easiest if you resist the urge to convert any square roots you might encounter into decimals.
2. Let  $f(x) = x^2$ . How long is the curve from  $x = 0$  to  $x = 1$ ?
3. Let  $f(x) = x^3$ . How long is the curve from  $x = 0$  to  $x = 1$ ?
4. Let  $f(x) = \sin(x)$ . How long is the curve from  $x = 0$  to  $x = \pi$ ?
5. A cylindrical pipe has a radius of 5 cm and is 2 meters long.
  - (a) What is the volume of the pipe?
  - (b) If the pipe was filled with water, what would its mass be?
  - (c) Suppose there is some pollution in the water. The density of the pollution is given by  $\rho(x) = 0.002e^{-2x}$ , in units of grams per cubic meter. Determine the total mass of the pollution in the pipe.
6. The air density  $h$  meters above the surface of the earth is given by:

$$\rho(h) = 1.28e^{-0.000124h}, \quad (1)$$

where  $h$  has units of km and the units of  $\rho$  are  $\text{kg}/\text{m}^3$ . What is the mass of a cylindrical column of air 2 meters in diameter and 25 kilometers high, with a base on the surface of the earth?